science & innovation
Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

CSIR
Touching lives through innovation

"The objects of the CSIR are, through directed and particularly multidisciplinary research and technological innovation, to foster, in the national interest and in fields which, in its opinion, should receive preference, industrial and scientific development, either by itself or in co-operation with principals from the private or public sectors, and thereby contribute to the improvement of the quality of life of the people of the Republic, and to perform any other functions that may be assigned to the CSIR by or under this Act."

(Scientific Research Council Act 46 of 1988, as amended by Act 27 of 2014)

CSIR

Touching lives through innovation

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ANNUAL REPORT 2019/20

A THE CSIR AT A GLANCE

The Council for Scientific and Industrial Research (CSIR) is a leading scientific and technology research organisation that undertakes directed multidisciplinary research and technological innovation that contribute to the improved quality of life of South Africans. The organisation plays a key role in supporting government's programmes through directed research that is aligned with the country's priorities, the organisation's mandate and its science, engineering and technology competences.

CSIR GENERAL INFORMATION

REGISTERED NAME:	Council for Scientific and Industrial Research
PHYSICAL ADDRESS:	Meiring Naude Road Brummeria Pretoria
POSTAL ADDRESS:	PO Box 395 Pretoria 0001 South Africa
TELEPHONE NUMBER/S:	+27 12 841 2911
EMAIL ADDRESS:	Enquiries@csir.co.za
WEBSITE ADDRESS:	www.csir.co.za
EXTERNAL AUDITORS:	Auditor-General South Africa
BANKERS:	ABSA

LIST OF ABBREVIATIONS/ACRONYMS

AGSA	Auditor-General South Africa
ARDP	Accelerated Researcher Development Programme
ATC	Announcements, Tablings and Committee Reports
B-BBEE	Broad-Based Black Economic Empowerment
BD&C	Business Development and Commercialisation
BIDC	Biomanufacturing Industry Development Centre
BIDF	Biorefinery Industry Development Centre
C4IR SA	Centre for the Fourth Industrial Revolution South Africa
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CMP	Campus Master Plan
CSIR	Council for Scientific and Industrial Research
DSI	Department of Science and Innovation
dtic	Department of Trade, Industry and Competition
FPP	Fraud Prevention Plan
FY	Financial Year
GE	Group Executive
GIT	Graduate-in-Training
ICT	Information and Communications Technology
KPI	Key Performance Indicator
MTEF	Medium Term Expenditure Framework
MTSF	Medium Term Strategic Framework
NDP	National Development Plan
NICIS	National Integrated Cyber Infrastructure System
PFMA	Public Finance Management Act
PG	Parliamentary Grant
PPE	Property, Plant and Equipment
RD&I	Research, Development and Innovation
SANReN	National Research and Education Network in South Africa
SCM	Supply Chain Management
SET	Science, Engineering and Technology
SMME	Small Medium and Micro Enterprises
SO	Strategic Objective

CHAIRMAN'S OVERVIEW

Prof. Thokozani Majozi
CSIR Board Chairperson

On behalf of the Board, it gives me pleasure to present to you the 2019/20 Annual Report.

The CSIR mandate to conduct multidisciplinary research and technological innovation to foster industrial and scientific development, thereby improving the quality of life of South Africans continues to be the north star of the organisation. We have now served a full year with the new Board and, again, the diversity of the team is working in our favour in our quest to make a meaningful contribution to the organisation and country's national agendas. As the Board, we are committed to ensuring that the CSIR operates and is managed in an ethical and sustainable manner as it works towards fulfilling this mandate. Thus, we decided to apply the corporate governance principles of the Protocol on Corporate Governance in the Public Sector and the King IV Codes on Corporate Governance, in order to regularise and improve the corporate governance of the CSIR.

The year in review was the first full year of the implementation of the new CSIR Strategy, which aims to amplify the 'I' in CSIR. The transitionary period to the new strategy was not an easy endeavour. However, we believe that we have the right people to succeed as an organisation, and I commend the leadership and employees for embracing this change and proactively making it work.

Local and international partnerships and strategic alliances with industry, government, higher education institutions, and research and technology organisations are crucial to the success of the organisation. Therefore, opportunities for collaboration should be harnessed at every stage.

The Board is pleased with the organisation's financial performance in the year under review. The recent 12th clean audit status is an affirmation of our efforts to maintain financial diligence and uphold ethical processes in what we do.

The last quarter of the year under review was challenging and, like many organisations, the CSIR was confronted with having to respond to the COVID-19 pandemic in a rapid manner to ensure that our employees and their families are protected, while still making sure that the organisation continues to operate efficiently. The organisation's leadership rose to the challenge with courage and swiftly set in place protocols to safeguard the health and safety of employees. The organisation also responded to government's call and actively supported its efforts through the provision of different research, development and innovation services to minimise the impact of the spread.

The recent announcement on the country's economic outlook was expected, albeit not to the extent that it is. We are confident that the organisation is agile and innovative enough to emerge victorious. However, it will take diligence and intentional effort

WE HAVE NOW SERVED A FULL YEAR WITH THE NEW BOARD AND, AGAIN, THE DIVERSITY OF THE TEAM IS WORKING IN OUR FAVOUR IN OUR QUEST TO MAKE A MEANINGFUL CONTRIBUTION TO THE ORGANISATION AND COUNTRY'S NATIONAL AGENDAS.

from the leadership and every employee to work hard to preserve the legacy of this organisation. It is true that in any challenge, how we respond matters. It is also true that in every crisis, lies an opportunity. While the remnant effects of the pandemic cannot be ignored, we can choose to seize opportunities to collaborate with industry, as well as the medical and science professions for novel ways of making an impactful contribution to the fight against this pandemic. In this endeavour, the CSIR ought to not only focus on local, but also take full advantage of international collaborations.

This year marks the 75th anniversary of the CSIR. This outstanding feat bears testimony to the relevant role that the CSIR has played in our ecosystem of innovation since 1945. Our organisation has a rich heritage and strong reputation for excellence and innovation. It has played an important role in shaping the country's science, engineering and technology space. We are looking forward to celebrating this milestone with all our stakeholders.

On behalf of the Board, I would like to thank the Minister of Higher Education, Science and Innovation, Dr Bonginkosi Nzimande, for his support; the leadership of the CSIR, our employees and all our stakeholders for their hard work and commitment to the success of the organisation.

Prof. Thokozani Majozi
CSIR Board Chairperson

THIS YEAR MARKS THE 75TH ANNIVERSARY OF THE CSIR. THIS OUTSTANDING FEAT BEARS TESTIMONY TO THE RELEVANT ROLE THAT THE CSIR HAS PLAYED IN OUR ECOSYSTEM OF INNOVATION SINCE 1945.

ELIJIKAYO LIKASIHLALO

Egameni leBhodi, kuyintokozo enkulu kimina ukunethulela Umbiko Wonyaka wezi-2019/20.

Igunya le-CSIR lokuqhuba ucwaningo emikhakheni eyahlukahlukene kanye nobuchwepheshe obusha ukukhuthaza inqubekela phambili kwezezimboni nezesayensi, ngaleyo ndlela kuthuthukiswe iqophelo lempilo yabantu baseNingizimu Afrika liyaqhubeka nokuba yigugu lenhlangano. Manje sesisebenze unyaka ogcwele neBhodi elisha futhi, nalapho, ukwehlukahluka kwamalungu ethimba kusisebenzele futhi kuyasivuna njengoba inhloso yethu kungukwenza igalelo elibonakalayo enhlanganweni nasezinhlelweni zezwe lonke. NjengeBhodi, sizibophezele ekuqinisekiseni ukuthi i-CSIR isebenza futhi iphethwe ngendlela efanelekile futhi esimeme njengoba isebenzela ukufeza leli gunya. Ngakho-ke, sithathe isinqumo sokusebenzisa imigomo yokubusa ngokubambisana yeNkambiso Yokuphathwa Kwenkampani eMkhakheni Ozimele kanye NamaKhodi Okuphatha i-King IV, phecelezi i-Protocol on Corporate Governance in the Public Sector and the King IV Codes on Corporate Governance, ukuze kulawulwe futhi kuphuculwe ukuphathwa kwenkampani i-CSIR.

Unyaka ohlaziywayo ubungunyaka wokuqala ogcwele wokuqaliswa kweCebo elisha lakwa-CSIR, elihlose ukugqamisa u-'I' ku-CSIR. Le nkathi yokushintshela kuleli su elisha beyingelula neze. Kodwa-ke, sikholwa ukuthi sinabantu abafanelekile abazosisiza siphumelele njengenhlangano, futhi ngiyabuncoma ubuholi kanye nabasebenzi ngokwamukela lolu shintsho nokuzimisela ukuba lube yimpumelelo.

Ubambiswano olwenziwa kuleli nasemazweni omhlaba nobudlelwano bamasu nezimboni, uhulumeni, izikhungo zemfundo ephakeme, kanye nezinhlangano zocwaningo nezobuchwepheshe kusemqoka kakhulu empumelelweni yenhlangano. Ngakho-ke, amathuba okubambisana kufanele asetshenziswe kuzo zonke izigaba.

Ibhodi lithokozile ngendlela inhlangano eqhuba ngayo kwezezimali kulo nyaka ohlaziywayo. Isimo sakamuva socwaningomabhuku olumsulwa iminyaka eyi-12 siqinisekisa futhi sifakazela imizamo yethu yokusebenza ngobuqotho kuzo zonke izinqubo zethu esizenzayo.

Ikota yokugcina yonyaka ohlaziywayo beyilukhuni ngempela futhi, njengezinhlangano eziningi, i-CSIR iye yabhekana nomsebenzi wokulwa nobhubhane lwe-COVID-19 ngendlela ephuthumayo ukuze izame ukuqinisekisa ukuthi abasebenzi bethu kanye nemindeni yabo bavikelekile, ngenkathi beqinisekisa ukuthi inhlangano iyaqhubeka nokusebenza kahle. Ubuholi benhlangano bayamukela ngezandla zombili le nselele nangesibindi futhi bashesha basungula imigomo yokuvikela impilo nokuphepha kwabasebenzi. Le nhlangano iphinde yasabela ikhwelo ebelihlatshwe uhulumeni futhi yeseka ngokuzimisela imizamo yakhe ngokuhlinzeka ngezinsizakalo ezahlukahlukene zocwaningo, ezentuthuko nemisebenzi yokusungulwa kwezinto ezintsha ukuze kuncishiswe umthelela wokubhebhetheka kwesifo.

Isimemezelo sakamuva ebesichaza ngesimo somnotho wezwe besilindelekile, yize noma besingalindele ngezinga esikulona. Sinethemba lokuthi inhlangano isemandleni futhi inamasu amasha amaningi ngokwanele ukuze ikwazi ukunqoba. Kodwa-ke, kuzobiza ukukhuthala nokuzikhandla okuvela kubaholi nakubo bonke abasebenzi ukuze basebenze kanzima ukugcina ifa lale nhlangano. Kuyiqiniso ukuthi kunoma iyiphi inselele, indlela esiphendula ngayo isemqoka. Kuyiqiniso futhi ukuthi kuzo zonke izinhlekelele, kusuke kungatholakala ithuba. Yize imiphumela esasele yalolu bhubhane ingenakuzitshwa, singakhetha ukuwabamba ngazo zombili amathuba okusebenzisana nezimboni, kanye nemikhatha yobuchwepheshe bezokwelapha nezesayensi ukuze sizuze izindlela ezintsha zokwenza igalelo elikhulu nelinomthelela ekulweni nalolu bhubhane. Kulo mzamo, i-CSIR akufanele nje igxile kuphela kokwasendaweni, kodwa futhi isebenzise ngokugcwele ithuba lokusebenzisana namazwe omhlaba.

Kulo nyaka siqopha iminyaka engama-75 selokhu kwasungulwa i-CSIR. Ukufinyelela kuleli zinga kufakazela ngokuvelele ukubaluleka nendima edlalwe yi-CSIR ohlelweni lwethu lokusungulwa kwezinto ezintsha kusukela ngonyaka we-1945. Inhlangano yethu icebe kakhulu ngamagugu injalo nje inedumela elikhulu lokwenza izinto ngobunyoninco nokusungula izinto ezintsha. Isidlale indima ebalulekile yokubumba ezesayensi zezwe, ezobunjiniyela kanye nezobuchwepheshe. Silangazelele kakhulu ukugubha le ngqophamlando sikanye nabo bonke ababambiqhaza bethu.

Egameni leBhodi, ngithanda ukubonga uNgqongqoshe Wezemfundo Ephakeme, Isayensi Nezokusungula, uDkt Bonginkosi Nzimande, ngokungeseka kwakhe; ubuholi bakwa-CSIR, abasebenzi bethu nabo bonke ababambiqhaza bethu ngokuzikhandla kwabo nangokuzinikela empumelelweni yenhlangano.

USolwazi uThokozani Majozi
USihlalo weBhodi yase-CSIR

KAKARETŠO YA MODULASETULO

Legatong la Boto, ke thaba go le abela Pego ya Ngwaga le Ngwaga ya 2019/20.

Taolelo ya CSIR ya go dira dinyakišišo tša dikarolo tše dintši le tšweletšopele ya theknolotši go godiša kaonafatšo ya intasteri le mahlale, ka gona ya kaonafatša boleng bja bophelo bja Maafrika Borwa go ba bjo bokaone bja nepo ya go kgahliša ya mokgatlo. Gonabjale re šomile tekano ya ngwaga le Boto ye mpsha gomme, gape, go ba le batho ba go fapana mo sehlopheng go a re šomela mo leetong la rena la go kgatha tema ye bohlokwa go mokgatlo le mananeo a bosetšhaba a naga. Bjalo ka Boto, re ikgafile go kgonthiša gore CSIR e a šoma gape e laolwa ka mokgwa wa maitshwaro a mabotse le go swarelela ge e šoma go fihlilela taolelo ye. Ka gona, re tšere sephetho sa go phethagatša melao ya taolo ya tirišano ya Prothokholo ka ga Taolo ya Tirišano mo Lekaleng la Setšhaba le Mananeo a King IV ka ga Taolo ya Tirišano, gore re kgone go laola le go kaonafatša taolo ya tirišano ya CSIR.

Ngwaga wa tshekatsheko e bile ngwaga wa mathomo wa phethagatšo wa Leano le lefsa la CSIR, leo maikemišetšo a lona e lego go hlaloša 'Nna' ka CSIR. Nako ya go fetogela go leano le lefsa ga se ya ba maitapišo a bonolo. Le ge go le bjalo, re kgolwa gore re na le batho ba maleba go atlega bjalo ka mokgatlo, gomme ke tumiša bataolo le bašomi ka go phethagatša phetogo le go kgatha tema gore e šome gabotse.

Ditirišano tša ka mo gae le lefaseng ka moka le peakanyo ya ditumelelano le intasteri, mmušo, diinstitušene tša thuto ya godimo, le mekgatlo ya dinyakišišo le theknolotši di bohlokwa mo katlegong ya mokgatlo. Ka gona, dibaka tša tirišano di swanetše go kgokaganya legato le lengwe le lengwe.

Boto e thabišwa ke phethagatšo ya ditšhelete ya mokgatlo mo ngwageng wa tshekatsheko. Maemo a gonabjale a tlhakišo ya go hlweka ya bo 12 ke kgonthišo ya maitapišo a rena go hlokomela ditšhelete le go swara ditshepedišo tša maitshwaro a mabotse go seo re se dirago.

Kotara ya mafelelo ya ngwaga wa ditšhelete wa tshekatsheko o bile le ditlhohlo, go swana le mekgatlo ye mengwe, CSIR e bile le tlhohlo ya go arabela go leuba la COVID-19 ka tsela ya lebelo go kgonthiša gore bašomi ba rena le malapa a bona ba a bolokega, mola re kgonthiša gore mokgatlo o tšwela pele go šoma gabotse. Taolo ya mokgatlo e thomile tlhohlo ka tlhohleletšo gomme ya beakanya ka lebelo melao ya go šireletša maphelo le polokego ya bašomi. Mokgatlo o arabetše gape boipiletšo bja mmušo gomme wa thekga ka mafolofolo maitapišo a wona ka go sepediša dinyakišišo tša go fapana, ditirelo tša kaonafatšo le tšweletšopele go fokotša khuetšo ya phetelo.

Tsebišo ya kgauswanyana ya ponagalo ya ekonomi ya naga e be e letetšwe, le ge go le bjalo, kgolo ka moo e lego ka gona. Re na le tshepo ya gore mokgatlo o arabela le go tšweletšapele mo go lekanego go atlega. Le ge go le bjalo, go tla nyaka tlhokomelo le maitapišo a go ikemišetša go bataolo le mošomi yo mongwe le yo mongwe go šoma ka maatla go boloka bohwa bja mokgatlo. Ke nnete gore go mathata a mangwe le a mangwe, go na le sebaka. Le ge ditlamorago tša leuba di ka se hlokomologwe, re ka kgetha go hwetša dibaka tša go dirišana le intasteri, gammogo le ditsebi tša kalafo le mahlale go hwetša mekgwa ye mefsa ya go kgatha tema ga mohola go lwantšha leuba le. Ka maitapišo a, CSIR ga se ya swanela go nepiša fela mo gae, eupša le go šomiša sebaka sa ditirišano tša lefase ka moka.

Ngwaga wo re keteka matswalo a bo 75 a CSIR. Katlego ye ye botse ke bohlatse go bohlokwa le mošomo woo CSIR e o dirilego mo tikologong ya diphedi tša tšweletšopele go tloga ka 1945. Mokgatlo wa rena o na le bohwa bja go huma gape le maemo a maatla a bokgoni le tšweletšopele. E kgathile tema ye bolokwa go bopa mahlale a naga, boentšenere le sekgoba sa theknolotši. Re letetše go keteka legato le le bohlokwa le bakgathatema ba rena ka moka.

Legatong la Boto, ke rata go leboga Tona ya Thuto ya Godimo, Saense le Tšwelotšopele, Ngaka Bonginkosi Nzimande, ka thekgo ya gagwe; boetapele bja CSIR, bašomi ba rena le bakgathatema ka moka ka go šoma ka maatla le boikgafo gore mokgatlo o atlege.

Prof. Thokozani Majozi
Modulasetulo wa Boto ya CSIR

MESSAGE FROM THE CEO

Dr Thulani Dlamini
CSIR CEO

The 2019/20 financial year marked the first year of the implementation of the new CSIR Strategy. The strategy has a distinct focus on industrial development and is built around the vision of accelerating socioeconomic prosperity in South Africa through leading innovation.

A key element to the success of the strategy is the continuous engagement with various stakeholders in the private and public sectors, and the establishment of mutually beneficial partnerships locally and internationally. We have had a number of positive engagements with industry, and some of the outcomes include the extension of contracts for services rendered by the CSIR, signed memorandum of agreement, exchange programmes between CSIR and Industry, joint technology development agreements, establishment of joint research infrastructure and negotiations on new areas of collaboration.

Our employees are the bedrock of our organisation and the CSIR remains committed to building and transforming human capital and creating an enabling environment where our EPIC values of pursuing Excellence, celebrating People, personifying Integrity and welcoming Collaboration are entrenched. We are proud to be ranked as the most attractive employer by most students and professionals in the category of natural science in the Universum Most Attractive Employer rankings for 2019. This is indeed commendable.

Once again, our staff have raised the CSIR flag high on various local and international platforms and have received various accolades for the excellence in their work. I am proud of these stellar achievements. Our investment in human capital development for the year under review amounted to R122 million, and you can read more about some of the academic achievements of our employees on pages 56 and 57.

For the reporting year, our total income amounted to R2 764 million, an increase of 7% compared to 2018/19, but less than the targeted amount of R2 859 million for the year under review. Our net profit amounts to R55 million. This is an encouraging amount as we exceeded our target of R46 million and the previous financial year's actuals by R47 million. Despite a positive financial position, we remain cautious, yet hopeful, about our future prospects.

Once again, we received a clean audit from the Auditor-General of South Africa. We are proud of this achievement, which is a 12th consecutive outcome for the organisation and a reflection of our commitment to upholding ethical operations.

The last quarter of the year under review was challenging, as we had to deal with the reality of the COVID-19 pandemic.

Our response to COVID-19 was twofold. Internally, we responded swiftly and kept our employees informed about the relevant preventative measures and information on mental, physical and emotional wellness. Through the advice of our business continuity team, we analysed various scenarios and set up systems to allow staff to work from home. Externally, we supported the national effort to respond to this pandemic and upgraded our Biosafety Level 3 laboratories to be able to conduct COVID-19 tests, in

A KEY ELEMENT TO THE SUCCESS OF OUR STRATEGY IS THE CONTINUOUS ENGAGEMENT WITH VARIOUS STAKEHOLDERS IN THE PRIVATE AND PUBLIC SECTORS, AND THE ESTABLISHMENT OF MUTUALLY BENEFICIAL PARTNERSHIPS LOCALLY AND INTERNATIONALLY.

partnership with the National Health Laboratory Service. We established an data and information centre using our C-MORE platform for situational awareness to track and trace COVID-19 cases, as well as provide decision support to the Department of Health. We also developed diagnostic point-of-care testing kits and have, to date, conducted over 15 000 tests, against a target of 20 000 by 31 March 2021. These are but a few of the responses that we have implemented.

As we cast our eyes into the future, we are aware that, like most businesses, we are not immune to the impact of COVID-19 and we will feel the reality of the economic impact for months to come. This is more so because our strategy has a strong industry focus and this pandemic has impacted most of our prospective partners and clients too. Furthermore, our international onsite research programmes were halted due to the restrictions imposed on travelling and we were unable to earn income on contracts due to delays in the procurement of goods required to support some of our projects. However, the effects of the pandemic were not all bad. Some of the opportunities that came as a result of the pandemic are the reduction in operating costs; prospective business in areas such as health, chemicals and manufacturing; as well as the new virtual ways of conducting business.

The year 2020 is special to us as we look forward to our 75-year anniversary in October. This is a milestone that we are humbled to celebrate and we are cognisant that not too many organisations in our sector can say the same. As part of our celebrations, we will host the 7th Biennial CSIR Conference and organisational Excellence Awards, as well as reveal the refreshed CSIR brand, which supports our new vision and strategy, something that we are very excited about.

As the CSIR, we are only as strong and successful as the calibre of our people, as well as the collective effort we put into our day-to-day work. None of the achievements of this past year would have been possible without our leadership team and our employees. Therefore, I would like to thank the CSIR staff for their hard work, passion and commitment to the organisation.

Finally, I would like to convey my gratitude to the Board for their oversight and assuring support in the last year.

Dr Thulani Dlamini
CSIR CEO

OUR **EMPLOYEES** ARE THE BEDROCK OF OUR **ORGANISATION.**

UMYALEZO WESIKHULU ESIPHEZULU

Unyakamali wezi-2019/20 uphawula unyaka wokuqala kwaqaliswa ukusebenza Kwecebo elisha lakwa-CSIR. Icebo leli ligxile ekuthuthukisweni kwezimboni futhi lakhelwe ngaphansi kombono wokuphangisa ukudlondlobaliswa komnotho womphakathi eNingizimu Afrika kusetshenziswa amacebo amasha obuciko.

Iphuzu eliqavile empumelelweni yaleli cebo ukubonisana ngokuqhubekayo nababambiqhaza abathile emkhakheni ozimele kanye nomkhakha kahulumeni, kanjalo nokusungulwa kobambiswano oluzohlomulisa izingxenye zombili kuleli naphesheya kwezilwandle . Sesibe nemihlangano yokubonisana nezimboni ebe yimpumelelo, futhi eminye yemiphumela ibandakanya ukwelulwa kwezinkontileka zokuhlinzeka ngezidingo ngabakwa-CSIR, ukusayinwa kwesivumelwano sokusebenzisana, izinhlelo zokunanelana abasebenzi phakathi kwabakwa-CSIR Nezimboni, izivumelwano zokuthuthukiswa kobuchwepheshe ngokuhlanganyela, ukusungulwa kwengqalasizinda yezocwaningo ngokuhlanganyela nokubonisana ngezindawo ezintsha okungasetshenziswana kuzona.

Abasebenzi bethu bangumgogodla wenhlangano yethu futhi i-CSIR isazibophezele ekwakheni nasekwenzeni inguquko kwezabasebenzi kanjalo nokwakha indawo ekhuthazayo lapho izindinganiso zethu ze-EPIC zokuphishekela Ukwenza kahle, ukubungaza Abantu, ukuphila Ubuqotho nokwamukela Ukusebenzisana zigcizelelwa futhi zithuthukiswe khona. Siyaziqhenya ngokuqokwa njengomqashi othandwa kakhulu ngabafundi abaningi kanye nabasebenzi abaqeqeshiwe esigabeni sezesayensi yemvelo emkhakheni we-Universum Most Attractive Employer wangowezi-2019. Lokhu kuyancomeka impela.

Sebephindile futhi, abasebenzi bethu baphakamisa ifulegi le-CSIR ezinkundleni ezahlukahlukene zakuleli nasemazweni omhlaba njengoba sebeklonyeliswe ngezindondo ezahlukahlukene ngokwenza umsebenzi wabo ngokuncomekayo. Ngiyaziqhenya ngalezi zimpumelelo ezinhle kangaka. Utshalomali lwethu ekuthuthukisweni kwabasebenzi kulo nyaka obukezwayo kube yizigidi zamarandi eziyi-R122, futhi ungafunda kabanzi ngokunye okuhlonyulwe abasebenzi bethu kwezemfundo ekhasini lama-56 nelama-57.

Kulo nyaka esibika ngawo, isamba semali engenile sifinyelela ezigidini zamarandi eziyi-2 759, okusho ukuthi senyuke ngama-7% uma kuqhathaniswa nonyaka wezi-2018/19, nokho kodwa singaphansi kwesamba ebesihlosiwe sezigidi zamarandi eziyi-2 859 kunyaka obukezwayo. Inzuzo yethu isiyonke ibalelwa ezigidini zamarandi ezingama-56. Lokhu kuyakhuthaza kakhulu ngoba sedlulile kwisamba sethu ebesihlosiwe sezigidi zamarandi ezingama-46 kanjalo nenani lemali yonyaka ofile okwakuyizigidi zamarandi ezingama-47. Yizenoma sisesimweni esihle ngokwezimali, nalapho sisahamba ngokucophelela okukhulu, nangethemba, ngezimpokophelo zethu ngekusasa.

Nakulokhu futhi, siphinde sathola ucwaningomabhuku oluvela kuMcwaningimabhuku-Jikelele waseNingizimu Afrika olungenacala. Siyaziqhenya kakhulu ngale mpumelelo, nokuwumphumela wenhlangano weshumi nambili amahlandla elandelana futhi uyisibonakaliso sokuzibophezela kwethu ekubambeleleni ekusebenzeni ngobuqotho nangenkambiso enhle.

Ikota yokugcina yonyaka obukezwayo beyinezinselele eziningi, njengoba kudingeke sibhekane ngqo nobunjalo bobhubhane lwe-COVID-19.

Indlela esisabele ngayo ku-COVID-19 imbaxambili. Ngaphakathi, senze umnyakazo osheshayo futhi sagcina abasebenzi bethu benolwazi ngezinyathelo zokuvikela ezifanele

kanye nolwazi kanjalo nempilonhle ngokwengqondo, okomzimba nangokomzwelo. Ngokwelulekwa yithimba lethu lokuqhubeka nokusebenza kwebhizinisi, sihlaziye izimo ezahlukahlukene sabeka nezinhlelo zokuvumela abasebenzi ukuthi bakwazi ukusebenzela emakhaya. Ngaphandle, sixhase umzamo kazwelonke wokubhekana nalolu bhubhane futhi sathuthukisa amalebhu ethu e-Biosafety Level 3 ukuze sikwazi ukwenza izivivinyo ze-COVID-19, ngokubambisana ne-National Health Laboratory Service.

Sisungule isikhungo solwazi sisebenzisa uhlaka lwethu i-C-MORE yokuqwashisa ngesimo nokulandelela iziguli ze-COVID-19, kanye nokuhlinzeka uMnyango wezeMpilo ngokwesekwa ngolwazi oluzobasiza bakwazi ukuthatha izinqumo. Siphinde senza amakhithi okuhlola atholakala ezindaweni zokunakekelwa futhi kuze kube manje, sesenze ukuhlola okwevile kokuyizi-15 000, uma kuqhathaniswa nomgomo esasizibekele wona wokuhlola okuyizi-20 000 uma kufika umhla zingama-31 kuNdasa wezi-2021. Lokhu kungokunye kwemizamo embalwa esesiyenzile.

Njengoba siphonsa amehlo ethu esikhathini esizayo, siyazi ukuthi, njengamabhizinisi amaningi, nathi sisengakhinyabezwa umthelela we-COVID-19 futhi sizobuzwa kahle ubunjalo bomthelela wezomnotho ezinyangeni ezizayo. Lokhu kungenxa yokuthi isu lethu ligxile kakhulu ezimbonini kanti lolu bhubhane luthinte kakhulu abalingani bethu kanjalo labo abazoba ngamakhasimende ethu. Ngaphezu kwalokho, izinhlelo zethu zocwaningo ezikhungweni zomhlaba wonke ziye zamiswa ngenxa yemikhawulo ebekiwe kwezokuhamba futhi asikwazanga ukungenisa imali ngezinkontileka ngenxa yokubambezeleka kokuthengwa kwempahla ebeyidingeka ukuxhasa eminye yemiklamo yethu. Kodwa-ke, imiphumela yalolu bhubhane ayizange ibe mibi yonke. Amanye amathuba esiwathole ngenxa yalolu bhubhane kube ukwehla kwezindleko zokusebenza; imisebenzi yethu ezindaweni ezifana nezempilo, amakhemikhali kanye nezokukhiqiza; kanye nezindlela ezintsha zokwenza ibhizinisi ngosizo lwe-inthanethi.

Unyaka wezi-2020 ubaluleke kakhulu kithina njengoba silangazelela ukugubha iminyaka engama-75 ngoMfumfu. Lokhu kuyingqophamlando okuyintobeko enkulu kithina ukuyigubha futhi siyazi ukuthi aziziningi kakhulu izinhlangano emkhakheni wethu ezingasho lokhu. Njengengxenye yemigubho yethu, sizosingatha iNgqungquthela yesi-7 yakwa-CSIR Yaminyaka Yonke, phecelezi i-7th Biennial CSIR Conference kanye noMcimbi WokuKlomelisa Ngezindondo Kwabenza Umsebenzi Wabo Ngokuncomeka, phecelezi ama-Excellence Awards, futhi sizodalula uphawu lwe-CSIR oluvuselelwe, olweseka umbono wethu nesu elisha, nokuyinto esinentokozo enkulu ngayo.

Njenge-CSIR, ukuba namandla kwethu njengenhlangano kanye nokuphumelela kuncike kuhlobo lwabantu bethu, kanjalo negalelo lethu sonkana esilifaka emsebenzini wethu wansuku zonke. Akukho nokukodwa okuzuzwe kulo nyaka odlule obekungenzeka ngaphandle kwethimba lethu lobuholi kanye nabasebenzi bethu. Ngakho-ke, ngithanda ukubonga abasebenzi bakwa-CSIR ngokusebenza kwabo ngokuzikhandla, ugqozi nokuzinikela kwabo enhlanganweni.

Okokugcina, ngithanda ukudlulisa ukubonga kwiBhodi ngokungamela kwalo kanjalo nokweseka elikuhlinzeke onyakeni ofile.

UDkt Thulani Dlamini
ISikhulu esiPhezulu se-CSIR

MOLAETŠA WA MOHLANKEDIMOGOLOPHETHIŠI

Pego ya ngwaga wa ditšhelete e dira ngwaga wa mathomo wa phethagatšo ya Leano la CSIR le lefsa. Leano le na le nepišo ya go fapana go kgolo ya intasteri gomme le theilwe godimo ga pono ya go potlakiša katlego ya ekonomi ya leago ka Afrika Borwa ka tšweletšopele ya godimo.

Karolo ya motheo ya katlego ya leano ke go boledišana nako le nako le bakgathatema ba go fapana mo makaleng a praebete le a setšhaba, le go thongwa ga tirišano ye botse yeo e kopanetšwego ya mo gae le lefaseng ka moka. Re bile le dipoledišano tše dibotse tše mmalwa le intasteri, gomme tše dingwe tša dipoelo di akaretša katološo ya dikontraka tša ditirelo tšeo di abjago ke CSIR, memorantamo ya tumelelano yeo e saennwego, mananeo a dipoledišano gare ga CSIR le Intasteri, ditumelelano tša kaonafatšo tšeo di saennwego, go thongwa ga infrastraktšha ya dinyakišišo le dipoledišano ka dikarolo tše difsa tša tirišano.

Bašomi ba rena ke motheo wa mokgatlo wa rena gomme CSIR e dula e ikgafile go ageng le go fetošeng letlotlo la batho le go hlola tikologo yeo e matlafetšego moo dikholego tša rena tša EPIC tša go tšwetša pele Bokgoni, go keteka Batho, go bontšha botshepegi le go amogela Tirišano di thomilwego. Re thabela go lekanyetšwa bjalo ka mongmošomo wo mokaone ke baithuti le ditsebi tše dintši mo legorong la mahlale a tlhago mo ditekanyetšong tša Mongmošomo wa Go goga Šedi Kudu wa Universum tša 2019. Se se a lebogega.

Gape, bašomi ba rena ba phagamišitše folaga ya CSIR mo difaleng tša go fapana tša mo gae le lefaseng ka moka gomme ba amogetše difoka tša go fapana ka bokgoni bja mošomo wa bona. Ke ikgantšha ka dikatlego tše tše dikgolo. Peeletšo ya rena go kaonafatšeng letlotlo la batho go ngwaga wa tshekatsheko e bile R122 milione, gomme o ka bala tše dintši ka ga tše dingwe tša dikatlego tša thuto tša bašomi ba rena mo matlakaleng a 56 le 57.

Go ngwaga wa pego, palomoka ya letseno la rena e bile R2 764 milione, koketšego ya 7% go bapetša le ya 2018/19, eupša ka fase ga bokaalo bjoo bo lebantšwego bja R2 859 milione bja ngwaga wa tshekatsheko. Letseno leo le šetšego le fihla go R55 milione. Ye ke palomoka ya go hlohleletša ka ge re fetile selebanywa sa rena sa R46 milione le dithoto tšeo di rekišitšwego tša ngwaga wa ditšhelete ka R47 milione. Ntle le maemo a ditšhelete a mabotse, re dula re hlokometše, gape ka boitshepo, ka ga dipono tša rena tša ka moso.

Gape, re amogetše tlhakišo ya go hlweka go tšwa go Motlhakišipharephare wa Afrika Borwa. Re ikgantšha ka katlego ye, yeo e lego dipoelo tše 12 tša go latelana tša mokgatlo le pono ya boikgafo bja rena bja go hlohleletša ditshepetšo tša maitshwaro a mabotse.

Kotara ya mafelelo ya ngwaga wa tshekatsheko e bile le ditlhohlo, ka ge re ile ra swanela ke go šogana le maitemogelo a leuba la COVID-19.

Karabelo ya rena go COVID-19 e bile gabedi. Ka gare, re arabetše ka bjako gomme ra fa bašomi ba rena tshedimošo ka magato a tšhireletšo a maleba le tshedimošo ya go phela gabotse ga monagano, mmele le maikutlo. Ka maele a sehlopha sa rena sa go tšwetša pele kgwebe, re sekasekile maemo a go fapana le go beakanya mananeo a go dumelela bašomi go šomela ka gae. Ka ntle, re thekgile maitapišo a mmušo go arabela go leuba le gomme ra kaonafatša dilaporotori tša rena tša Tšhireletšophedi ya Legato la 3 go kgona go dira diteko tša COVID-19, ka tirišano le Tirelo ya Laporotori ya Maphelo ya Bosetšhaba. Re thomile senthara ya data le tshedimošo re šomiša sefala sa C-MORE ya rena go lemoša ka maemo a go latišiša le go hwetša ditiragalo tša COVID-19, gammogo le go aba thekgo ya diphetho go Kgoro ya Maphelo. Re dirile gape didirišwa tša go dira diteko tša lefelo

la tlhokomelo gomme, go fihla gonabjale, re dirile diteko tša go feta 15 000, kgahlanong le selebanywa sa 20 000 ka la 31 Hlakola 2021. Tše ke tše dingwe tše mmalwa tša dikarabelo tšeo re di phethagaditšego.

Ge re lebelela bokamoso, re lemoga gore, go swana le dikgwebo tše dingwe, ga re a bolokega go COVID-19 gomme re tla itemogela go amega ga ekonomi mo dikgweding tšeo di tlago. Se se ka tsela ye ka lebaka la gore leano la rena le na le nepišo ye maatla ya intasteri gomme leuba le amile bontši bja badirišani ba rena ba bohlokwa le badirelwa. Gape, mananeo a rena a ka gare a boditšhabatšhaba a emišitšwe ka lebaka la dikiletšo tša mesepelo gomme ga re kgone go hwetša letseno go dikontraka ka lebaka la go ditelega ga go reka dithoto tšeo di nyakegago go thekga diprotšeke tše dingwe tša rena. Le ge go le bjalo ditlamorago tša leuba di be di se tše dibe ka moka. Tše dingwe tša dibaka tšeo di tlilego ka lebaka la leuba ke go fokotšwa ga ditshenyagelo tša go šoma; dikgwebo tša bohlokwa mo dikarolong tša go swana le maphelo, dikhemikhale le tšweletšo; gammogo le mekgwa ye mefsa ya inthanete ya go sepetša kgwebo.

Ngwaga wa 2020 o ikgethile go rena ge re lebelela pele go matswalo a rena a ngwaga wa bo 75 ka Dibatsela. Se ke histori yeo re ikokobetšago ge re e keteka gomme re a lemoga gore ga se mekgatlo ye mentši mo lekaleng la rena yeo e ka bolelago sa go swana le se. Bjalo ka karolo ya meketeko ya rena, re tla swara Khonferense ya CSIR ya Biennial ya bo 7 le Difoka tša Bokgoni tša mokgatlo, gammogo le go utolla leswao le lefsa la CSIR, leo le thekgago pono le leano la rena le lefsa, selo seo re se thabetšego kudu.

Bjalo ka CSIR, re na le maatla gape re atlegile bjalo ka bokgoni bja batho ba rena, gammogo le maitapišo a mohlakanelwa ao re a dirago mošomong wa rena wa letšatši le lengwe le lengwe. Dikatlego tša mengwaga ye ya go feta di be di ka se kgonege ka ntle ga sehlopha sa boetapele bja rena le bašomi ba rena. Ka gona, ke rata go leboga bašomi ba CSIR ka go šoma ka maatla ga bona, lerato le boikgafo bja bona mo mokgatlong.

Sa mafelelo, ke rata go leboga Boto ka taolo ya bona le go kgonthiša thekgo mo ngwageng wa go feta.

Ngaka Thulani Dlamini
Mohlankedimogolophethiši wa CSIR

STATEMENT OF RESPONSIBILITY AND CONFIRMATION OF ACCURACY FOR THE ANNUAL REPORT

To the best of my knowledge and belief, I confirm the following:

All information and amounts disclosed in the annual report are consistent with the annual financial statements audited by the Auditor-General.

The annual report is complete, accurate and is free from any omissions.

The annual report has been prepared in accordance with the guidelines on the annual report as issued by National Treasury.

The annual financial statements (Part F) have been prepared in accordance with the International Financial Reporting Standards applicable to the CSIR.

The accounting authority is responsible for the preparation of the annual financial statements and for the judgements made in this information.

The accounting authority is responsible for establishing and implementing a system of internal controls that has been designed to provide reasonable assurance as to the integrity and reliability of the performance information, the human resources information and the annual financial statements.

The external auditors are engaged to express an independent opinion on the annual financial statements.

In our opinion, the annual report fairly reflects the operations, performance information, human resources information and financial affairs of the CSIR for the financial year ended 31 March 2020.

Yours faithfully

Chief Executive Officer
Dr Thulani Dlamini
30 September 2020

Chairperson of the Board
Prof. Thokozani Majozi
30 September 2020

STRATEGIC OVERVIEW

The Council for Scientific and Industrial Research (CSIR) researches and develops transformative technologies to accelerate socioeconomic prosperity in South Africa. The organisation's work contributes to industrial development and supports a capable state.

VISION

We are accelerators of socioeconomic prosperity in South Africa through leading innovation.

MISSION

Collaboratively innovating and localising technologies while providing knowledge solutions for the inclusive and sustainable advancement of industry and society.

VALUES

Our beliefs, principles and the impact we wish to make to improve the quality of life of South Africans are **EPIC**.

TEAM CSIR:

Pursues	**E**xcellence
Celebrates	**P**eople
Personifies	**I**ntegrity
Welcomes	**C**ollaboration

OBJECTIVES

- Conduct research, development and innovation of transformative technologies and accelerate their diffusion;
- Improve the competitiveness of high-impact industries to support South Africa's re-industrialisation by collaboratively developing, localising and implementing technology;
- Drive socioeconomic transformation through RD&I that supports the development of a capable state;
- Build and transform human capital and infrastructure; and
- Diversify income, and maintain financial sustainability and good governance.

THE CSIR MANDATE

"The objects of the CSIR are, through directed and particularly multidisciplinary research and technological innovation, to foster, in the national interest and in fields which, in its opinion, should receive preference, industrial and scientific development, either by itself or in co-operation with principals from the private or public sectors, and thereby contribute to the improvement of the quality of life of the people of the Republic, and to perform any other functions that may be assigned to the CSIR by or under this Act."

(Scientific Research Council Act 46 of 1988, amended by Act 71 of 2014)

75 YEARS OF TOUCHING LIVES THROUGH INNOVATION

» ORGANISATIONAL STRUCTURE

science & innovation
Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

Prof. Thokozani Majozi
CSIR Chairperson of the Board

Dr Thulani Dlamini
CSIR CEO

Khungeka Njobe
Group Executive:
Business Excellence
and Integration

Andile Mabindisa
(Acting) Group
Executive:
Human Capital

Nomcebo Monama
(Acting) Chief
Financial Officer*

Dr Motodi Maserumule
Group Executive:
Mining,
Manufacturing,
Defence & Security

Dr Rachel Chikwamba
Group Executive:
Chemicals,
Agriculture,
Food and Health

Adv Esmé Kennedy
Group Executive:
Legal, Compliance
and Business
Enablement

Resignations during the 2019/20 FY

1. Ms Sithembile Bhengu was CSIR Group Executive: Human Capital, until 8 April 2019
2. Ms Zanele Ngwepe was CSIR Chief Financial Officer until 30 June 2019
3. Ms Cheryl Howell was Acting Chief Financial Officer from 1 July until 31 December 2019

**Acting since 1 January 2020.*

B ORGANISATIONAL HIGHLIGHTS

This annual report represents the first opportunity to report back on the organisation's newly defined strategic objectives, which were formulated in response to our current local and global context.

The convergence and pace of new technologies are fundamentally disrupting industries and require **research, development and diffusion of transformative technologies.** A breakthrough in generating potent anti-HIV antibodies using a chemically modified plant-based system is but one example of what is possible in this regard.

To counter the deindustrialisation experienced in the country, we are dedicated to **contributing to reindustrialisation through technology development, localisation and implementation**. Our capabilities in laser technology and support for government-led initiatives, such as the Aerospace Industry Support Initiative and the Technology Localisation Implementation Unit, illustrate how we contributed to this objective.

Economic and social development in South Africa has been constrained by the challenges of unemployment and poverty. We are **supporting the development of a capable state** in many respects, from helping agencies counter poaching to helping the country with responsible planning for growth and progress in the energy and aquaculture sectors.

To help ensure that we maximally leverage the opportunities locked up in new technologies, the CSIR continues to invest in and leverage **human capital and infrastructure**, as is evident from our graduate-in-training programme, our staff's remarkable academic enrichment and successes in drawing investment in much-needed technology infrastructure.

A breakthrough in generating potent anti-HIV antibodies using a chemically modified plant-based system illustrates the CSIR's ability to develop transformative technologies.

Researchers have developed a formulated research-grade monoclonal antibody generated from a *Nicotiana benthamiana* plant grown in a controlled growth chamber.

GENERATING POTENT ANTI-HIV ANTIBODIES USING A CHEMICALLY MODIFIED PLANT-BASED SYSTEM

The CSIR, in collaboration with the National Institute of Communicable Diseases (NICD), is developing broadly neutralising antibodies against HIV-1, the most widespread human immunodeficiency virus, for the prevention and treatment of HIV/Aids.

CSIR scientists and their research partners were able to demonstrate the ability to engineer tobacco plants to produce unique glycosylation and rare sulfation post-translational modifications, a result that is not usually seen in plants. Glycosylation is a biochemical process during which a glycan – a large carbohydrate molecule – attaches to a protein, a lipid or another organic molecule.

The glycoengineered *Nicotiana benthamiana* (a relative of the tobacco plant) expressed two broadly neutralising antibodies called CAP256-VRC26 08 and CAP256-VRC26 09. These two antibodies were isolated by collaboration partners CAPRISA and the NICD from a South African HIV positive patient during a trial conducted by CAPRISA. The outcome showed that the antibodies from the CAP256 lineage were the most active, with high potency and broad specificity. This was confirmed with mammalian-made cells and the result showed that the antibodies were structurally similar to those made in human cells. Furthermore, with required post-translational modifications installed in *Nicotiana benthamiana,* the antibodies were just as potent and broadly neutralising as when produced in human cells.

For the technology to be rolled out, the research team must test the efficacy of the plant-made CAP256 antibodies in macaques, followed by clinical trials. This phase is being funded by the Strategic Health Innovation Partnership of the Department of Science and Innovation and the Medical Research Council. The research partners are exploring options to make the technology accessible to clinics via an industry partner.

The technical achievement to date has underlined the potential of a plant-based immunisation or antiretroviral therapy regimen, and proven South Africa's capability to make such antibodies.

DRONE DETECTION RESEARCH FACILITY DEVELOPED FOR EUROPEAN R&D PARTNER

The CSIR has completed the design and development of a drone detection research facility for *armasuisse Science and Technology* in Switzerland in the culmination of a six-year cooperation agreement. The system has proven its ability to detect and localise airborne objects as small as micro-drones, over a few kilometres.

Comprising three nodes – a transmitter node and two receiver nodes – the multi-static system's components are deployed a few kilometres apart to provide persistent air surveillance over more than 1 000 hectares. The benefit of this multi-static radar system – as opposed to a monostatic set up in one fixed location – is that it allows the facility to observe the area under surveillance from different perspectives. This diversity improves the chances of the system being able to detect the movement of airborne objects against interference from background clutter.

A key innovation in the system is the use of a phased array antenna. Through careful control of constructive interference between radio waves generated from 280 small antenna elements, the radar energy can be steered towards any part of a scene. Traditionally, phased array antennas have only been accessible to the richest nations in the world, but by novel utilisation of consumer wireless technology, CSIR engineers have made it possible to harness this capability for South African use.

The facility will be used for further research into trade-offs involved in multi-static systems – an area of active research internationally – including understanding the statistics of radar returns from the environment (clutter) and drones. Already, a system with this level of sensitivity can detect radar returns from several other small moving objects like birds, animals and humans.

The two multi-static receiver nodes being setup for initial testing at the client site in Switzerland.

The transmitter node providing all weather monitoring for drone activity over the open area towards the Swiss alps.

The transmitter node deployed in the veld during tests in South Africa.

One of the two fully laden test vehicles (Truck A) on the high-speed oval track at Gerotek. Truck A was fitted with conventional tyres for the first round of testing.

REDUCING ROAD FREIGHT COSTS AND EMISSIONS THROUGH GREEN TYRES

The CSIR, in collaboration with the University of the Witwatersrand (Wits), tyre company Michelin, and Cambridge University in the United Kingdom (UK), performed full-scale tests of modern low-rolling resistance tyres – called green tyres – on trucks. The tests demonstrated an 8 to 10% reduction in fuel use and carbon emissions, which equates to a reduction of approximately 4% in operating costs. The research was carried out through the new South African Centre for Sustainable Road Freight.

Logistics companies are increasing efforts to reduce costs and carbon emissions, to which fuel use is the main contributor. Green tyres have the potential to improve fuel efficiency, but local transport operators are not yet convinced of their value. Michelin set out to validate the fuel-saving potential of these tyres in local conditions through validated research trials.

The collaboration stems from the work of the South African Centre for Sustainable Road Freight, of which Michelin was the first industry partner. The Centre is a collaboration between the CSIR, Wits University, Stellenbosch University, the Tshwane University of Technology and the University of the Western Cape.

Full-scale experiments were carried out on two identical, fully loaded interlink truck combinations over a week at Gerotek in October 2019. One was fitted with standard X Multi tyres, and the other with green X Energy tyres, and both trucks were instrumented with sensors and data loggers.

The CSIR contributed expertise in sustainable road freight transport, truck dynamics, mechanics and vehicle testing, and contributed to the experimental design, on-the-day testing and the dissemination of the results. The project was supported by a Royal Academy of Engineering (UK) grant and Michelin, while drivers, trucks, trailers and fuel were provided by Iveco, Afrit, Lafarge and Total. Increased uptake of these tyres will help to reduce the cost of logistics and carbon emissions in South Africa.

BUILDING RESILIENT ROADS FOR A CHANGING CLIMATE

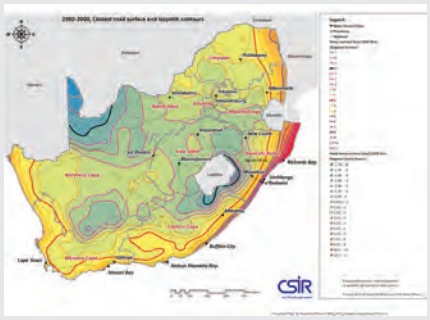
A CSIR study investigated the effects of climate change, with particular focus on the effects of rising temperatures on bituminous binders used for building asphalt roads in South Africa.

For many years, CSIR researchers have been at the forefront of developing standards that help engineers and urban planners build roads that can withstand evolving demands. The latest study is important because it presents a practical solution to making South African roads more adaptable to the inevitable impacts of a changing climate. The interdisciplinary study incorporated climate model projections with algorithms used for road material selection to quantify the effects of climate change on bituminous binder selection.

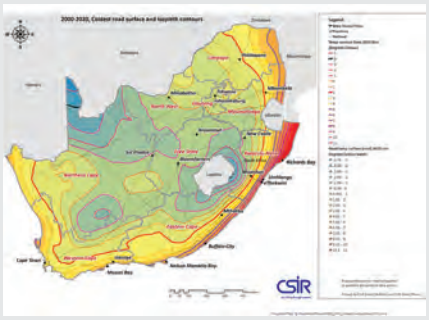
The effects of rising temperatures were analysed by using geographical information systems and building on existing knowledge and methods that led to the current performance-graded specifications. The temperature of the asphalt layer or road surface is dependent on the climate of the area and plays an important role in determining the stiffness of the asphalt layer. The specifications were introduced in 2019 by the Road Pavement Forum and now form part of a South African national standard. The study on adapting asphalt pavements for climate change intends to inform current specifications for bituminous binder selection.

The study has sparked further investigation into building climate-resilient infrastructure for the transport sector, which will form part of the National Climate Change Research Agenda for the South African transport infrastructure sector.

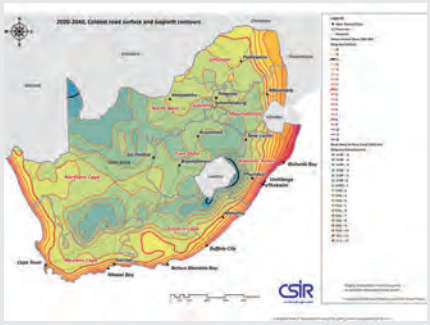
Coldest
The effect of climate change on minimum pavement temperatures over 80 years between 1980 and 2060.



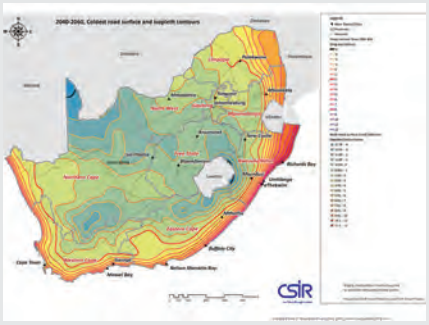
1980 – 2000



2000 – 2020

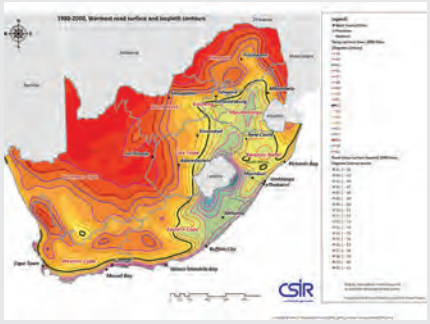


2020 – 2040

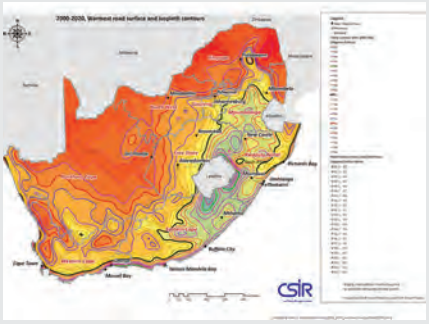


2040 – 2060

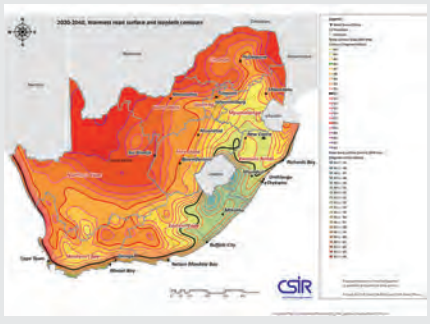
Warmest
Effect of climate change on 7-day-average maximum pavement temperatures over 80 years between 1980 and 2060.



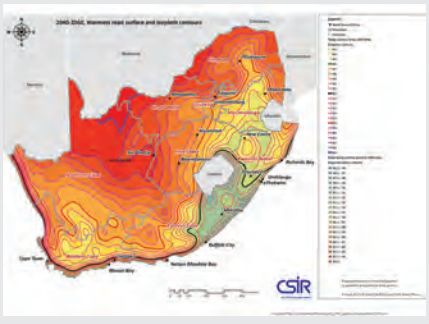
1980 – 2000



2000 – 2020



2020 – 2040



2040 – 2060

Zimkhitha Mbekeni (left) from the Cape Peninsula University of Technology and Ryno Els from Sea Technology Services checking the underwater connector on a wave glider's electronic enclosures.

SOCCO BECOMES A PIONEER IN OCEAN ROBOTICS TECHNOLOGY

Research to understand the Southern Ocean and the role it plays in the global and regional carbon-climate system has given birth to innovative technologies. Researchers at the Southern Ocean Carbon and Climate Observatory (SOCCO), which celebrated 10 years of carbon-climate research in the Southern Ocean, have collaborated with Sea Technology Services, a small, medium and micro enterprise in ocean engineering services, to create a new high-tech observation platform.

The Southern Ocean's uptake of anthropogenic carbon dioxide (CO_2) and heat plays a critical role in slowing down the pace of global warming and climate change. To address the need for precision in ocean CO_2 observations, the team designed and built a new instrument for observations on partial pressure of CO_2 that can cope with extreme conditions in the Southern Ocean. The instrument can function autonomously for one year and gives precise results of CO_2 in the atmosphere and ocean. These developments led to the manufacturing of units for SOCCO and for export to the European Union.

Building on these developments, and to address the challenge of the current limitations of robotics operations during the low and no sunlight seasons in the Southern Ocean, the team, in collaboration with engineers at the Centre for High Performance Computing, is also developing a bespoke underwater generator. The generator is capable of delivering sufficient power at the low speed of the wavegliders and is ready for its first sea trials. The team also built robotic instruments that provide real-time information for use in fishery and fishery-related governance.

GROUND-PENETRATING RADAR SUITABLE TO ASSESS REHABILITATED OPENCAST COALMINE SOILS

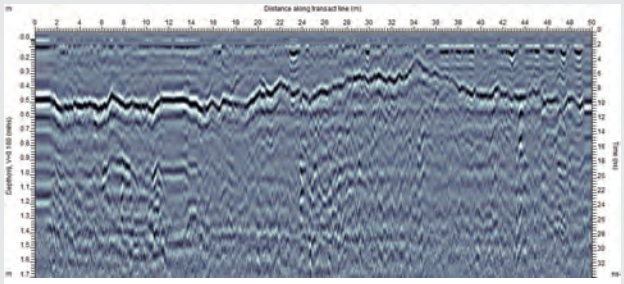
The CSIR and the Agricultural Research Council undertook a collaborative research project funded by the Coaltech Research Association to improve the characterisation and assessment of rehabilitated areas after opencast mining. Coaltech is a collaborative research organisation whose vision is to add value to the coal industry for the benefit of the country.

Rehabilitated mining areas can be repurposed, for example, for agriculture and cattle farming, if the rehabilitation process is done correctly. Therefore, the rehabilitated areas need to be as uniform as possible, in terms of the depth of the rehabilitated soils.

The traditional method of investigating soil conditions in rehabilitated areas of South African coal mines involves grid-based observations (at a fixed interval), usually using a hand-held soil auger – a tool used to bore holes in the ground to study soil samples. The advantage of using ground-penetrating radar (GPR) technology is that it facilitates continuous investigation between auger sampling points, instead of specific sampling points only. Additionally, it provides an indication of the spatial variability and occurrence of varying depth classes and reduces manpower costs, while the data are recorded and stored digitally and continuously, covering a larger area in a specific time and making it possible to study the variation between auger grid points more rapidly.

The researchers found that GPR technology can make a significant contribution to accurately and cost-effectively tracking the continuity and depth variations of the boundary layer. It was also found that GPR accuracy does not depend on the different seasons and that 500 MHz offers the best overall data resolution for this purpose. Using GPR, in conjunction with a soil scientist, it should be possible to cover at least twice the number of observation grid points on a continuous transect basis. Obtaining information based on direct observation by soil auger would be necessary only at selected grid points or at occasional intervals along the transect, where it is determined that a calibration is required, or some subsurface uncertainty needs to be investigated.

CSIR field technician Jonas Machake (left) and researcher Zintle Nontso conducting a GPR survey at a rehabilitated mining area.



A radargram, with the x-axis representing the distance along the transect line, while the y-axis represents the depth of penetration and the radar pulse travel-time. A strong ground-penetrating radar (GPR) reflection can continuously be seen along the transact line at a depth of 0.5 meters. This strong GPR reflection represents the boundary layer of the rehabilitated soil.

LASER TECHNOLOGY ADDRESSES UTILITY'S MAINTENANCE CHALLENGE

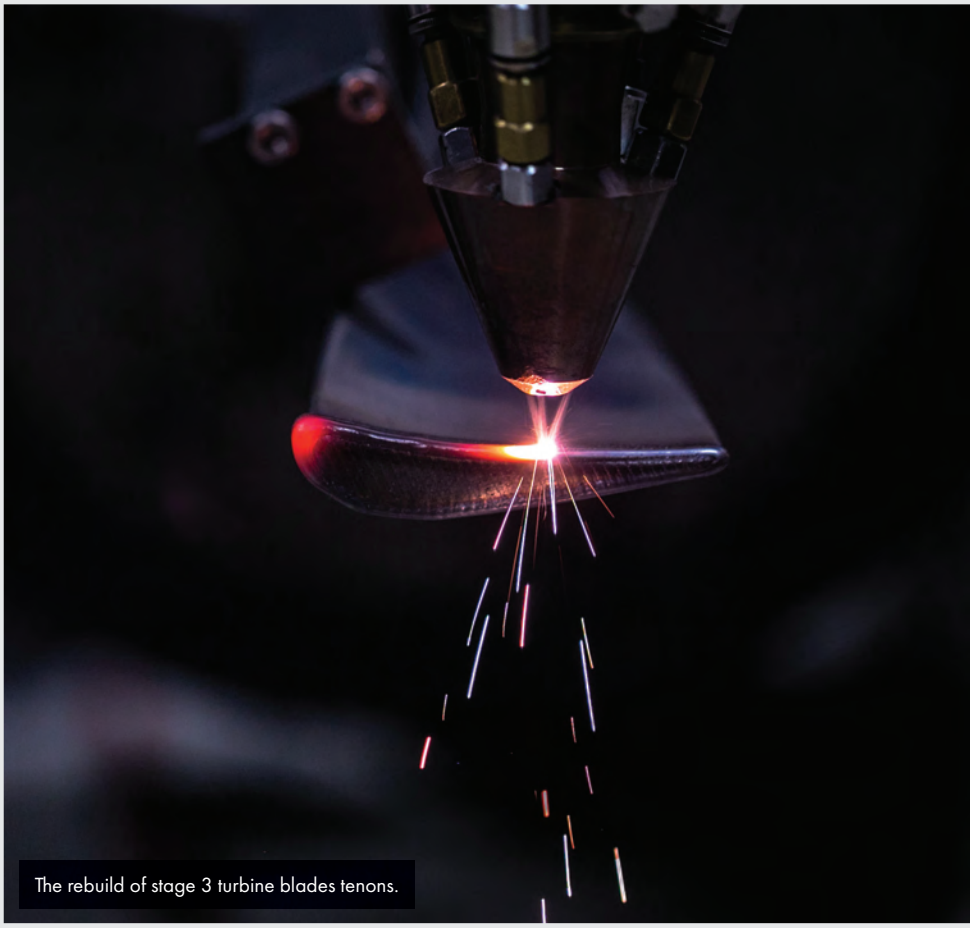
The CSIR has developed a method of rebuilding the tenons of turbine blades in support of Eskom's maintenance programme.

CSIR laser welding specialists, in close collaboration with their Eskom partners, identified possible welding materials to be used for the rebuilding of tenons, whereafter the CSIR prepared weld coupons for the metallurgical investigation of the different weld metals and determined the post-weld heat treatment processes to follow. The CSIR team also developed welding patterns to rebuild tenons to a near-net shape as part of the welding procedure qualification for tenon build-up.

Generally, a large number of turbine blades are scrapped during turbine maintenance and repair projects, which involves shroud or under strap repair, since the tenons of blades need to be ground down to remove the shroud from the turbine rotor.

The in-situ rebuilding of the tenons on turbine rotors by laser metal deposition is a time and cost-efficient option of repairing the blades for further use. This is true for both scheduled and unscheduled maintenance, as only the blades that are affected by the maintenance activity need to be refurbished, without the need to scrap or remove any blades from a rotor.

Furthermore, the capability to refurbish scrapped blades will reduce costs, as there are a number of rows of scrapped blades available that can return to service or be available as spare sets after complete refurbishment.



The rebuild of stage 3 turbine blades tenons.

CSIR experts in laser-enabled manufacturing and laser engineering are, from left, Kgabo Mojela, Priscilla Lesele, Maritha Theron, Dr Corney van Rooyen, Andrew Madi and Lethabo Kekana.

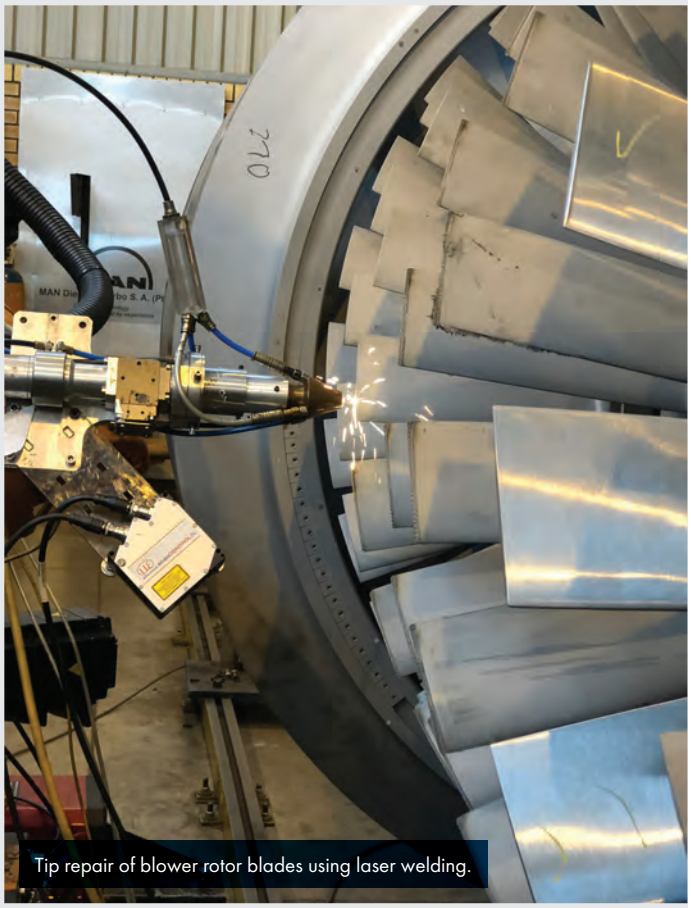
PARTNERING WITH INDUSTRY TO OFFER LASER-BASED MANUFACTURING EXPERTISE

The CSIR developed a laser-based metal deposition technology for MAN Energy Solutions, which was jointly implemented to improve the efficiency of in-service blower rotors at Sasol.

The refurbishment project improved the efficiency of the rotors by more than 10%. This resulted in significant energy cost savings for Sasol, because of the lower energy input required to achieve the same airflow output.

The technology enables accurate and complex weld build-up profiles on existing components, with limited distortion of the original component. This is made possible by the low heat input of the laser welding process. Laser welding proved ideal because of the accuracy required for the blades on such a compressor and the need for a thin profile build-up.

Earlier, the CSIR had signed a collaboration agreement that allowed it and MAN Energy Solutions to jointly offer a laser-based repair and refurbishment service to their clients. The CSIR's contribution to the collaboration is to provide laser-based manufacturing technologies for the refurbishment of high-value components and plant equipment.



Tip repair of blower rotor blades using laser welding.

The CSIR's Dr Corney van Rooyen monitors the laser welding process.

A blower rotor in the repair bay at MAN Energy Solutions.

TECHNOLOGY INTERVENTION HELPS LOCAL FIRM TO DIVERSIFY ITS BUSINESS

The Technology Localisation Implementation Unit, a CSIR-hosted initiative of the Department of Science and Innovation, has implemented a number of technology interventions at Novatek, which will help the company become globally competitive.

Novatek is a Johannesburg-based company that has extensive expertise in hydro-powered mining equipment – providing hydropower technology solutions to optimise underground mining. The company develops and manufactures innovative high-tech rock drilling and mining machinery.

Through Firm-level Technical Assistance Packages, the company was able to obtain the international quality standard ISO 9001 Certification and implement lean manufacturing standards and integrated business management software.

Novatek was one of the finalists in the Mandela Mining Precinct's Isidingo Drill Challenge. The company's rock drilling and mining machinery was demonstrated at the Mandela Mining Precinct in November 2019.

Another one of its products, the Buffalo drill rig, has the potential to significantly improve mining effectiveness. Novatek has been shortlisted as a potential supplier to Denel.

Novatek's Buffo drill rig.

Novatek's Buffalo rig demonstrates a people-centric approach to technology design. The prototype strikes a balance between weight and usability.

SURVEILLANCE CAMERA GETS THE NOD FROM LOCAL AND INTERNATIONAL MARKETS

A South African-developed optical system generated interest at its international launch. The SmartCAM system was developed by Kutleng Dynamic Electronic Systems, a small, medium and micro enterprise supported by the Aerospace Industry Support Initiative – a programme of the Department of Trade, Industry and Competition, hosted and managed by the CSIR.

The innovative optical system, launched at the Amazon Re-Invent Conference in Las Vegas in December 2019, offers a wide variety of applications, ranging from defence, security and environmental surveillance, to the monitoring of urban areas. It features a high-performance on-board image processing system.

With most of the components in the camera sourced in South Africa, the design and development of the camera contributes to the strengthening of the South African manufacturing sector.

A local aerospace company is adapting the SmartCAM to serve as a 360-degree intelligent surveillance camera. The camera will function in auto-detect and reporting mode, in a remote site, with exposure to extreme weather conditions. This is an opportunity to prove the durability of the system and provide essential feedback to Kutleng on the harsh operational environment, the transmission of data from remote locations, as well as the logistics behind installation and maintenance.

International uptake also seems likely, with an international company having expressed interest in licensing the SmartCAM system for border surveillance. The technology will be licensed together with the back-end infrastructure that is currently under development to deliver a turnkey solution to the client.

The SmartCAM in an enclosed application.

Jenasi SmartCAM multiple spectrum independent camera heads.

The Jenasi SmartCAM enclosure with external field programmable gate array system on module.

LOCAL FIRM DEVELOPS A NEW MARINE DOMAIN AWARENESS SYSTEM

The Technology Localisation Implementation Unit (TLIU) has assisted Cybicom, a South African company that specialises in electronic and systems engineering, to develop a marine domain awareness system. The project is directly linked to two large shipbuilding projects that have been awarded by Transnet and Armscor.

The newly developed technology means that Cybicom is now able to offer its third-generation naval command and control (C2) system for use aboard small to medium-sized naval platforms. The naval C2 is designed to fill the gap between commercial navigation tools and big, expensive combat management systems.

The latest naval C2 system takes advantage of the very latest in software development kits and geospatial tools available. This allows the system to be truly agile and scalable. The system has been purpose-built to address the needs of cost-sensitive customers that still require the functionality of a modern, fully integrated naval command and control system.

The TLIU has been instrumental in facilitating engagements with stakeholders. This resulted in the Paramount Advanced Technologies group taking a decision to collaborate with Cybicom on the integration of the system as a holistic offering for control systems in Africa.

The TLIU is an initiative of the Department of Science and Innovation aimed at increasing the level of localisation of targeted products being manufactured in South Africa, as well as increasing local content in products manufactured by multinational corporations and original equipment manufacturers operating locally.

TECHNOLOGY LOCALISATION INTERVENTION HELPS FIRM SECURE CONTRACT

The CSIR-hosted Technology Localisation Implementation Unit (TLIU) has assisted iLED Holding Pty Ltd, a Gauteng-based manufacturing company, to obtain the latest international quality assurance standard, which helped them secure a long-term contract with global firm, Siemens AG. iLED specialises in electronic manufacturing and metal fabrication.

The intervention focused on the acquisition of computer-aided design software, the facilitation of the certification process with international certification procedures in quality management systems, in line with the International Organization for Standardization (ISO), and obtaining Conformité Européenne (CE) product type testing.

For metal fabrication, the company needed to comply with ISO9001:2015 standards and obtain a CE marking. The latter would allow the company to export to European markets. These were pre-requisites for the Siemens AG contract. For electronic manufacturing, the company needed the latest modelling and design software to improve design capabilities and shorten development to manufacture time. A CE marking for the Internet of Things (IoT) edge controller, an automation and control system that the company manufactures, was also a requirement for European markets.

The TLIU intervention has resulted in iLED becoming the licensed manufacturer of all Siemens electrical distribution boxes and panels for high voltage distribution in Africa, as well as in the creation of 10 sustainable jobs for South Africans with low skills. In addition, a spin-off company, called Digital Twin, collaborated with IoT innovators, Thingstream, to provide IoT connectivity solution to support the world's largest brewer, Anheuser-Busch InBev, a South African Brewery (SAB) subsidiary, with a system that enables SAB to track and monitor the temperature and location of its coolers and fridges. The new entity has created eight jobs.

In a further development, the TLIU assisted with product type testing of the Pigeon to comply with electromagnetic interference specifications at a South African National Accreditation Systems approved laboratory. This small 4IR intelligent Global Positioning System, General Packet Radio Service-enabled sensor controller can be used anywhere in the world to sense and monitor processes for industrial applications. The product, which has also received a CE marking, has been tested for electromagnetic interference, radio frequency connectivity and safety aspects. More than 20 of the units have been sold in the United Kingdom.

MORE SUPPORT FOR LOCAL MARINE MANUFACTURERS

South African manufacturers of marine components are now able to get assistance with standardisation and certification compliance that will enable them to produce components on par with international market standards.

This follows the implementation of the Marine Manufacturing and Repairs Supplier Development Programme by the Aerospace Industry Support Initiative (AISI). The programme, which was launched by the Department of Trade, Industry and Competition, supports initiatives designed as targeted interventions to encourage marine manufacturers to improve industry competitiveness.

The ripple effect of the programme is significant, as several companies have received certification for marine products in the industry. This kind of support has subsequently led to new market niches opening up in the marine and related industry. It has also unlocked more new export opportunities for the local marine industry, and will lead to job creation in South Africa. AISI is housed and managed by the CSIR.

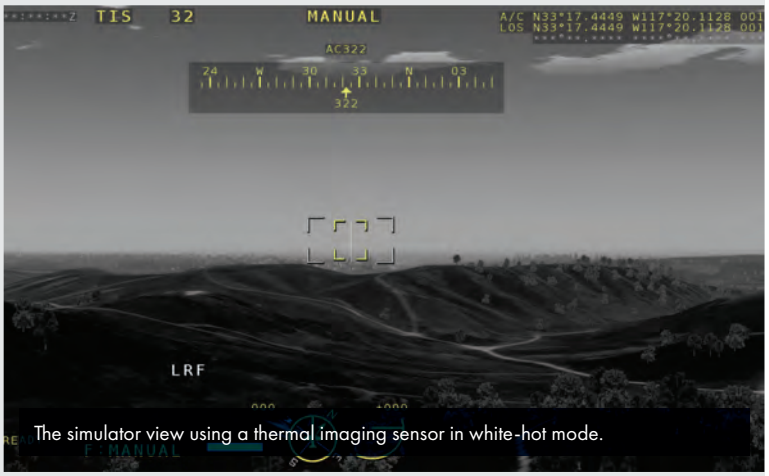
SIMULATION SOLUTION FOR AIR OBSERVATION DEVELOPED

The Aerospace Industry Support Initiative (AISI), in collaboration with Cybicom Atlas Defence, has developed an air observation training simulator. AISI is a programme of the Department of Trade, Industry and Competition, housed and managed by the CSIR.

The ARGOS-II Airborne Observation System was designed for installation on helicopters, fixed-wing aircraft and unmanned aerial vehicles to provide observation and targeting capabilities for military, border and maritime patrol, and law enforcement missions.

Two complete ARGOS-II Training Simulators have since been commissioned, and one is in use for in-house training at Hensoldt South Africa (HOSA). CSIR researchers are refining the simulator organically with HOSA, based on user feedback, while upgrading features such as thermal imaging and sensor simulation.

This project has contributed to the development of locally designed sensor simulation capabilities and job creation opportunities in South Africa.



The simulator view using a thermal imaging sensor in white-hot mode.

The simulator view using a TV Zoom sensor.

CSIR COMPLETES DEVELOPMENT OF DATABASE FOR INTELLIGENT SPECTRUM SHARING

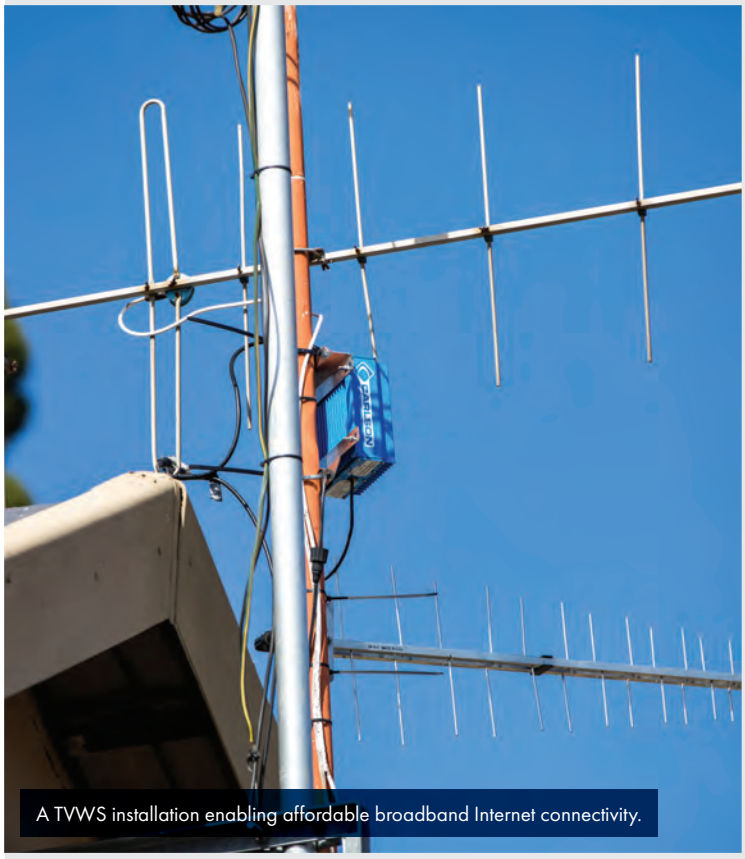
The CSIR has completed the development of its Television Whitespace (TVWS) network planning tool and secondary geo-location spectrum database. This enables TVWS planners and network operators to utilise the CSIR technologies to deploy TVWS networks in the country and beyond. These networks are key for providing affordable, long-range fixed wireless Internet connectivity to underserved, peri-urban, rural and hard-to-reach communities.

In 2017, the CSIR secured funding from the Technology Innovation Agency for the commercial-grade development of the geo-location-based dynamic spectrum access technology to improve the effective utilisation of national spectrum resources in the very high frequency and ultra-high frequency band, while looking into extending the technology to other spectrum bands.

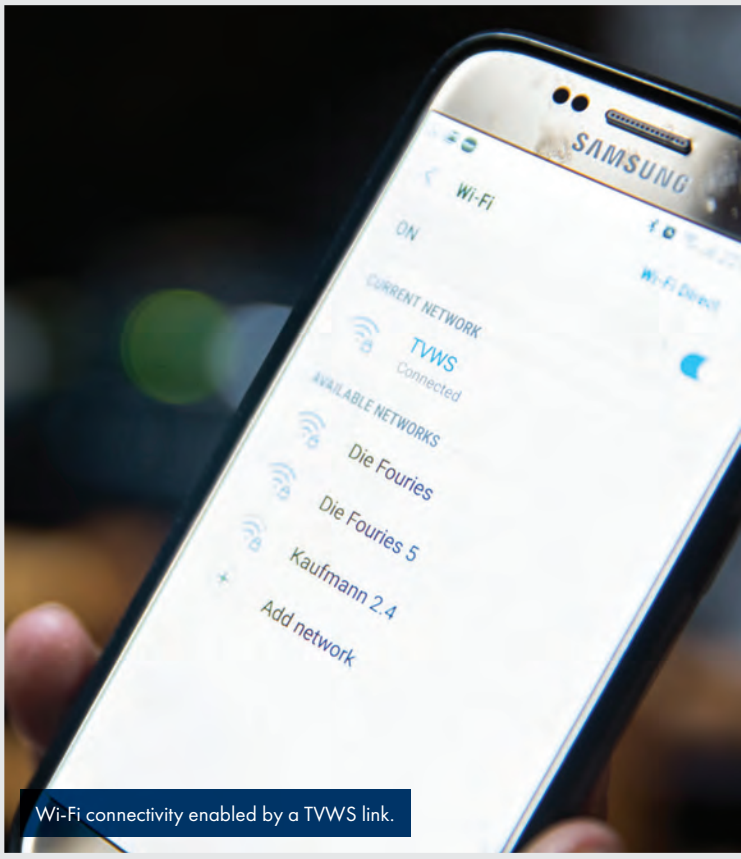
In addition to the earlier-developed regulatory reference spectrum database that gives any national spectrum regulator the capacity to have full control of the national spectrum resources per band, and acts as a monitoring tool to guarantee that the necessary quality of service is achieved, a component has now been developed that enables intelligent spectrum allocation. It interfaces with wireless network service providers and provides spectrum availability information, while reducing interference through accurate modelling of the radio environment. Furthermore, a network-planning tool allows seamless TVWS network planning within the relevant regulatory constraints.

The completion of the spectrum allocation component will enable network operators to utilise the CSIR technology to deploy TVWS networks in the country and beyond.

The CSIR has received the go-ahead to proceed to the next key milestone of the project, which entails developing the core TVWS network-sharing platform and business models.



A TVWS installation enabling affordable broadband Internet connectivity.



Wi-Fi connectivity enabled by a TVWS link.

A three-sector TVWS base station installed on a co-located tower in Pretoria, Gauteng.

ASSISTING A LOCAL SMME TO COMPLY WITH TELEVISION WHITESPACE REGULATIONS

The CSIR has assisted a local small, medium and micro enterprise, Indigo Broadband South Africa, to achieve regulatory compliance for their Television Whitespace (TVWS) network devices. Indigo Broadband is the sole distributor of the Carlson Wireless TVWS equipment brand in Africa.

This is a critical milestone in the introduction of commercial TVWS services in South Africa, as these are the first network devices that are fully compliant with South African TVWS Regulations.

Last year, the Independent Communications Authority of South Africa approved the CSIR's Secondary Geo Location Spectrum Database for assessing compliance of TVWS devices with South African TVWS Regulations of 2018. As a result, Indigo Broadband can rapidly roll out TVWS networks that fully comply with South African regulatory requirements, and thereafter rapidly accelerate this into other African countries. Several other local and international companies have since approached the CSIR for assistance with meeting regulatory compliance.

TVWS is a term used to describe portions of the unused radio spectrum. TVWS signals have the ability to travel long distances and penetrate both natural and man-made obstacles. They are ideal for providing affordable, long-range fixed wireless Internet connectivity to underserved, peri-urban, rural, and hard-to-reach communities and facilities to support applications in the fourth industrial revolution.

OPTIMISING SHIFT CYCLES IN MINING FOR IMPROVED PRODUCTIVITY, HEALTH AND SAFETY

The Mandela Mining Precinct, utilising funding from the Minerals Council South Africa, contracted the CSIR and University of Johannesburg to develop a draft framework for optimising shift cycles to maximise productivity, while ensuring optimal health and safety outcomes in South African mining operations.

The study forms part of the *Longevity of Current Mines* programme, which is one of six focus areas of the Mandela Mining Precinct in support of the greater South African Mining, Extraction, Research, Development and Innovation strategy. The programme aims to ensure that South African mineral resources are mined adequately and ensure efficiency of extraction, while operating cost effectively and safely.

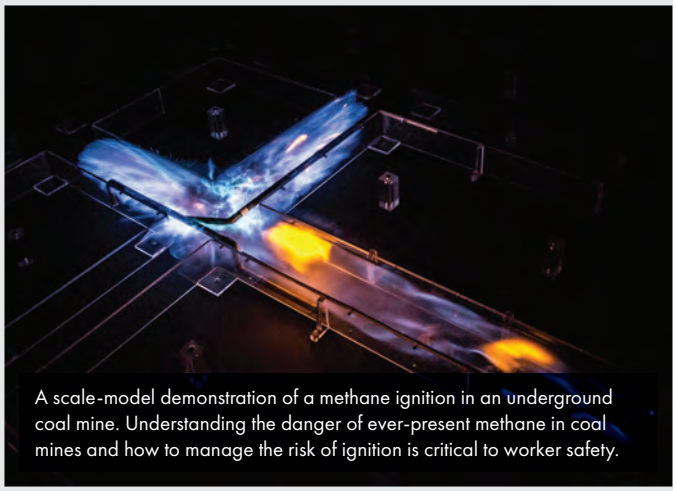
The project was initiated to optimise face time availability to complete work requirements, which are challenged by excessive travelling times, as a result of the increasing depths and working distances from shaft infrastructure of most narrow-reef gold and platinum mines, with additional activities enforced upon the mines as safety precautionary measures. The study highlighted the need for greater attention to worker fatigue caused by factors such as commuting times, job demands and living conditions. Potential challenges associated with ancillary activities that have an impact on available time spent working at the rock face were identified, and alternate shift cycles were recommended.

To compile the framework, researchers drew on literature studies; data collected from case studies at a gold mine in Gauteng and a platinum mine in Mpumalanga; and workshops with technical experts.

A mine worker operating a rock drill at the rock face of a South African mine.

Kloppersbos Training and Testing Supervisor Isaac Mthombeni demonstrates the inertising of coal dust with stone dust using the Hartman device. The application of stone dust in coal mines is effective in preventing and mitigating lethal coal dust explosions.

A full-scale coal dust explosion demonstration in the 200 m explosion gallery gives trainees a safe, first-hand experience of the power of such explosions.



A scale-model demonstration of a methane ignition in an underground coal mine. Understanding the danger of ever-present methane in coal mines and how to manage the risk of ignition is critical to worker safety.

CSIR TRAINS RECORD NUMBER OF MINEWORKERS IN MINE SAFETY

As a research partner to the Mine Health and Safety Council's Centre of Excellence, the CSIR has expanded its multidisciplinary capabilities and concomitant facilities to support the goal of zero harm in South African mines. A record number of more than 4 000 mineworkers underwent mine safety training at the CSIR-managed Kloppersbos facility in the past year. The facility, situated north of Pretoria, was established for conducting underground methane and coal dust explosion suppression systems testing, as well as testing to quantify the explosibility of coal from South African mines.

Every year, the specialist mine testing facilities at the CSIR support 220 mines across South Africa with mandatory occupational health and safety-related testing requirements. This includes the testing of wire ropes that are used on the mine winders that transport workers and materials up and down mine shafts. Tests are also performed on mine support products, such as poles, props and packs installed to support the hanging wall in underground working areas. Requirements also include the testing of tendons, netting and steel wire mesh products that serve to prevent falls of ground – one of the leading causes of fatalities and serious injury in mining.

The CSIR sampled and tested a record number of 2 961 self-contained self-rescuers as part of an ongoing programme that helps to ensure that these emergency breathing apparatus are in good working order when mine workers' lives depend on them. In 2019, South Africa recorded the lowest number of fatalities in mines in history.

TECHNOLOGY DEVELOPMENT FOR LOCAL MANUFACTURE OF CHEMICAL OXYGEN DEMAND KITS

CSIR-developed high and medium-range chemical oxygen demand kits.

CSIR senior process engineer Prisha Naicker with locally manufactured chemical oxygen demand test kits, developed for a client. Industry and municipalities are required to adhere to water discharge specifications for chemical oxygen demand.

The CSIR assisted a small, medium and macro enterprise (SMME) with the development of South Africa's first locally produced chemical oxygen demand kits.

Chemical oxygen demand is a critical waste treatment measurement in everything from municipal systems to food manufacturing waste streams. It is an indirect measurement of the amount of organic matter in a sample.

As part of the SMME support offered by the Biomanufacturing Industry Development Centre (BIDC), in partnership with the Department of Science and Innovation's Industry Innovation Partnership Fund, the CSIR was able to develop chemical oxygen demand kits for the measurement of high and medium-range contaminants. The kits were validated for use in municipal and industrial waste effluents and work in six of the top-selling photometer brands. Previously, South Africa relied on the importation of the equipment and measuring kits at a fluctuating and high cost.

The technology was licensed and transferred to PLS Pty Ltd for local manufacture and supply to the African and global market. The BIDC assists both SMMEs and established industry to translate early stage research and development into market-ready products.

The kit development team, from left, CSIR engineer Frances O'Brien, CSIR senior engineer Prisha Naicker, CSIR bioprocessing research group leader Dr Santosh Ramchuran, Jaco Swanepoel PLS Director and Lara Kotzé-Jacobs, BIDC programme manager.

BIDC TRANSFERS MARKET-READY BAOBAB-BASED PRODUCTS TO SMME

The Biomanufacturing Industry Development Centre (BIDC) has assisted small, medium and micro enterprise (SMME), VIDA Pharmaceutical, to develop sample-sized Baobab maize porridge and snackbars for market testing. The BIDC is a CSIR facility established to translate biomanufacturing concepts and technologies into market-ready products and services.

The product prototype was formulated and developed by the BIDC and subsequently manufactured by an accredited service provider.

VIDA Pharmaceutical's nutritious porridge, which can also be consumed as a shake, facilitates digestive health and functions as a probiotic and antioxidant high in Vitamins A, C and B12, protein, fibre, calcium and zinc. The company's snackbar is made of Baobab fruit pulp, nuts, raisins and cranberries. Very much like their cereal, it is a healthy snack that is high in Vitamin C, magnesium, iron, zinc and dietary fibre, with no sugar or preservatives added.

With the BIDC's world-class infrastructure and diverse capability, the product underwent thorough nutritional content analysis and shelf life testing. In addition, the product packaging was designed according to specification and assessed to ensure compatibility.

Since the transfer of the products to VIDA Pharmaceutical in 2019, the Baobab-based products have been market-tested and the company is ready to start with production and distribution to local retail stores and wholesalers.

The CSIR co-developed a baobab-based instant maize porridge and snack bar with VIDA Pharmaceuticals, an SMME that uses biodiverse resources to create medical and nutritious food products.

RESEARCH AND DEVELOPMENT ON THE QUALITY AND SAFETY OF PLANT-BASED TRADITIONAL MEDICINE PRODUCTS

The CSIR assisted six traditional health practitioners to develop safe and standardised traditional medicines for commercialisation in a project funded by the Department of Science and Innovation.

Traditional health practitioners in South Africa struggle to expand their market reach due to a lack of resources and skills to develop traditional medicine products that conform to acceptable standards of safety and quality.

In the pilot project, six products were selected, following a call for expression of interest to traditional health practitioners across the country and subsequent evaluation. The products, which were based on traditional uses, were Umphetha™, an iced tea used to treat internal ulcers, cleanse blood and boost the immune system; Moshumasekgwa™, a tea that treats high blood pressure, diabetes and urinary problems; Lenong, a tissue oil to treat wounds and arthritis; Kgopa™, a petroleum jelly to treat sores, skin problems and stomach ache; Prijap Biolife™, a herbal liquid with *in vitro* immunomodulatory and anti-inflammatory properties that have the potential to strengthen the immune system, and increase energy levels and appetite; as well as Areka Ya Makgoma™, a herbal sachet that facilitates the healing process of opportunistic infections and improves appetite.

The CSIR tested the final formulations of the products to determine their quality and safety for human use. The organisation also developed the technology packages containing the research, product and process development data. The training provided by the Innovation Hub (through CoachLab) and the South African Bureau of Standards resulted in packaging and logo designs for the respective products and provided training to the traditional health practitioners on business development and entrepreneurship.

CSIR researchers assisted Prijap Biolife™ with the development of a safe and standardised 100% natural herbal liquid remedy that has the potential to strengthen the immune system and increase energy levels.

The CSIR provided in vitro data on a herbal tea called Moshumasekgwa™, which has the potential to regulate type 2 diabetes mellitus, by inhibiting α-amylase. It also treats ailments like high blood pressure and urinary problems.

A 3 kW solar photovoltaic array at the CSIR outdoor testing facility in Pretoria.

SAFEGUARDING INVESTMENTS IN SOLAR PHOTOVOLTAIC PROJECTS THROUGH DECISION SUPPORT

The CSIR conducted research and testing for numerous manufacturers using its newly completed quality and reliability laboratory for solar photovoltaic (PV) modules. The laboratory features accelerated stress testing and measurement equipment purchased with funding support from the Technology Localisation and Implementation Unit, a Department of Science and Innovation localisation initiative.

The laboratory conducted research and testing for Renusol, a PV module clamp manufacturer; ARTsolar and ILB Helios, both South African PV module manufacturers; as well as international PV module manufacturers. Test results helped to determine safe operating specifications, identify product improvements and reduce risk for PV investments. A batch testing for a CSIR rooftop PV project uncovered a serial defect in the PV modules, which would have led to safety and performance issues for the CSIR over the lifetime of the plant. The manufacturer identified and addressed the defect before installation.

The CSIR is also developing machine-learning applications to address the explosion in the volume, variety and velocity of data streaming from renewable energy generation. Deep-learning models for automated defect detection and classification of electroluminescence images provide decision support for the procurement of PV modules for large projects. Electroluminescence images are like an X-ray image for PV modules and contain critical data regarding the quality and reliability of PV modules. However, there is no commercial solution for automatic analysis for large batches. Together with the University of the Witwatersrand, the CSIR is developing a machine learning solution to meet this need identified by manufacturers, solar PV module buyers and laboratories.

GUIDEBOOK TO SHAPE OPTIMAL COUNTER-POACHING TECHNOLOGY SOLUTIONS

The CSIR has completed a comprehensive guidebook for the Department of Environment, Forestry and Fisheries (DEFF) and its conservation agencies on the best practices, technologies and systems to consider when establishing a counter rhino poaching capability.

Titled *Guidelines to Inform the Establishment of Anti-Poaching Related Systems and Services,* the publication contains contributions from a range of organisations with first-hand experience in nature conservation, security technologies and countering wildlife crime. The project to compile the report was funded by USAID, through World Wildlife Fund South Africa.

The information is aimed at any organisation that needs to establish and sustain an anti-poaching capability, regardless of scope or size. It covers higher level design concepts, governance and organisation, as well as the practical aspects of staffing, facilities and operational teams – also taking into account animals such as dogs and horses. Substantial content is included on technical systems, such as perimeter security, access control, connectivity and mobility, the integration of technologies, such as combining sensors or video surveillance, and how systems activate response teams on the ground and in the air.

The content of the guideline is largely based on the experience gained by the CSIR in supporting the South African National Parks in its drive against rhino poaching. It also includes contributions from the Southern Africa Wildlife College, Ezemvelo KwaZulu-Natal Wildlife, the Greater Kruger Environmental Protection Foundation, the Private Rhino Owners Association, the Peace Parks Foundation and DEFF (law enforcement division). The publication is available from the department at no cost.

To counter poaching, conservation agencies use a range of capabilities, including specialist canine abilities, ranger training and support, weaponry and secure communication, working together as an operational whole.

Surveillance systems using radar and optronic technologies to detect and prevent poaching.

A rapid-response air capability has obvious benefits in integrated counter poaching operations.

IMPROVED VISUAL QUALITY FOR COUNTER-POACHING SURVEILLANCE

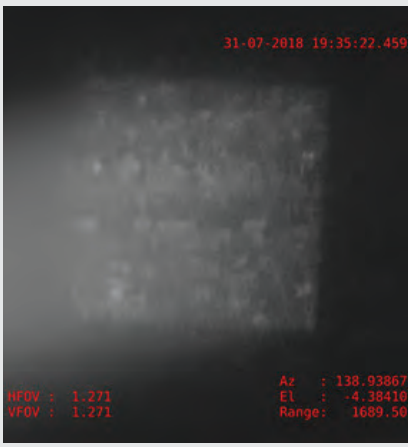
The CSIR-developed long-range surveillance system that has been used with great success in the Kruger National Park in the fight against rhino poaching now has an even sharper eye, achieved through a new cross-illumination configuration of the optical system.

The system uses long-range near-infrared illumination to detect humans in pitch-black night conditions. The illumination is not visible to the naked eye, but the system's camera is able to detect it clearly. Previously, when the illuminator and the camera were co-located in a mono-static configuration, small particles in the atmosphere caused significant backscatter. However, with the new configuration – separating the illuminator and the camera and configuring the parts at a specific distance from each other – the backscatter is reduced significantly. This cross illumination, or bi-static, approach is able to deliver improved image quality because there is less atmosphere in the field of view overlap between the camera and the illuminator.

The system's success depends on its stealth deployment and operation. It detects movement, distinguishing humans from animals – all unnoticed by those entering the Park illegally in daylight or at night. Rangers respond rapidly, ideally before animals are harmed.

The configuration allows for the development of a much-simplified design of the next-generation camera. Other existing and similar surveillance systems employ thermal sensors, which are significantly more expensive. The combination of near-infrared laser illumination and selected sensors creates a more affordable detection solution and therefore the system is ideal for smaller game farms and other civilian security applications.

The CSIR has deployed a day-night surveillance camera in the Kruger National Park as part of the Meerkat wide area surveillance system (above). However, operating a coincident sensor-illumination configuration at long ranges when there is high aerosol content in the atmosphere, proved problematic. Following the combination of off-set illumination and optimum laser power, the visibility of objects of interest under low light level conditions improved, as is evident in the image left (below).



ENERGY AND AQUACULTURE SECTORS BENEFIT FROM COMPLETION OF FOUR STRATEGIC ENVIRONMENTAL ASSESSMENTS

The CSIR has completed four strategic environmental assessments (SEAs) that support the planning and development of energy and aquaculture projects in South Africa.

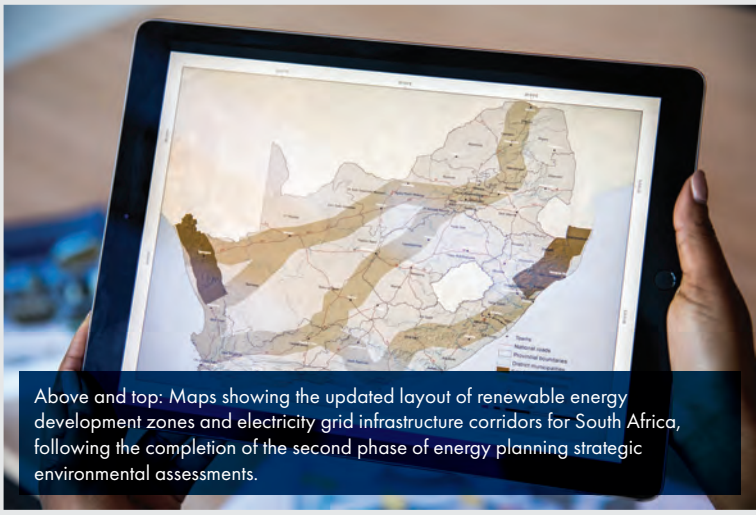
The assessments help to optimise effective and responsible planning for development in the renewable energy, electricity grid, gas transmission and aquaculture sectors. This is achieved by pre-assessing the environmental impact, providing pre-agreed protocols for assessing environmental impacts, as well as consolidating and streamlining authority decision-making processes.

The energy-related assessments follow the completion of a first phase of assessments in 2015 for wind and solar photovoltaic development, and in 2016 for electricity grid infrastructure. The latest wind and solar energy SEA identifies new renewable energy development zones in the north of the country close to areas with high electricity demand. It proposes three new renewable energy development zones (REDZs), in the areas around Emalahleni, Klerksdorp and Beaufort West. The intention is to gazette these REDZs into legislation.

The latest SEA for the expansion of electricity grid infrastructure was commissioned to guide responsible power line and substation planning within pre-assessed corridors, and address delays around obtaining environmental approvals for such infrastructure. This study also generated an environmental compliance standard for power line developments within the pre-assessed corridors. This standard is being gazetted into legislation. It is the first of its kind to be developed in South Africa for electricity grid development and as an outcome of an SEA process.

As part of national energy planning, an assessment was also completed for the development of a phased gas pipeline network for South Africa. These nine identified 100 km-wide gas transmission corridors cover key demand areas and nodes, such as ports, industrial development zones, special economic zones and potential gas reserves.

As part of Operation Phakisa, the CSIR completed an assessment for the development of marine and freshwater aquaculture in South Africa. This SEA identified 17 strategic aquaculture development zones, eight for marine and nine for freshwater. The study provides guidance to authorities and the aquaculture industry on responsible planning for these projects.



Above and top: Maps showing the updated layout of renewable energy development zones and electricity grid infrastructure corridors for South Africa, following the completion of the second phase of energy planning strategic environmental assessments.

CSIR experts in environmental assessment are from left, Abulele Adams, Paul Lochner, Kelly Stroebel and Luanita Snyman-Van der Walt.

CSIR COMPLETES 3D MODEL STUDIES FOR A PROPOSED TIDAL POOL IN PORT ST JOHNS

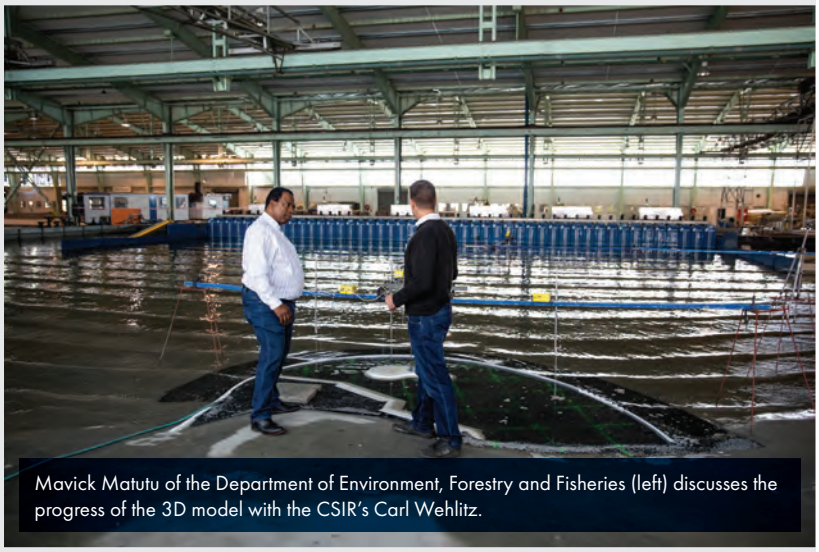
The CSIR has completed the physical modelling studies of a proposed new tidal pool in Port St Johns, in the Eastern Cape, for the Department of Environment, Forestry and Fisheries. The studies were undertaken at the CSIR's coastal and hydraulics laboratory, where some of the biggest and busiest ports in the world have been tested.

Port St Johns was one of the most popular recreational swimming and surfing spots on the Wild Coast for many years, but has suffered a loss of visitors in recent years, following a number of shark attacks and drownings. Government considered various interventions, including the possibility of constructing a tidal pool to halt the decline in tourism and associated job losses, and more importantly, loss of lives.

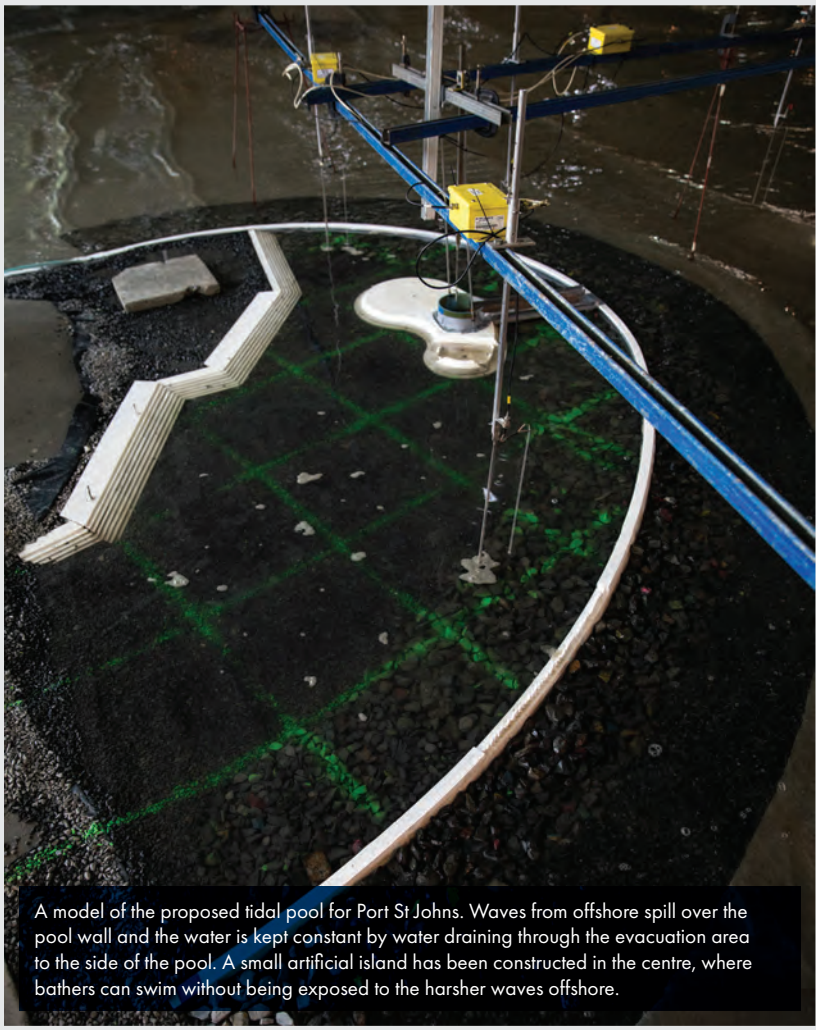
The CSIR constructed a small-scale replica of the tidal pool in the Stellenbosch-based laboratory. In constructing physical models, such as this one, engineers use the data from surveys to mimic the actual sea floor conditions, which contribute to how waves are formed. Data on local wave conditions were also used to simulate impacts on the tidal pool.

Three aspects were tested. The first was the wave climate inside and outside the pool to ensure that the waves inside the pool are small enough for safe bathing. The second was overtopping, in which the water that is washed over the wall and into the pool is quantified; and thirdly, flushing – how different water currents that formed inside the pool behave and how the water is then evacuated out of the pool. Flushing is important to prevent the water in the tidal pool from stagnating.

The testing was completed in November 2019 and the results were submitted to the consulting engineers.



Mavick Matutu of the Department of Environment, Forestry and Fisheries (left) discusses the progress of the 3D model with the CSIR's Carl Wehlitz.



A model of the proposed tidal pool for Port St Johns. Waves from offshore spill over the pool wall and the water is kept constant by water draining through the evacuation area to the side of the pool. A small artificial island has been constructed in the centre, where bathers can swim without being exposed to the harsher waves offshore.

03 SUPPORT THE DEVELOPMENT OF A CAPABLE STATE

A GIS map of the Gauteng provincial road network, displaying road asset management information.

ASSISTING GAUTENG WITH MANAGING ITS ROAD ASSETS

The CSIR has assisted the Gauteng Department of Roads and Transport on various aspects of road asset management.

The CSIR assisted the department with the appointment, management and control of professional service providers to carry out visual condition assessments of the road network, bridges and major culverts; profile and strength measurements of the paved roads; and subsequent lifecycle cost analysis. The data collected was used to prepare road asset management plans for the province.

CSIR researchers developed a geospatial decision support system that allows staff members of the department, politicians and members of the public to access information regarding the Gauteng provincial road network via the web. The information includes inventory information and condition data for the road network, bridges and major culverts; up-to-date traffic count information; and road proclamations. An app allows access to the system from tablets and smart phones, and provides usage statistics.

Provincial road asset management systems with current data on the condition of the assets are a prerequisite for provincial roads departments to qualify for National Treasury's Provincial Roads Maintenance Grant. The grant was instituted by National Treasury to ensure proper road maintenance in the country.

PUBLIC-PRIVATE PARTNERSHIP PURSUES COLLECTIVE SOCIOECONOMIC IMPACT

The CSIR, Anglo American, Exxaro, Aurecon and World Vision South Africa are the founding members of a social development initiative launched in Limpopo in October 2019. Under the name, 'The Impact Catalyst', the partners and the Limpopo government, through the Office of the Premier, are bound by a shared objective of achieving improvements in the health, wellbeing and prosperity of communities across provinces and mining communities in South Africa.

The initiative has set out to improve access to education, develop stronger levels of social empowerment, improve service delivery, enable individuals to better their health and find ways of conserving the environment through, for example, alternative energy use, building the biodiversity economy and reducing waste.

Examples of initiatives set in motion through this partnership include investigating alternative livelihoods for mining communities in agro-processing and biodiesel production; the commercial development of integrated game farms through a hub model, whereby farms contribute meat to a central meat processing unit and other game-related commercial opportunities in hunting, breeding, sales, game products and ecotourism; the establishment of an enterprise that manufactures personal protective equipment to support sectors such as mining, construction and food production; and the use of laser-based refurbishment and 3D printing technologies for the repair, surface hardening and enhancement of metal components in mining as an alternative to conventional repair techniques.

Mr Malcolm Boyd, World Vision South Africa Board Chairperson, addresses guests at the launch in Limpopo. Back (from left) are Mr Mxolisi Mgojo, Exxaro Chief Executive Officer, Dr Thulani Dlamini, CSIR Chief Executive Officer and Mr Andile Sangqu, former Executive Head of Anglo American.

CSIR RESEARCH IN PLASTICS AND THE CIRCULAR ECONOMY

Three of the 16 types of carrier bag options assessed in a lifecycle sustainability assessment undertaken by the CSIR. The study found that reusable plastic carrier bags are the best option in South Africa.

The CSIR is leading the way in research related to integrated waste management, lifecycle sustainability assessment, plastics and the circular economy in South Africa.

CSIR researchers undertook a lifecycle sustainability assessment of grocery carrier bags, a first of its kind study in South Africa. The study indicated that reusable plastic carrier bags are the best option in South Africa, as they have a substantially lower environmental impact compared to single-use bags – if consumers reuse them.

The study, funded by the Department of Science and Innovation, provided a scientific assessment to inform government, producers, retailers and consumers about the environmental and socio-economic impacts of different types of carrier bags. Sustainable product design is a critical part of South Africa's transition to a more circular economy.

The study assessed 16 types of carrier bags made from a range of different materials. Twenty-one environmental and socioeconomic indicators were used to assess each bag. These included a new indicator developed by the team to account for the impacts of plastic pollution, which is currently missing from most lifecycle assessment methods. In addition, two key socioeconomic indicators, namely impacts on employment and affordability for consumers, were included.

The CSIR is also collaborating with the United Nations Industrial Development Organization to support South Africa's transition from conventional plastics to more environmentally sustainable alternatives. The aims of the study, which is funded by the Government of Japan, are to reduce the amount of plastic leaking into the environment and strengthen the local alternative material industry.

Finally, CSIR experts in integrated waste management participated in a research study, led by the World Bank and commissioned by National Treasury, to review the South African solid waste sector, with a particular focus on fiscal instruments and the circular economy.

Acknowledging the signing of a funding agreement for a project to combat plastic pollution are (left) Mr Khaled El Mekwad, UNIDO Representative in South Africa and the Ambassador of Japan in South Africa, His Excellency Mr Norio Maruyama.

INTEGRATING WASTE RECLAIMERS INTO MUNICIPAL SOLID WASTE MANAGEMENT SYSTEMS AND THE RECYCLING ECONOMY

A study on the integration of the informal waste sector and improving conditions for waste pickers or reclaimers found that separation-at-source – the practice of separating household waste material to prevent it from entering waste destined for landfill – dispossessed reclaimers. It found that reclaimers are already deeply integrated into municipal solid waste management systems and the recycling economy through their separation-outside-source system, which predates government's recycling policy, and is a key mechanism for diverting waste from landfills.

The study was undertaken by the University of the Witwatersrand, under the Waste RDI Roadmap, an initiative hosted by the CSIR and funded by the Department of Science and Innovation. The Waste RDI Roadmap Grant system is a government initiative aimed at evidencing South Africa's transition to a circular economy. The study is in line with the Waste Management Strategy of the Department of Environment, Forestry and Fisheries that was announced in 2011, which included a commitment to provide guidance on how to improve reclaimers' conditions.

Informed by this strategy, a number of municipalities, reclaimer organisations and industry have undertaken integration initiatives, but for the purposes of this study, the focus was on the City of Johannesburg in Gauteng and the Metsimaholo Local Municipality in the Free State. The researchers investigated the experiences of reclaimers, officials and residents using qualitative methods, participatory mapping and 370 semi-structured interviews.

The study found that a 'charity model of integration' did not value reclaimers' knowledge but assumed that they require charitable support rather than payment for their service. It recommended that, when it comes to integration and recycling, reclaimers be included in agreements and decision-making, and indicated that a new approach was required.

A waste picker in Pretoria, Gauteng.

COLLABORATING TO CREATE A MOBILE FOOD SAFETY-TESTING LABORATORY FOR RURAL SOUTH AFRICA

The CSIR is collaborating with Mobile Agri Skills and Development Training (MASDT), a non-profit company that assists small and medium enterprises in the agricultural sector, to introduce an accessible and affordable mobile facility for food safety testing to support commercial and rural agro economies in South Africa.

Unsafe food and foodborne diseases are a concern worldwide. The United Nations Sustainable Development Goals 2030 stated that there is no food security without food safety. The prevention of foodborne diseases, through stringent food safety measures, will remain important as international trade increases and the food supply chain becomes more complex. In South Africa, commercial and small farmers do not have easy, affordable access to residue and pathogen testing.

The CSIR has been conducting a study into the development of an ISO 17025 accredited mobile laboratory prototype for food safety testing and hosted a workshop on the topic for industry and government stakeholders. Over the next three years, the project aims to optimise the MASDT mobile facility prototype, which was initially funded by the Small Enterprise Development Agency, ensure that accreditation is received for the facility, and target the agricultural sector in clearly defined areas with the view of becoming financially sustainable and valorising agricultural commodities, including indigenous products, for larger markets.

The current look and feel of the Mobile Food Testing Laboratory. Plans are underway to optimise the facility to house complete analytical services with laboratory information management systems as well as digitised and customised mobile testing equipment that produces results in real time, and is ISO 17025 accredited.

CSIR senior researcher Tobias van Reenen (left) and Collen Mashigo of MASDT in the mobile food testing laboratory.

The mobile food testing facility was showcased at a CSIR-hosted workshop for industry and government stakeholders.

CSIR ESTABLISHES INFORMATION AND CYBERSECURITY RESEARCH CENTRE

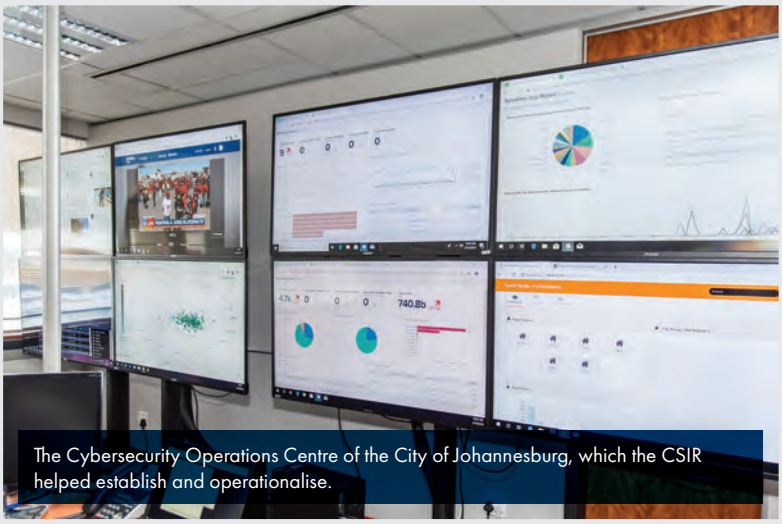
The CSIR consolidated a range of specialist research and technology areas in the domain of information security, identity management and cyberwarfare to form a new research centre.

Cybercriminals threaten industry, individuals and national state security with significant associated personal and economic risk. The CSIR Information and Cybersecurity Research Centre focuses on research, development and innovation of home-grown cybersecurity, information security and identity management solutions to securely identify and protect people and technological systems against vulnerabilities, threats and risks in the digital realm.

The centre focuses on developing capabilities that enhance data, applications, networks and mobile security; building cyber-crime combatting platforms through digital forensics and cybercrime analysis; and developing next-generation identity authentication approaches and systems, and cyber-physical critical infrastructure. The centre's research focus is guided by the adapted Cybersecurity National Institute of Standards and Technology framework and makes it a close partner to government in the interest of a cyber-secure and safe South Africa.

The centre also collaborates with the private sector to innovate, design, develop, commercialise and localise transformative technologies.

The focus on emerging threats builds on a sound CSIR track record in developing products to protect, test, monitor and validate cybersecurity systems and network vulnerabilities, training platforms and biometric verification systems.



The Cybersecurity Operations Centre of the City of Johannesburg, which the CSIR helped establish and operationalise.

CSIR software developer Tshegofatso Mangole demonstrates a CSIR-designed and built indigent register and service delivery platform to improve service delivery and empower indigents in South Africa.

The CSIR has undertaken research on fingerprinting sensing technology, using high-speed, large-volume optical coherence tomography.

BUILDING A PIPELINE OF WELL-ROUNDED FUTURE RESEARCHERS

The CSIR bursary programme has supported 786 students over the last five years. In 2019/20, the organisation retained 39 out of 42 final-year students in specialised internships, while others opted to further their studies, eight enrolling for Honours degrees and two pursuing their Master's.


Thembelihle Thema during her studies in the United States of America.

ACCESS TO LIFE-CHANGING EXPERIENCES

A CSIR bursary to study civil engineering through the University of Cape Town (UCT) gave Thembelihle Thema a chance to pursue a career that she is passionate about and gain a global perspective in the field at a young age. The CSIR granted Thema a bursary in 2016 after completing matric the year before.

The CSIR bursary programme helps to build a pipeline of future employees and enables the organisation to acquire capacity in disciplines that are critical for its success. The programme provides social, personal and psychological support to bursary holders, and offers structured vacation work to give students exposure to their future working environment.

Thema received an opportunity to be part of an outbound exchange programme offered by UCT, which made it possible for her to attend the University of Wisconsin-Madison in the United States of America (USA) for five months. The exchange programme creates a cross-functional experience that benefits the student and the CSIR, not only through the international exposure to the subject matter, but also through the networks that the student establishes while abroad.

While in the USA, Thema worked on an independent study with one of her professors to assist with an ongoing model linked to the development of freight rail within the north-western states in the USA.

CREATING A POOL OF GRADUATES ALIGNED TO THE CSIR'S PROFESSIONAL NEEDS

The CSIR appointed 19 recent graduates from its bursary programme to participate in its graduate-in-training programme. The programme was introduced to formalise the training of new graduates and create a competence pool that supports the organisation's strategy. The programme was designed taking into consideration the requirements of relevant professional registration bodies, such as the Engineering Council of South Africa and the South African Council for Natural Scientific Professions.

Trainees are exposed to as many CSIR functions as possible through induction and rotation. In addition, the programme focuses on learning and development, and social innovation for impact.

Final year students on the CSIR bursary programme were identified as possible candidates, and 25 professional engineers within the organisation signed up to be mentors. The programme is a partnership between the graduates, mentors and line managers hosting the graduates, and creates opportunities for training through exposure to various research projects.

GRADUATE-IN-TRAINING PROGRAMME

MEET JUNIET KGAPHOLA

Juniet Kgaphola completed her Honours degree in geography and environmental science at the University of Pretoria as a CSIR bursary recipient. She began the graduate-in-training programme in February 2019 and has since been involved in a number of key projects.

Kgaphola started her CSIR journey working on a project that investigated the impact of environmental refugees in Southern Africa. Researchers studied the preparedness of Southern African countries to respond to future internal and cross-border displacements as a result of environmental disasters. In a second project, Kgaphola and her colleagues studied household water-use behaviour in six South African metropolitan areas.

She also assisted the CSIR group focusing on hydrosciences with the monitoring of surface and groundwater at the Cradle of Humankind World Heritage Site. She is currently working on a project that focuses on sustainable land management, in which she facilitates community engagement – encouraging farmers to establish home gardens with fruit trees, fodder trees and herbaceous crops in the Lepellane catchment in Mphanama village. The project forms part of her Master's studies in environmental science through the University of KwaZulu-Natal.

Kgaphola says she gained a sound working knowledge of environmental legislation and policy, and aspects of social sciences, while working on these projects.

MEET MICHANDRE SMIT

Michandre Smit has a BSc in zoology, a BEng in civil engineering and is working on her Honours in pavement engineering, all with the University of Pretoria.

Smit has dramatically increased her knowledge on the curling of concrete pavements, a key consideration in road design. In a project with the Florida department of transportation, she contributed to training in installing multi-depth deflectometers, a deflection measuring device that is retrofitted into pavement layers, and a redesign of the device to be able to detect curling of concrete pavements.

As the newest member of the team, she had to learn the device installation protocol under very difficult weather conditions and time constraints. She has gained technical experience through international exposure and improved her communication skills. Smit is currently working on a project that focuses on the self-healing of asphalt using biological material.

MEET JODY JULIES

Jody Julies first heard about the CSIR during a school excursion to SciFest in Makhanda, in the Eastern Cape, in 2014. When an opportunity to apply for a bursary to study engineering presented itself, he took it. Julies obtained his BEng in mechatronics from Stellenbosch University through the CSIR's bursary programme, making him an ideal candidate for the new graduate-in-training programme.

As part of the programme, Julies was placed in the CSIR's Energy Research Centre where he has become a valued member of the team that undertakes wind energy research. One of the most notable projects that he has worked on was designing the wind component of a mini-grid solution intended for a community in Upper Blinkwater, Eastern Cape.

The remoteness of the village hampers access to electricity from the national utilities grid. The project relies on a hybrid approach in which wind turbines, a photovoltaic system, a battery source and a back-up diesel generator are used.

Julies says working with data and modelling to find the ideal energy solution for a community that would otherwise have no access to the national grid, has shown him how his work can have real-life impact.

HALF A MILLION LEARNERS REACHED THROUGH SCIENCE ENGAGEMENTS

Team CSIR participated in 30 outreach activities across the country and reached approximately 500 000 learners. In one such event, the CSIR hosted just over 600 school learners as part of National Science Week for an interactive climate change-inspired exhibition, featuring careers and projects in this field. The organisation also participated in the 6th Annual Green Youth Indaba 2019, an event that brings industry experts and youth together to expose them to careers, skills and entrepreneurial opportunities within the green economy.

Learners from various high schools at the CSIR Career Day.

ANNUAL GREEN YOUTH INDABA 2019

The objective of the Indaba is to empower the youth with the information and skills needed to eradicate youth unemployment and poverty by tapping into green economy jobs and business opportunities. The CSIR exhibited biodegradable and biologically active products for water treatment and domestic use, and demonstrated how air quality is measured and modelled.

NATIONAL SCIENCE WEEK

National Science Week, an initiative of the Department of Science and Innovation, is a countrywide celebration of science. The CSIR exhibition focused on climate change and its link with our oceans, water resources, human health, energy, food security, as well as the building of roads for future climatic conditions.

SASOL TECHNOX

Sasol TechnoX is an exhibition that aims to enthuse learners, students and the public about the possibilities of science and technology. The CSIR exhibited three-dimensional printing, robotics, defence, security technologies and interventions for smart logistics.

Laique Merlin Djeutchouang and the CSIR's Dr Sarah Nicholson engage with learners on climate change at the CSIR Career Day exhibition.

OTHER OUTREACH PROJECTS

1. The 12th Annual Soweto Career Expo 2019 – Soweto, Gauteng
2. The 18th Science Beyond Borders Festival 2019/Science Tube – Thohoyandou, Limpopo
3. Capricorn Edu Science Festival and Botlokwa Career Day – Botlokwa, Limpopo
4. eThekwini Youth Employability Indaba and KwaZulu-Natal (KZN) Career Expo – Durban, KZN
5. Science Guidance Community Development – Jozini, KZN
6. The 4th Annual Technical Teachers Conference – Kempton Park, Gauteng
7. The Gauteng Youth Expo – Nasrec, Gauteng
8. The 7th Annual Career Expo – Lusikisiki, Eastern Cape
9. Annual Career Exhibition Day – Bela Bela, Limpopo
10. City of Tshwane Career Expo – Pretoria, Gauteng
11. The 6th Annual Green Youth Indaba 2019 – Pretoria, Gauteng
12. Learners' Focus Week in Energy – Pretoria, Gauteng
13. Pre-National Science Week Science Engagement – Polokwane, Limpopo
14. Toro Phetagala Career Expo – Senwabarwana, Limpopo
15. Seriti Kriel Career Expo – Kriel, Mpumalanga
16. The 8th Eding International Science Festival – Mafikeng, North West
17. National Science Week Launch – Kimberley, Northern Cape
18. Tygerberg Career Fair 2019 – Tygerberg, Western Cape
19. Sasol TechnoX – Sasolburg, Free State
20. National Science Week 2019/CSIR Career Day – Pretoria, Gauteng
21. STEM Conference – Johannesburg, Gauteng
22. Durban Career Day – Durban, KZN
23. Eastern Cape SUV challenge – Port Elizabeth, East London, Butterworth, Mthatha, Coffee Bay, Eastern Cape
24. Thabazimbi Youth Expo – Thabazimbi, Limpopo
25. Taung Space Week – Taung, North West
26. Bohlabela Career Expo – Bushbuckridge, Mpumalanga
27. Nkangala District Career Exhibition – Nkangala, Mpumalanga
28. Bojanala District Career Expo/Science Beyond Borders – Rustenburg, North West
29. Village Science Expo – Johannesburg, Gauteng
30. Morokweng Career Expo – Morokweng, North West

CSIR Chief Executive Officer Dr Thulani Dlamini welcomes learners to the CSIR Career Day.

Post-doctoral researcher Dr Sabelo Madonsela (left) and CSIR principal researcher Dr Moses Cho at the CSIR Career Day.

Learners celebrate at the end of an informative day at the closing ceremony of the CSIR Career Day.

CELEBRATING THE CLASS OF 2019

The CSIR has supported the academic development and transformation of its staff, both in the science, engineering and technology and support bases. In 2019, 57 staff members obtained their Master's or Doctorates in line with the organisation's values of excellence.

Bahle Mkhize,
CSIR project manager
MSc (Project Management) with distinction, University of Cape Town

Dr Belinda Matebese,
CSIR researcher
PhD (Applied Maths), Stellenbosch University

Chane Pieterse,
CSIR engineer
MEng (Electronic Engineering), University of Pretoria

Dr Chemist Mabena,
CSIR researcher
PhD (Physics), University of the Witwatersrand

Coral Featherstone,
CSIR principal researcher
MSc (Computer Science and Info Systems), University of South Africa

Dr Dimakatso Gumede,
CSIR postdoctoral researcher
PhD (Medicine), University of Cape Town

Duwan Bester,
CSIR engineer
MEng (Mechanical Engineering), North-West University

Fhumulani Mphadzha,
CSIR systems engineer
MEng (Engineering Management), University of Pretoria

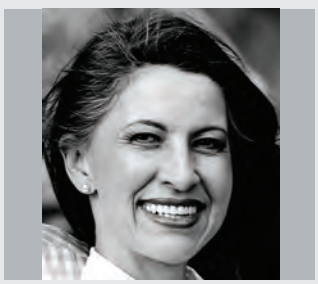
Dr Ghaneshree Moonsamy,
CSIR senior researcher
PhD (Biotechnology), Durban University of Technology

Dr Heloise Meyer,
CSIR senior engineer
PhD (Computer Science), University of Pretoria

Dr Ireshyn Govender,
CSIR postodoctoral researcher
PhD (Biochemistry), University of the Witwatersrand

Joseph Moeta,
CSIR intern
MSc (Chemistry), University of Johannesburg

Dr Karien Venter,
CSIR senior researcher
PhD (Civil Engineering), Stellenbosch University

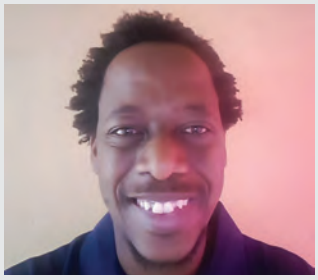


Dr Laticha Walters,
CSIR senior researcher
PhD (TeleHealth), University of KwaZulu Natal

Dr Luyanda Ndlela,
CSIR postdoctoral studentship
PhD (Zoology), Stellenbosch University

Mogau Sebopa,
CSIR candidate researcher
MEng (Civil Engineering), Stellenbosch University

Dr Moses Dlamini,
CSIR senior engineer
PhD (Computer Science), University of Pretoria



Muzi Matyila,
CSIR senior engineer
MSc (Computer Science & Info Systems), University of South Africa

Dr Nobuhle Majozi,
CSIR researcher
PhD (Remote Sensing and Geographical Information Systems), University of Twente, the Netherlands

Dr Ntsoaki Mathabathe,
CSIR senior researcher
PhD (Metallurgy and Materials), University of Pretoria

Dr Paul Mokilane,
CSIR senior researcher
PhD (Statistics), University of the Witwatersrand

Ridewaan Hanslo,
CSIR senior engineer
MSc (Computer Science), University of South Africa

Dr Samuel Mabakane,
CSIR senior systems administrator
PhD (Computer Science), University of Cape Town

Sarah Dikgale,
CSIR senior technologist
MTech (Operations Management), University of Johannesburg

Shirley Nobaza,
CSIR events practitioner
Master of Public Administration University of Pretoria

Dr Shivani Goolab,
CSIR postdoctoral researcher
PhD (Veterinary Science), University of Pretoria

Tshepo Fothane,
CSIR senior systems administrator
Master's (Business Administration), The Management College of Southern Africa

Dr Vusani Mandiwana,
CSIR postdoctoral researcher
PhD (Pharmaceutical Sciences), North-West University

Dr Jako Nice,
CSIR senior researcher,
PhD (Architecture), University of Pretoria

Windy Mokuwe,
CSIR researcher
MSc (Information Technology), University of Pretoria

CSIR staff who obtained their Master's and PhDs but were not available for a photograph are: ***Bridgett Malatji****, CSIR studentship, MSc (Medicine);* ***Chris Mc Duling****, CSIR senior engineer, MTech (Mechanical Engineering);* ***Dr Jacob Medupe****, CSIR research group leader, PhD (Information Technology);* ***Vusi Mahlangu****, CSIR laboratory manager, MTech (Chemistry), Tswhane University of Technology;* ***Dr Jerome Andrew****, CSIR senior researcher, PhD (Engineering);* ***Joanne Calitz****, CSIR senior engineer, MEng (Electrical Engineering);* ***Dr Joseph Sefara****, CSIR engineer, MSc;* ***Dr Katekani Shingange****, CSIR postdoctorate, PhD (Physics);* ***Dr Lamla Thungatha****, CSIR engineer, PhD (Chemistry);* ***Lesego Maubane****, CSIR technologist, MTech (Chemical Engineering);* ***Lichelle Grobler****, CSIR intern, MSc (Biotechnology);* ***Lizwe Mdakane****, CSIR senior researcher, PhD (Electronic Engineering);* ***Dr Loyiso Maweza****, CSIR postdoctorate, PhD (Physics);* ***Matshidiso Marengwa****, CSIR candidate technician, Master's (Information Technology);* ***Muhammed Sha****, CSIR project manager, MSc (Technology and Innovation Management);* ***Philemon Hlongwane****, CSIR senior project manager, MBL;* ***Rakgoshi Lekalakala****, CSIR technologist, MTech (Polymer Technology);* ***Sihle Matinise****, CSIR candidate researcher, MSc (Geography and Environmental Management);* ***Sizwe Sethosa****, CSIR systems engineer, MEng (Project Management);* ***Dr Solly Motaung****, CSIR researcher, DTech (Water Care);* ***Stanley Semelane****, CSIR senior engineer, MSc (Chemical Engineering);* ***Theresa George****, CSIR researcher, Master's (Engineering);* ***Tumelo Moalusi****, CSIR intern, MSc.*

The laboratory-scale supercritical carbon dioxide encapsulation facility operated by CSIR chemical engineer Andri Swanepoel.

INFRASTRUCTURE

DSI AND THE CSIR TO ESTABLISH THE FIRST SUPERCRITICAL CARBON DIOXIDE ENCAPSULATION FACILITY IN AFRICA

Africa's first pilot-scale supercritical encapsulation facility is being established at the CSIR. Encapsulation is used in the cosmeceutical, food and feed sectors to enclose active ingredients to protect them from oxygen, light, stomach acids and free radicals. The facility will enable local small, medium and micro enterprises (SMMEs) and firms to produce products at scale and investigate market uptake.

The advantage of the supercritical carbon dioxide-based encapsulation process is that it encapsulates an active in an inert environment without exposure to moisture, oxygen and solvents, while operating at low temperatures, thereby preserving the activity of the active ingredients. Additionally, the technology can be used for the micronisation of pure compounds, such as polymers, fats and waxes, to optimise physical characteristics, such as size, morphology and crystallinity.

Using this process, the CSIR had developed and licenced an encapsulation technology to a local SMME for the commercialisation of a range of probiotic-containing health supplements. However, a major barrier for full-scale commercialisation is that, currently, there are no pilot supercritical carbon dioxide encapsulation facilities in South Africa to produce products at scale.

Following a CSIR proposal, the Department of Science and Innovation awarded high-end infrastructure funding for a pilot-scale supercritical carbon dioxide encapsulation facility to be established at the CSIR. It will have a production capacity of up to 100kg/product per day, and will be able to process a wide range of materials without the risk of cross-contamination. As the end products will be for use in food (nutraceuticals for human and animal use) and personal care products, the Hazard Analysis Critical Control Point safety system will be implemented across the facility.

The establishment of this pilot facility at the CSIR will allow industry partners access to CSIR scientists for training and skills transfer, as well as technology development and transfer to industry. It will also allow the de-risking of supercritical carbon dioxide-based technologies to enable rapid market uptake and toll manufacturing.

ENHANCED WIND TUNNEL CAPABILITY FOR AIRCRAFT INLET TESTING

The CSIR has developed a mass flow control unit that simulates the effect of an aircraft inlet system on a jet engine, using the model of an aircraft being tested in a wind tunnel.

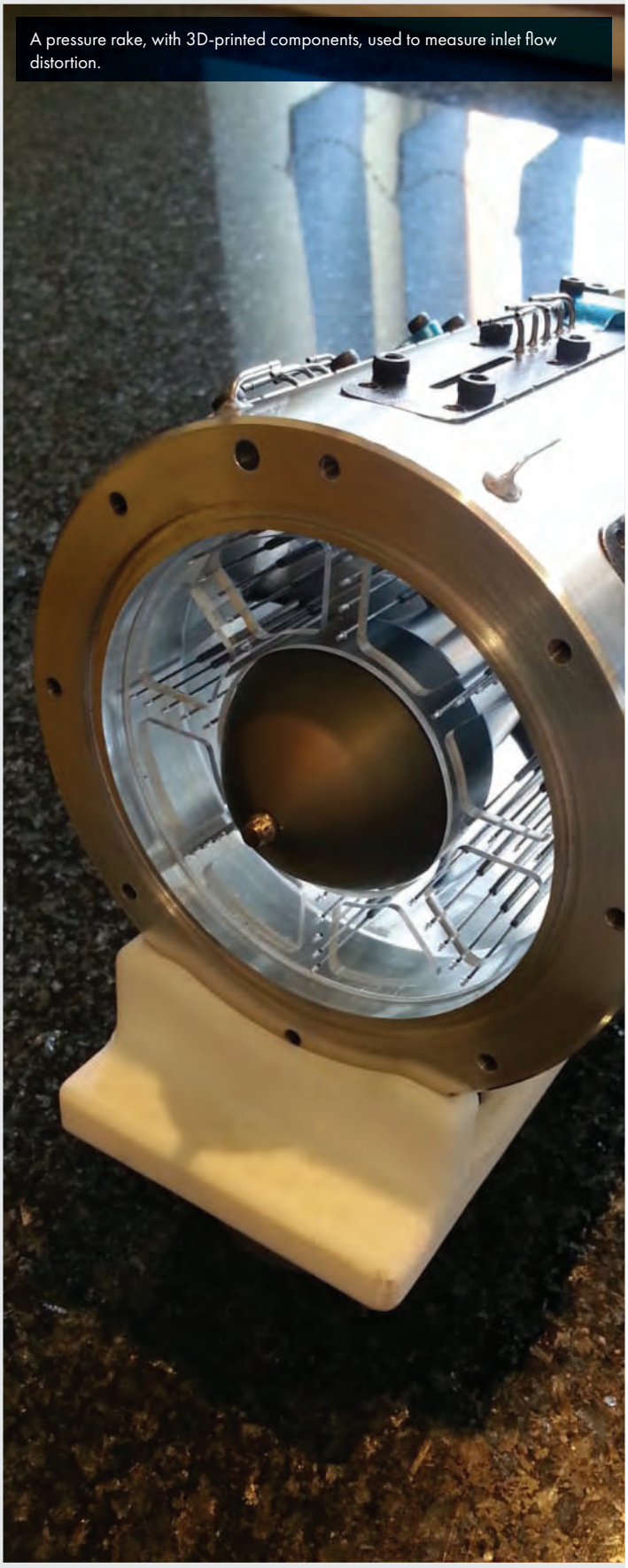
Also known as an active inlet flow induction and measurement system, it is used in conjunction with a pressure rake, which was also designed by the CSIR, that is placed at the model aircraft's aerodynamic interface plane position of the jet engine's compressor face.

The device is used in tests to characterise the aerodynamic performance of the airframe inlet as it delivers air to the engine compressor face. It controls and measures the amount of air ingested by the inlet of the wind tunnel model during the wind tunnel test, while the pressure rake measures the pressure distribution of the inlet air at the engine compressor face.

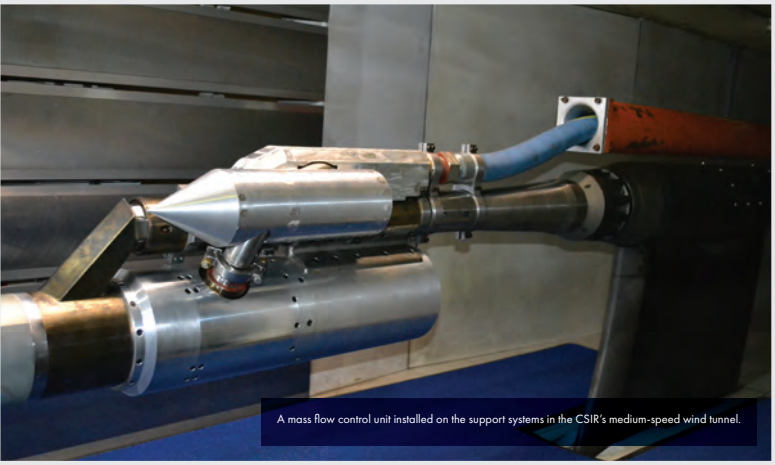
The system was completed in time to be deployed for the ambitious airframe development of the international Aero-system company, whose first test was the characterisation of the jet engine inlet system. The system was designed for application in the CSIR's medium-speed wind tunnel – one of a suite of tunnels housed at the CSIR.

The development of the inlet testing capability is the culmination of more than a decade's work. Every wind tunnel requires its own dedicated system as each tunnel differs in architecture and performance. The development process provided an opportunity for a Master's study, supported by the CSIR studentship programme.

Fundamental elements of the system were studied and simulated using computational fluid dynamics and a basic elemental ejector system was developed to study the performance of the proposed solutions.



A pressure rake, with 3D-printed components, used to measure inlet flow distortion.



A mass flow control unit installed on the support systems in the CSIR's medium-speed wind tunnel.

Data centre servers at the SDN laboratory.

CSIR COMPLETES LAB TO STRENGTHEN THE COMPETITIVENESS OF LOCAL NETWORKING PRODUCTS

A new software defined networking (SDN) lab at the CSIR will strengthen the global competitiveness of South African networking products.

The lab infrastructure, including servers, network switches, and other information and communications technology (ICT) equipment, has been installed and configured. The lab will be used to accelerate diffusion for SDN and network function virtualisation (NFV) technologies research, conduct trials and undertake tests for industry.

The SDN lab has installed OpenStack, an open standard cloud-computing platform. The platform enables the lab to provide public and private clouds where users and clients have access to virtual servers, switches and other ICT resources. SDN and NFV are key emerging technologies that can be used for the development of shared infrastructure solutions that will lower entry barriers for small, medium and micro enterprises. This will have a positive impact on the transformation of the networks industry, with carrier service providers, Internet service providers and data host centres all set to benefit.

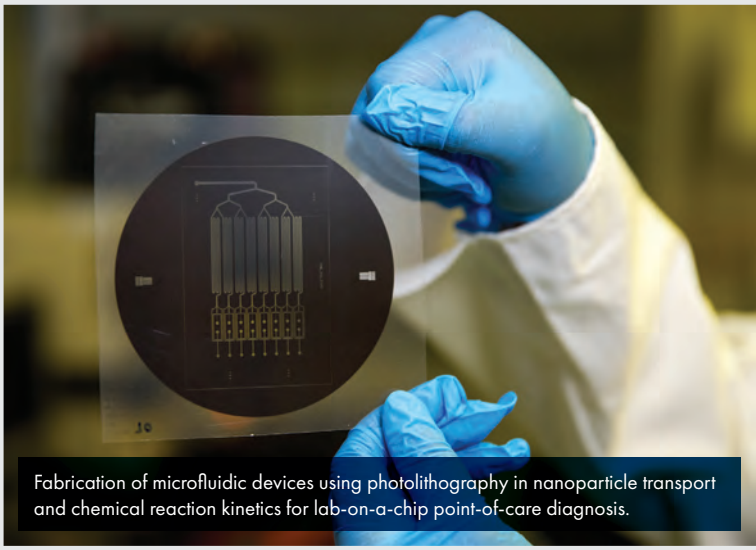
The SDN lab offers professional services and issues certification for conformance of network switches to Open Flow, a protocol that enables the centralised management and control of network switches. It is the first Open Flow Conformance testing facility in the southern hemisphere and Africa.

CSIR NANO-MICRO DEVICE MANUFACTURING FACILITY IDENTIFIED AS FACILITY OF STRATEGIC IMPORTANCE

The CSIR's Nano-Micro Device Manufacturing Facility was selected by the South African Research Infrastructure Roadmap (SARIR) of the Department of Science and Innovation (DSI) to host one of five national nodes that will support research and development in nano-micro manufacturing technologies on a national level. The facility will focus on assisting researchers from academia, as well as industry, to apply microfluidics, advanced materials and additive manufacturing in developing lab-on-chip point-of-care prototypes that will have an impact on human and animal health, as well as the environment.

Given the potential health benefits of nano-micro manufacturing technologies, SARIR recognised the strategic importance of this interdisciplinary field and its contribution to the beneficiation of metals, minerals and advanced manufacturing technologies, such as additive manufacturing. Currently, findings show that various South African projects address these particular research initiatives, but lack central facilities that will specifically assist projects to reach a higher technology readiness level towards commercialisation. The five nodes selected as DSI nano-micro manufacturing facilities will assist researchers with product development in lateral flow devices, lab-on-chip devices (specifically the CSIR node), chemical and bio-sensors, as well as printed electronics.

The CSIR facility is equipped with a gas-sensor testing facility, as well as physical metal layer deposition and various special printing systems, which have assisted six projects significantly to date. Moving forward, the open-access facility with nano/micro fabrication and characterisation equipment will develop low-cost systems for chemical and diagnostic applications, including multiple microfluidic technology platforms.



Fabrication of microfluidic devices using photolithography in nanoparticle transport and chemical reaction kinetics for lab-on-a-chip point-of-care diagnosis.

IMPROVING THE COMPETITIVENESS OF AFRICAN INDUSTRIES THROUGH LASER TECHNOLOGIES

The CSIR contributed to the use of laser technology to advance science and technology in Africa through the African Laser Centre (ALC), a programme of the CSIR National Laser Centre. The ALC supports research collaboration between researchers in South Africa and the rest of the African continent in this emerging technology field.

Annually, the ALC facilitates about 20 collaborative research projects between South African and African researchers. In 2019/20, the programme produced 63 journal papers, while 50 PhD students and 46 researchers from the rest of Africa participated in the projects. The participants of the programme were from 12 African countries.

The projects covered a range of application areas, including photonics in health, communication, manufacturing and environmental sensing.

- **63** REFEREED JOURNAL PAPERS
- **54** CONFERENCE PROCEEDINGS
- **99** TOTAL NUMBER OF STUDENTS WHO PARTICIPATED IN PROJECTS
- **34** MASTER'S STUDENTS WHO PARTICIPATED IN THE PROJECTS
- **50** PHD STUDENTS WHO PARTICIPATED IN THE PROJECTS
- **48** RESEARCHERS FROM SOUTH AFRICA WHO PARTICIPATED IN THE PROJECTS
- **46** RESEARCHERS FROM THE REST OF AFRICA WHO PARTICIPATED IN THE PROJECTS

Delegates attending the African Laser Centre LRC Biophotonics in Cancer Symposium, held on 5 and 6 September 2019 at the University of Johannesburg.

Undercutting and collapse of road embankment (left) and bridge abutment (right) due to flooding in the Gaza Province in Mozambique.

SHARING KNOWLEDGE FOR CLIMATE-RESILIENT RURAL ACCESS IN AFRICA

The CSIR is contributing to the development of climate-resilient road networks in rural communities in Africa.

Africa is experiencing changes to its climate, which are resulting in widespread damage to road infrastructure and its associated assets. Rural accessibility is being compromised in a number of countries and sub-regions because of extreme weather events, with both direct and indirect adverse effects on livelihoods and associated socioeconomic development.

To help address this threat to Africa's development, in 2016, the Africa Community Access Partnership (AfCAP), a research programme funded by UKAid, commissioned a project to produce regional guidance on the development of climate-resilient rural access in Africa through research and knowledge sharing within and between participating countries. In the second phase, CSIR researchers demonstrated appropriate engineering and non-engineering adaptation procedures; enhanced the capacity of three participating countries, namely Ethiopia, Ghana and Mozambique, to deal with the effects of climate on their low-volume access roads; and contributed to the capacity of additional AfCAP partner countries through the implementation of a training-the-trainer programme.

The research team produced a climate adaptation handbook that provides a methodology for carrying out a climate adaptation assessment for rural access to assist socioeconomic development, three guideline documents on change management, climate risk and vulnerability and engineering adaptation, as well as a visual assessment manual. These publications have been translated into French and Portuguese.

FURTHER AFIELD

CSIR COMPLETES PRE-FEASIBILITY STUDY ON TYRE RECYCLING FOR CARIRI

The CSIR has completed a pre-feasibility study into waste tyre recycling and asphalt rubber production for the Caribbean Industrial Research Institute (CARIRI). The recommendations have been accepted and the two organisations are engaging on the next phase of the project.

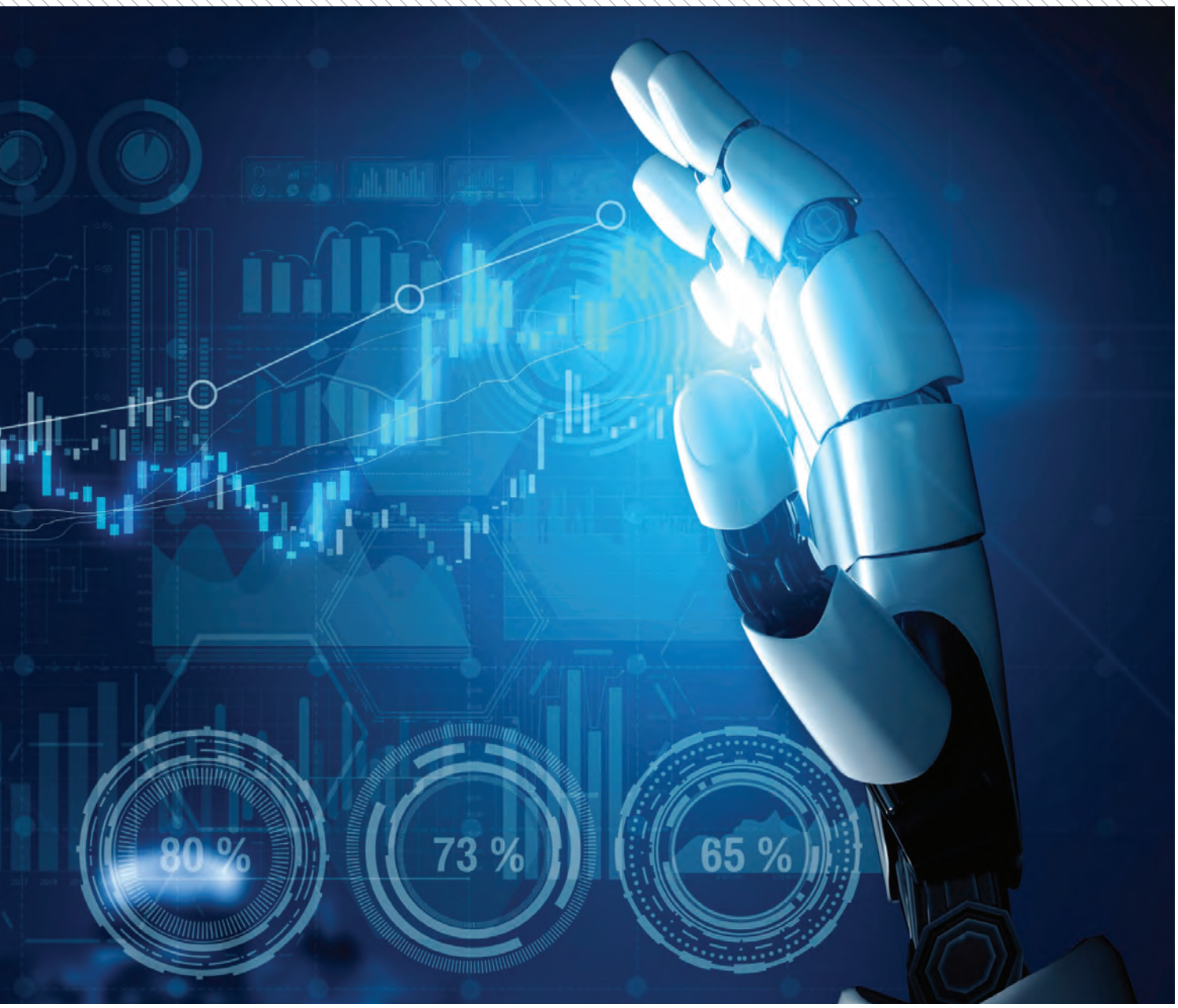
CARIRI identified an opportunity for the development of a plant for asphalt rubber, a blend of rubber granules and asphalt cement, in Trinidad and Tobago. The opportunity is based on the availability of asphalt, waste tyres, as well as tyre shredding machinery. There was also the need to resolve the problem of improper disposal of waste tyres and address economic diversification.
An asphalt rubber plant that uses waste tyres would greatly reduce the environmental impact of waste tyres, which includes the leaching of toxic chemicals into the soil and groundwater sources, and the emission of toxic gasses from burning tyres.

The CSIR has been involved in the waste tyre-recycling sector for more than 30 years, and the two organisations have a long-standing strategic partnership. To produce rubberised asphalt, production facilities for rubber crumb and rubberised asphalt would have to be set up.

Official statistics indicate that more than a million tyres are imported into Trinidad and Tobago annually. Only a low percentage of these tyres is reported to be recycled via the approved mechanisms, which include shredding for volume reduction and landfill disposal.

C ORGANISATIONAL PERFORMANCE

This section provides an overview of the organisation's performance against the set objectives and targets for the 2019/20 FY. The overview provides a description of any significant developments that may have impacted on the organisation's ability to deliver on its Strategic Plan and Annual Performance Plan.



AUDITOR'S REPORT: PREDETERMINED OBJECTIVES

The AGSA (the external auditor) currently performs the necessary audit procedures on the performance information to provide reasonable assurance in the form of an audit conclusion. The audit conclusion on the performance against predetermined objectives is included in the report to management, with material findings being reported under the *Predetermined Objectives* heading in the *Report on other legal and regulatory requirements* section of the Auditor's Report.

For the Auditor's Report, refer to page 128 in Part F.

SITUATIONAL ANALYSIS

SERVICE DELIVERY ENVIRONMENT

A number of external and internal environmental factors influenced the strategic direction of the CSIR. Our research programmes address national priorities and, as such, our RD&I activities are developed in response to national strategies, such as the NDP and its derivative strategies and policies, through various government departments, especially the DSI. Equally, we develop capabilities to respond to national and international private sector requirements. We are cognisant of the changing environmental factors, both internally and externally, that may influence that strategic direction.

Historically, the CSIR has contributed significantly to South Africa's RD&I, supporting university, medical and industrial research. It contributed significantly to industrial development, through the setting up of other specialised research councils, rendering support to enterprises, setting up successful start-up companies, and enhancing significant parts of major players, such as Denel Aerostructures. To date, the CSIR has created 105 companies, 54 of which are still thriving.

Over the past decade, South Africa has experienced premature de-industrialisation. This position is exacerbated by the fact that South Africa struggles to perform in the key drivers required to reinvigorate the industrial sector from a global perspective. For example, the country is ranked 83rd in labour market efficiency, 112nd in higher education and training, 124th in technological readiness and 135th in innovation. Therefore, it is clear that addressing these key drivers is essential to reversing the de-industrialisation that South Africa is experiencing. The CSIR plays a significant role, particularly with respect to innovation and technology readiness and partially in providing training for the required skills.

RD&I is critical to the future of South Africa. Government recognises that generating knowledge and improving the understanding of science enable society to find solutions to today's economic, social and environmental challenges, as well achieve sustainable development. Historically, scientific and technological developments have underpinned industrial and economic advances, improvements in health systems, education and infrastructure, and have thus contributed to the quality of life of the people.

The state and nature of funding for RD&I remains a concern for the National System of Innovation, and particularly for the CSIR. The Gross Expenditure on Research and Development remains well below the target of 1.5%, set by the then DST. In addition, the PG allocation of the CSIR has experienced cuts.

Our response, in addressing funding constraints and achieve growth through our new strategy, is to increase private sector and international income by aligning our offerings to market needs. Still, public sector income remains a key component of our income as offerings and services to public institutions enable the fulfilment of our mandate and SOs. However, the National Treasury Regulations make it increasingly difficult for public entities to contract directly with government and state-owned enterprises. Public institutions require the CSIR to compete for research and development activities in open tenders, which, as a public entity mandated to perform this type of work, should not be the case. In the 2018/19 FY alone, this practice led to the loss of revenue opportunities to the tune of R800 million.

What is encouraging is that industrial policies continue to place science, technology and innovation at the centre of industrial development, with a clear statement that certain sectors, such as mining, can only be transformed through technological innovations and strong partnership between government and the private sector.

The CSIR performed well over the past five-year MTSF period (2015 – 2019), meeting or exceeding nearly 80% of the KPI targets agreed upon with the DSI, with a further 13% of targets partially achieved (defined as within 10% of acceptable performance limits). Over this period, the CSIR has consistently performed well in the areas of scientific outputs, but with less than expected performance in human capital, finance and governance, particularly in respect of B-BBEE and safety over the past two years. Measures have been put in place to address these issues and meet these targets.

Commencing 1 April 2019 – the beginning of the reporting FY – the new CSIR Strategy and the new operating model came into effect. The CSIR Shareholder's Compact 2019/20, essentially implemented the new strategy and aligned its strategic plan and operational plan to the new CSIR vision, mission, strategic intent and SOs, in addition to considering key external factors

and other internal factors. The KPIs were reviewed to align and give effect to the new five SOs of the new strategy and were included as part of the plans of the reporting FY.

The divisions, clusters, impact areas and research groups were established in line with the new operating model during the FY. Key leadership roles were filled or confirmed with qualifying candidates during the reporting year. These key roles included Divisional Group Executives, Cluster Executive Managers, Impact Area Managers, Research Group Leaders, as well as the crucial roles, such as the BD&C Executives. While some leadership roles defined as part of the new operating model are still vacant, as at FY end, the overall operations can be described as stable.

Placement of SET staff was also finalised during the FY. While attrition of SET capacity and senior SET capacity (e.g. chief researchers and principal researchers) was experienced as the change was effected during the FY, investment in the CSIR human capital development programmes that are about "growing our own timber", such as the GIT programme and the ARDP, continued. The CSIR was also able to appoint 63 staff members from the CSIR student pipeline, which reduced the impact of resignations to some extent.

Commencing in quarter 3 of the FY, there was a focus on the optimisation of support functions in divisions, clusters and portfolios. The process of support optimisation proved to be more challenging and protracted than planned. However, by the end of quarter 4, only a few support optimisation planned activities were still outstanding.

During the reporting FY, there was also focus on the review and development of new policies aligning to the new strategy. The policies approved by the Board include the reviewed Approval Framework, several finance and human capital policies, as well as the Privacy, Records Management, Access to Commercial Data and Information Resources, PG Investment and Research Ethics Policies. The development and review of policies will continue into FY 2020/21.

Investments in new capability building, including through infrastructure, further development of technology demonstrators and commercialisation projects, were prioritised and enhanced during the reporting FY. The intent through these investments was to contribute to the achievement of the SOs of the new strategy.

The organisation also took initiatives to ensure financial sustainability through various directed cost saving interventions. Safety and governance remained priorities for the CSIR. In the safety area, we have maintained a good safety record for the year

ORGANISATIONAL PERFORMANCE ENVIRONMENT

The CSIR embarked on the implementation of its new strategy with the key focus being strengthening the "industrial" component of our mandate. Along with the new strategy, came a number of structural changes and movements of research groups and capabilities to new structures with new or nuanced focus and objectives. Naturally, these changes disrupt the day-to-day activities of the organisation. Quarter 2 of the 2019/20 FY saw the continued implementation of the new CSIR Strategy with the finalisation of staff placements in various senior roles such as BD&C, impact area and research group leadership. With the stabilisation of the new CSIR Operating Model and smoother operations, which was realised in the second half of the year, the CSIR saw strong recovery and improved delivery against our SOs. However, the onset of the COVID-19 pandemic towards the end of the quarter 4 of the reporting FY had an impact on the organisation, and will likely continue to have a significant impact in the new FY.

Much of the research embarked on during the previous FY continued and, despite the restructuring, research teams made progress in fulfilling the five SOs as per our new strategy. Due attention was also given to focus research areas such that they add value to our target stakeholders and customers. Performance with respect to scientific targets, such as publication equivalents and patents granted, exceeded targets. However, translation of knowledge into technology demonstrators, technology licences and joint technology development with industry, did not meet targets. The main reason for underperformance in this regard was the delayed placement of planned capacity to drive BD&C, as well the lag time following the refocus of research programmes in alignment with the new strategy.

The number of SMMEs supported during the reporting year exceeded the annual target set. Many projects supporting national policy and capability development for the state were completed in the fourth quarter, with both these performance areas either meeting or exceeding targets. The role of the CSIR in supporting the state was again highlighted during the onset of the COVID-19 pandemic, as the CSIR was requested to assist in a number of areas, including through establishing the National Response Centre, leading the ventilator production, providing a testing service, and undertaking vaccine

development and production of personal protective equipment. This is testament to both the expertise and the multidisciplinary nature of the CSIR.

During a period of significant change, there is also the risk of losing key staff. Over the last two quarters of the 2018/19 FY, we saw the loss of some key senior staff. Through this reporting year, we aimed to rebuild where capacity had been lost, particularly in line with the new strategy. Throughout the FY, some key positions filled included senior SET and BD&C staff in the divisions and clusters. Initiatives such as the ARDP and GIT programme have been put in place for internal human capital development.

Due to financial constraints, the CSIR also decided not to fill some vacancies. However, targeted recruitment to re-capacitate critical areas as per the new strategy, will be further pursued in the new FY.

In the third quarter of the reporting year, reorganisation of the support functions commenced and a commitment was made that there will be no forced disengagements as an outcome. At FY end, structural changes and staff placements against the support structures were near completion. For the 2019/20 FY, staff turnover was 14.6% and this includes some exits related to the section 189 process. The CSIR expects stabilisation of the staff with potential growth towards the end of the 2020/21 FY. However, this depends on the extent of the impact of the COVID-19 pandemic.

In the final quarter of the 2018/19 FY, the CSIR made a strong financial turnaround, ending with a positive margin against a projected loss earlier that year. The CSIR did not meet the planned 2019/20 total income target, but the net profit was significantly ahead of the FY target and year-on-year comparison. Cost saving initiatives yielded positive results. Governance and safety remained a priority in the CSIR during the reporting year.

Overall, the CSIR met or exceeded 19 of the 31 KPIs measured, with a further one KPI partially achieved i.e. within 10% of the performance threshold. Of concern is the nature of the KPIs that were not met – 11 of 31 – as these relate to human resources and also those associated with industrial development support, e.g. technology demonstrators, localised technology, licence agreements and percentage of private income. As we move into the new FY and there is further implementation of the CSIR Strategy, meeting these KPIs is an area of focus.

KEY POLICY DEVELOPMENTS AND LEGISLATIVE CHANGES

Prevailing and emerging external and internal environmental factors influence the strategic direction of the CSIR. Our research programmes address national priorities as articulated by the President in the State of the Nation Addresses, and are aligned with various national strategies and frameworks, such as the NDP, the MTSF 2019 to 2024, and the departmental policies, particularly those of the DSI. The CSIR Strategy also seeks to give meaning to the **dtic**'s Industrial Policy Action Plan 2018/19 to 2020/21 and the DSI's White Paper on Science, Technology and Innovation, 2019, in particular. In addition to existing strategies, plans, policies and frameworks, the CSIR also intends to respond and contribute to the implementation of national priorities of the sixth democratic government that are under development. These include the NDP Five-year Implementation Plan, the **dtic**'s "Re-imagining Industrialisation Strategy for South Africa" and it's Sector Master Plans, the DSI's Decadal Plan 2020 and the District Model.

STRATEGIC OUTCOME ORIENTED GOALS

The strategic intent of the new CSIR Strategy can be summarised as growth, sustainability, impact and relevance. These four pillars bring alignment between responding to our mandate and addressing internal organisational imperatives.

The CSIR's intention is to use its capabilities, such as skilled human resource, infrastructure and intellectual property, to support the growth of the South African enterprises and assist in growing the South African economy, contributing to the alleviation of poverty, and addressing unemployment and inequality. The CSIR also intends to grow as an organisation, strengthening its human capital base and other competencies required to remain a world-class organisation, while strengthening its financial position.

Our intentions on sustainability refer to the CSIR developing technologies and innovations by diffusing/commercialising these to improve the competitive advantage of South African enterprises and ensuring that they are financially and environmentally sustainable. New viable industries are also being created as part of the new strategy. This intent also speaks to the financial sustainability and good governance of the CSIR in a resource-constrained environment.

The CSIR will strive to make a greater impact on the economy and society through the commercialisation of technologies and innovations for industrial and socioeconomic

development, as well as technology and knowledge transfer that enable a capable state.

The fourth pillar – relevance – relates to the appreciation of the relevance of innovation in industrialisation by private sector decision-makers and public sector policymakers. The intention is also to ensure that the organisation is relevant by addressing market needs and socioeconomic challenges, as well as being able to deliver on its mandate of improving the quality of life of the people of South Africa.

The strategy of the organisation hangs on its clearly defined SOs, which are derived from the prevailing strategic drivers in our operating environment:

SO1 CONDUCT RD&I, LOCALISE TRANSFORMATIVE TECHNOLOGIES AND ACCELERATE THEIR DIFFUSION.

The convergence and pace of new technologies are fundamentally disrupting industries and require synchronised RD&I efforts, in order to achieve maximum benefits. Thus, this SO entails conducting RD&I, as well localising transformative technologies and accelerating their diffusion into South Africa's high-impact industries.

SO2 COLLABORATIVELY IMPROVE THE COMPETITIVENESS OF HIGH-IMPACT INDUSTRIES TO SUPPORT SOUTH AFRICA'S RE-INDUSTRIALISATION.

South Africa has undergone de-industrialisation over the last decade. This SO seeks to improve the competitiveness of South Africa's high-impact industries through RD&I in a collaborative manner with partners, thereby contributing to the re-industrialisation of the country.

SO3 DRIVE SOCIOECONOMIC TRANSFORMATION THROUGH RD&I THAT SUPPORTS THE DEVELOPMENT OF A CAPABLE STATE.

Economic and social development in South Africa has been constrained by the challenges of inequality, unemployment and poverty. The CSIR aims to play a pivotal role in the socioeconomic transformation of South Africa through RD&I, supporting the development of a capable state, and enabling government to drive the socioeconomic transformation of South Africa through RD&I.

SO4 BUILD AND TRANSFORM HUMAN CAPITAL AND INFRASTRUCTURE.

This SO seeks to build and transform the required human capital and invest in infrastructure, leading to the organisation's capabilities that drive industrialisation and the advancement of society. This objective also emphasises the need for targeted capability development – human capital and infrastructure investment – to leverage emerging technologies.

SO5 DIVERSIFY INCOME, AND MAINTAIN FINANCIAL SUSTAINABILITY AND GOOD GOVERNANCE.

The South African public and private sector spend in RD&I is constrained, but RD&I remains a country focus. The RD&I needs are changing and there is increased competition in the RD&I sector. This SO seeks to improve the CSIR's financial sustainability by diversifying revenue sources and optimising the business model to achieve competitiveness supported by good, efficient and sound governance.

PERFORMANCE INFORMATION BY STRATEGIC OBJECTIVE

Allocation categories and alignment to SOs	2018/2019			2019/2020		
	Budget	Actual Expenditure	(Over)/ Under Expenditure	Budget	Actual Expenditure	(Over)/ Under Expenditure
	R'000	R'000	R'000	R'000	R'000	R'000
Baseline PG allocation to clusters and centres (SO1,SO2,SO3, SO4, SO5)	497 013	512 499	(15 486)	436 614	507 457	(70 843)
Baseline PG to portfolios and support functions (SO4, SO5)	263 080	247 594	15 486	321 453	250 611	70 843
Total Baseline PG	760 092	760 092	(0)	758 068	758 068	0

SO1 CONDUCT RD&I, LOCALISE TRANSFORMATIVE TECHNOLOGIES AND ACCELERATE THEIR DIFFUSION.

Some programmes implemented to contribute to this SO included:

Mining, which focuses on processes that ensure efficiency so that mines can maximise the recovery of the mineral wealth in a safe and sustainable manner. The research teams focused on input resource optimisation, modernised mining engineering and non-explosive rock breaking. The CSIR's research built on established programmes on geophysics and rock engineering, mining engineering, sensor development, and robotics and automation. The CSIR's priorities in mining included the optimisation of current mining, advanced orebody knowledge, mechanised mining, nonexplosive rock breaking and real-time information management systems.

Chemicals product development, which focuses on the development of specialty powders, nanomaterials, and specialty alloys, building on the Titanium Acceleration Master Plan and the South African Aluminium Industries Roadmap, among others.

Precision agriculture, which contributes to the development of a more competitive industry and rural economies by supporting agricultural production through earth observation, climate change modelling, big data and data analytics to support land use planning, and monitor pests and diseases.

Agroprocessing, which facilitates the transfer of fit-for-purpose 'urban' agro-processing technologies into rural settings and developing value-added processing of crops, including high-value indigenous plants. The programme incorporates the development of advanced capabilities for food safety testing efficiency and accuracy, as well as automated production line technologies.

Advanced agro-processing is building on existing interventions, such as the BIDF and the BIDC, which are important components of this integrated approach. Other relevant existing industries include produce (not product) lifecycle management, smart factory and logistics.

Medical devices and diagnostics interventions include the implementation of product lifecycle management and advanced manufacturing support. New interventions focused on facilitating and accelerating the commercialisation of medical devices and diagnostics, through the provision of advanced materials for health applications, product testing infrastructure, incubation, regulatory and smart logistics support.

DSI-funded initiatives implemented were:

The national ICT Roadmap invested funds across key focus areas and ICT RD&I interventions. The RD&I activities by the CSIR were aligned with the ICT RD&I Roadmap and included:

- digitalisation of government such as e-Government, eHealth and Oceans and Coasts Monitoring;

- digitalisation of industry for the development of technology building blocks and proof of concepts of end-to-end solutions in a few specific industrial sectors;
- ICT Sector Growth and Transformation to enable the availability of low-cost and flexible network and radio equipment and associated infrastructure deployment models to support emerging business models; and
- cybersecurity and biometrics within CSIR Defence and Security.

The National Laser Centre developed and applied a novel laser application across a variety of sectors. The centre is involved in early stage research and development of novel lasers and applications through to late-stage research – additive manufacturing and prototyping – and developed service-based solutions, such as laser-based refurbishment and engineering.

The NICIS is a national cyberinfrastructure system that enables, supports, enhances and contributes to the performance of the national science ecosystem as a whole. The NICIS promotes scientific and industrial development through the provision of high performance computing capability, high speed network capacity (SANReN), a national data intensive research infrastructure (DIRISA) and a human capital development pillar integrated horizontally into globally connected systems and hierarchically into a local system providing seamless access to the research and teaching community.

SO1 KPIs: planned targets and actual achievements

SO1: Conduct RD&I, localise transformative technologies and accelerate their diffusion					
Performance Indicator	**Actual Achievement 2018/19**	**Planned Target 201920**	**Actual Achievement 2019/20**	**Deviation from Planned Target to Actual Achievement for 2019/20**	**Comment on deviations**
KPI 1: Publication equivalents	536	420	437.5	17.5	Target exceeded.
KPI 2: New priority patent applications filed	New KPI introduced in 2019/20	5	4	-1	This underperformance is attributed to the lag associated with the refocus of RD&I strategies, delayed filling in of positions relating to BD&C and the loss of some key staff through this year.
KPI 3: New patents granted	22	13	21	8	Target exceeded.
KPI 4: New technology demonstrators (TDs)	50	66	37	-29	This underperformance is attributed to the lag time associated with refocusing of RD&I strategies in line with the new CSIR Strategy, and the loss of some key staff.
KPI 5: Number of technology licence agreements signed	New KPI introduced in 2019/20	24	5	-19	This underperformance is attributed to delayed appointments of key skills in the BD&C functions as per the new Operating Model, as well as the lag related to the refocusing of RD&I strategies.
KPI 6: Number of localised technologies	New KPI introduced in 2019/20	12	7	-5	This underperformance is attributed to there being no finalised organisational strategy to drive the localisation of technologies.

The CSIR fared well on scientific outputs during the 2019/20 FY. The organisation produced 437.5 publication equivalents against a target of 420, thus exceeding the targeted performance level set. For a comprehensive list of scientific outputs, please go to www.csir.co.za. Four new priority patent applications, against a target of five, were filed, and 21 patents were granted by an examining patent office against a target of 13. The target of 66 for TDs, was not reached and only 37 submissions were approved. The CSIR only signed five licence agreements for the FY against a target of 24. The number of actual localised technologies was below the target, with seven declared relative to a target of 12, although this is within the set performance threshold.

As the BD&C functions in the divisions form, there is a greater focus on the recruitment of new SET staff. As the strategies and policies to drive commercialisation are effected, and investments in further development of TDs and commercialisation initiatives bear fruit, it is expected that the CSIR will see better performance in the future year with respect to performance areas that have to do with translation of knowledge and intellectual property into technology for diffusion to industry and society.

Patents granted (21)

Patent Title	Patent Number	Country
A device for calibrating a helmet	2705644	Russia
A field effect transistor and a gas detector including a plurality of field effect transistors	I653447	Taiwan
A hybrid microwave synthesis procedure for spinel cathode materials	CN 107108260	People's Republic of China
A method and apparatus for assessing the integrity of a rock mass	330307	India
A method of calibrating a camera and a system therefor	64696	Thailand
Accelerated pavement testing	10,495,556	United States of America
Apparatus, methods and systems for measuring and detecting electrical discharge	241647	Israel
Electronically deriving a conclusion of the condition of slurry flow in a non-vertical conduit	2015317280	Australia
Emulsion-derived particles	PI 0819130-1	Brazil
Immunomodulation by controlling ELR+ proinflammatory chemokine levels with the long non-coding RNA UMLILO	2,971,168	Canada
Laser apparatus and method having plural excitation sources with associated beam splitting arrangements for adaptive control	3336979	European Patent Office (EPO)
Membrane and method for preservation of produce	2542340	United Kingdom
Method and device for detection of whole organism bacteria	2549819	United Kingdom
Method and system for frequency compression	2019958	Netherlands
Method for encapsulating pharmaceutical actives	3291795	European Patent Office (EPO)
Method for identification of anti-HIV human miRNA mimics and miRNA inhibitors and anti-HIV pharmaceutical compounds (CONTINUATION)	10,351,916	United States of America
Preventative treatment and remission of allergic diseases	2007408	European Patent Office (EPO)
Production of a layered lithium-manganese-nickel-cobalt oxide material	10,396,357	United States of America
Production of cathode material	AR092069	Argentina
Site-specific nuclease single-cell assay targeting gene regulatory elements to silence gene expression	6535333	Japan
Upgrading of titaniferous material	21581	Vietnam

Priority applications filed (4)

Patent Title	Application Number	Country
Method for producing a vanadium oxide nanosensor and application thereof	2019/05914	South Africa
Polymer-lipid nanocomplex for enhanced aqueous solubilisation and absorption of hydrophobic active compounds	2019/02992	South Africa
Process for producing spherical powders of novel multicomponent based shape memory alloys and alloys made by the process	2019/08232	South Africa
Rubber modified bituminous binders	2019/07698	South Africa

The CSIR acknowledges the support from the National Intellectual Property Management Office's Intellectual Property Support Fund towards maintaining the CSIR patent portfolio.

SO2 COLLABORATIVELY IMPROVE THE COMPETITIVENESS OF HIGH-IMPACT INDUSTRIES TO SUPPORT SOUTH AFRICA'S RE-INDUSTRIALISATION.

Some programmes implemented to fulfil this SO include:

The **biochemical conversions platform**, which focuses on disruptive and innovative (bio) chemical conversion technology to create a dynamic African chemical industry with access to forward-looking and modern digitised and greener production processes.

The **biopharmaceuticals platform**, which focuses on the development and production of biological reagents, antibodies and peptides with improved specificity and activity compared to existing chemical products, and the development of novel bioprocesses to allow the production of these bio-based solutions according to Good Manufacturing Practice guidelines.

The **advanced materials and engineering platform**, which focus on raw material beneficiation, especially titanium, aluminium, steel and platinum group metals; import replacement of specialty metals and alloys, advanced polymers, plastics and next-generation composites and fibres; the testing and qualification capability for new materials; and nurturing end-to-end value chains working collaboratively with the end users.

The **defence platform**, which focuses on integrated, large-scale intelligence, surveillance and reconnaissance platforms; technology solutions that are interoperable, prioritising collaborative designing, advanced manufacturing, and defence industry supply chain developments; and complete Original Equipment Manufacturer solutions focusing on the middle tier for the short to medium term. This is an effort built on the current South African National Defence Force operations and other strategic capabilities, including weapons integration, propulsion systems and aerodynamic testing.

Smart logistics management was identified to become South Africa's reference institution for the explicit econometric modelling of the relationship between logistics performance and the different sectors of the economy, including agriculture, manufacturing, mining, trade and finance. The area seeks to give advice on appropriate technology adoption and adaptation strategies for the logistics value chain.

SO2 KPIs: planned targets and actual achievements

SO2: Collaboratively improve the competitiveness of high-impact industries to support South Africa's re-industrialisation					
Performance Indicator	**Actual Achievement 2018/19**	**Planned Target 201920**	**Actual Achievement 2019/20**	**Deviation from Planned Target to Actual Achievement for 2019/20**	**Comment on deviations**
KPI 7: Number of joint technology development agreements being implemented for industry	New KPI introduced in 2019/20	39	23	-16	Renewal of relationship-building with industry still requires traction and, in this regard, more effort will be put in 2020/21. The CSIR's capacity to drive BD&C was only established later during the 2019/20 and this function still requires strengthening in divisions.
KPI 8: Number of SMMEs supported	New KPI introduced in 2019/20	92	116	24	Target exceeded.

At the end of the 2019/29 FY, the CSIR did not achieve the target to enter into joint technology agreements with industry. Twenty-three agreements with industry were entered into against a target of 39. The underperformance in this regard is in part due to delayed contracts that could not be realised during the reporting FY. Further, in respect of new strategic industry relationship development, although there were efforts made, they did not gain traction in the reporting FY. However, some progress is being made through the formalisation of partnerships and commercial collaborations.

The CSIR exceeded the target set to support 92 SMMEs and supported 116 SMMEs by the end of the FY. The importance of the SMME sector driving and taking up innovations is key to the CSIR achieving its strategic intent. This performance is also a testament to the CSIR's commitment to support emerging industries, small businesses, and the national objectivesof economic development and job creation.

SO3 DRIVE SOCIOECONOMIC TRANSFORMATION THROUGH RD&I THAT SUPPORTS THE DEVELOPMENT OF A CAPABLE STATE.

Some programmes that contributed to this SO were:

The **health information systems and digitisation platform**, which applies interoperable health information systems for continuity of care and patient-centric healthcare delivery, and supports the implementation of the National Health Insurance. The CSIR's strategic interventions included a health normative standards framework and shared national ICT infrastructure, with additional focus on data mining, using digital and cognitive technologies to produce insights and trends for health system planning.

The **cybersecurity capability**, which provides cutting-edge research and development to address information and cybersecurity threats and vulnerabilities across diverse domains in South Africa. This includes, among others, sovereign technology innovations that enhance systems and applications security, data security, network security, mobile security, digital forensics, cybercrime analysis, next-generation identity authentication approaches and systems and cyber-physical critical infrastructure. These capabilities are built in collaboration with government, the private sector, institutions of higher learning and international partners for the advancement of national security imperatives in the cyber space.

The **civil security platform**, which offers command and control capabilities for crowd management; sensor systems for homes, businesses and critical infrastructure that will enable authorities to identify and react quicker to criminal activities; integrated security solutions for infrastructure security; and security solutions for the cash-in-transit industry. An integrated security solutions platform will link various security agencies and Justice, Crime Prevention and Security Cluster departments, so that they can collaborate and share information on security-related incidences. These interventions are built on the numerous security cluster capabilities and decision-support tools.

The Smart Transport Network programme, which is inclusive of logistics supply chain engineering, network nerve design and systems, digital transport networks, including smart (intelligent) ports, rail freight and smart roads. The focus is on the interconnectedness of the individual components through a systems functional approach, in order to optimise the national transport system – both passenger and freight transport. The concept of digitisation is to be used to integrate apparent separate issues into a high-level value add offering.

The World Economic Forum C4IR SA

The CSIR is the nominated host of the Centre on behalf of the government of South Africa. The establishment phase of the Centre commenced in 2019/20. The Centre's activities focus on the policy, regulatory and governance environment necessary for the implementation of the fourth industrial revolution and emerging technologies. The Centre will also provide a means for interaction with relevant public and private sector stakeholders, both locally and internationally. The C4IR SA is being designed as a public-private partnership initiative, facilitated by government, but with strong buy-in from relevant private and public sector partners. This platform will allow for fast tracking of national development through access to learning from other regions globally that are grappling with many of the same issues around the adoption of new and advancing technologies for public good and national growth.

SO 3 KPI: planned targets and actual achievements

SO3: Drive socioeconomic transformation through RD&I that supports the development of a capable state					
Performance Indicator	**Actual Achievement 2018/19**	**Planned Target 201920**	**Actual Achievement 2019/20**	**Deviation from Planned Target to Actual Achievement for 2019/20**	**Comment on deviations**
KPI 9: Number of reports contributing to National Policy Development	New KPI introduced in 2019/20	24	24	0	Target met.
KPI 10: Number of standards delivered or contributed in support of the state	New KPI introduced in 2019/20	16	10	-6	This is attributed to longer than expected times to attain approvals by decision-makers or acceptance of these inputs, despite the research being completed and delivered.
KPI 11: Number of projects implemented to increase the capability of the state	New KPI introduced in 2019/20	54	67	13	Target exceeded.

The CSIR met the performance target of 24 in respect of "the number of reports contributing to national policy development" and exceeded the target for the "number of projects implemented to increase the capability of the state" and attained an actual of 67. However, the CSIR under-performed and only attained an actual of 10 in relation to achieving the target of 16 in respect of the "number of standards delivered or contributed in support of the state". The underperformance is attributed to longer than expected times to attain approvals by decision-makers or acceptance of these inputs, despite the research being completed and delivered.

Of note and related to SO3 is that, with the outbreak of the COVID-19 pandemic worldwide and nationally, as at mid-March 2020, the CSIR was once again called upon to deploy its scientific and technological expertise to support the national effort to combat the pandemic. Several COVID-19 projects were initiated during quarter 4 and will be ongoing during 2020/21.

SO4 BUILD AND TRANSFORM HUMAN CAPITAL AND INFRASTRUCTURE.

Build and transform human capital: The CSIR Human Capital function has four strategic pillars that drive the human capital delivery and excellence, and they are as follows:

Building a diverse talent ecosystem and a sustainable future supply, which recognises the critical role that human capital has in meeting the immediate talent demands of the business post restructuring and responding to new CSIR Strategy demands in addressing the longer-term talent requirements and sources of supply. This encompasses building and retaining our own talent, as well as implementing the CSIR Talent Sourcing Strategy through LinkedIn to source disciplines now and in the future, and better enable the movement of skilled resources across the three divisions.

Strengthening leadership and deepening professionalism, which reinforces the commitment to leadership development and deepening professional SET and non-SET competencies. Leadership competencies are being strengthened through the enhancement and rollout of core leadership programmes, a commitment to the development of leaders and high potential staff and succession planning. In addition, the drive to increase behavioural and technical competencies is delivered through leveraging the CILLA Academy supplemented by business, commercial and function-specific skills development and increasing the profile of technical professionals.

Improving individual and organisational performance, which emphasises simplifying the organisation

to better integrate competencies on a CSIR-wide basis and focus on making the new structures work. This includes support to the business, which is critical to the CSIR Strategy.

Increased efficiency and the effectiveness of human resource systems and processes is key to the standardisation and simplification of human resource processes supported as necessary by IT solutions in response to the 4IR and further implementation of the human capital operating model.

Strategic Infrastructure Programmes. During 2019/20, 25 infrastructure projects were funded as part of the Annual Capital Investment Plan. The projects fell under the categories of research infrastructure and equipment, ICT and facilities and general infrastructure.

The CSIR, with support from the DSI, also continues to operate five research and development facilities that provide capability for industrial innovation initiatives, such as prototyping, upscaling, pilot manufacturing and testing and which allow research to be translated into market-ready products. These facilities include the Photonics Prototyping Facility, BIDC, BIDF, Nanomaterials Industry Development Facility and the Nano micro Device Manufacturing Facility.

In addition to infrastructure investments as part of the Annual Capital Investment Plan, the CSIR is also in the process of implementing a long-term strategic intervention in support of infrastructure renewal and development, namely the CMP. The CMP serves as a blueprint that guides infrastructure development and capital investment planning in the next 10 to 20 years. The CMP ensures that research infrastructure and the built environment are developed in an integrated manner. The plan provides the CSIR and broader stakeholder community with a planning framework within which the long-term development of infrastructure in the CSIR can be executed.

SO4 KPIs: planned targets and actual achievements

SO4: Build and transform human capital and infrastructure					
Performance Indicator	**Actual Achievement 2018/19**	**Planned Target 201920**	**Actual Achievement 2019/20**	**Deviation from Planned Target to Actual Achievement for 2019/20**	**Comment on deviations**
KPI 12: Total SET staff	1 608	1 619	1 367	-252	The lower than targeted number of SET staff is a result of vacancies not being filled due to financial constraints and which necessitated a moratorium on recruitment. Intense competition for SET skills in the market also contributed to the CSIR not meeting the target.
KPI 13: Percentage of SET staff who are black	62.08	62	63.35	1.35	The achievement of the target is due to targeted recruitment and a focus on transformation. The increase in the percentage of black SET staff indicates success in the retention interventions achieved, despite the decline in the actual number of SET staff during the year.
KPI 14: Percentage of SET staff who are female	35.95	36	35.04	-0.96	The CSIR's human capital development programmes, which have a sizeable cohort of females participating, are yet to contribute adequately to a representation that meets our targets.
KPI 15: Percentage of SET staff with PhDs	19.47	22	21.87	-0.13	On a year-on-year comparative basis, the proportional representation of PhD-qualified staff improved, but the target was missed as human capital development investment and recruitment efforts are yet to adequately contribute to meeting the target set.

SO4: Build and transform human capital and infrastructure					
Performance Indicator	**Actual Achievement 2018/19**	**Planned Target 201920**	**Actual Achievement 2019/20**	**Deviation from Planned Target to Actual Achievement for 2019/20**	**Comment on deviations**
KPI 16: Total chief researchers	14	15	11	-4	The reduction in the number of chief researchers was due to resignations. In addition to recruitment of highly qualified skills of the calibre of a chief researcher, the ARDP's objective is to develop the next cohort of chief researchers.
KPI 17: Percentage of chief researchers who are black	7.14	13	18.18	5.18	The CSIR's human capital objectives for 2019/20 were focused on increasing the percentage of chief researchers who are black or female South Africans through the ARDP programme as outlined above.
KPI 18: Percentage of chief researchers who are female	14.29	13	18.18	5.18	The CSIR's human capital objectives for 2019/20 were focused on increasing the percentage of chief researchers who are black or female South Africans through the ARDP programme as outlined above.
KPI 19: Total principal researchers	190	209	149	-60	Refer to comments under KPI 12.
KPI 20: Percentage of principal researchers who are black	27.37	31	28.19	-2.81	Refer to comments under KPI 12.
KPI 21: Percentage of principal researchers who are female	16.84	18	16.11	-1.89	Refer to comments under KPI 12.
KPI 22: Number of exchange programmes with industry	New KPI introduced in 2019/20	8	11	3	Target exceeded.
KPI 23: PPE Investment (Rm)*	74	95	85.51	-9.49	The CSIR is putting stringent measures (e.g. improvements in planning projects, prior planning of procurement, tighter project management and more stringent monitoring and evaluation), in place to improve the delivery of infrastructure and expenditure of budget allocated.

The CSIR total staff headcount at the end of the 2019/20 FY was 2 104, compared to 2 342 as at 31 March 2019, a decline of 238 (-10.16%) for this FY. The CSIR headcount at the end of quarter 4, includes 1 367 (64.97%) SET staff and 734 (34.07%) support staff. Losses of scientific leadership as illustrated by the decline in the number of chief researchers from 14 in 2018/19 to 11 in 2019/20, and principal researchers from 190 in 2018/19 to 149 in 2019/20, proved to be a concern. The lower than targeted number of SET staff is as a result of vacancies not being filled due financial constraints and which necessitated a moratorium on recruitment. Intense competition for SET skills in the market also contributed to the CSIR not meeting the target. The budget constraints were a result of the PG reduction and delays in finalising contract R&D agreements.

However, the CSIR also continued to invest in its human capital development programmes, such as the GIT programmes with 20 new individual intakes in 2019/2020, and the ARDP with eight candidates participating as part of its strategy to "grow its own timber". The CSIR also appointed 63 staff members from the CSIR student pipeline, which reduced vacancies to some extent.

The reduction in key SET capacity did impact the CSIR's ability to earn revenue and deliver on projects. In the coming year, the CSIR will place significant emphasis on recruitment and talent retention to re-establish the SET capacity.

The support staff restructuring, which included Human Capital staff, had an adverse impact on human resource activities such as talent acquisition and retention, as all affected Human Capital staff were included in the consultation process during quarter 4. This resulted in loss of productive capacity and delays in the recruitment of new staff.

In 2019/2020, the CSIR allocated a PPE budget of R95 million and formally approved a Capital Investment Plan that prioritised infrastructure and equipment procurement projects in the areas of RD&I, ICT and general infrastructure, including for facilities management. Expenditure against the PPE budget made available in 2019/20 was below target, at R85.5 million. Reasons cited for under-expenditure included delays in planning and procurement. The CSIR is putting stringent measures in place to improve the delivery of infrastructure and expenditure of budget allocated for the future year.

SO5 DIVERSIFY INCOME, MAINTAIN FINANCIAL SUSTAINABILITY AND GOOD GOVERNANCE.

Income diversification remains a key objective for the CSIR and the aim is to reduce the financial risk associated with a significant reliance on public sector income. Income diversification is also expected to improve the CSIR's profitability. As part of its reviewed business model, the CSIR aims to increase private sector R&D income and there will also be a concerted effort to pursue international opportunities, especially on the African continent. Commercialisation and technology transfer will also be intensified as part of achieving impact, in line with our strategic intent, but also to grow our royalty and licensing income.

Good governance is the bedrock of the CSIR's performance goals and the organisation aims to maintain an unqualified audit outcome, keep a good safety record and improve its B-BBEE credentials.

SO5 KPIs: planned targets and actual achievements

SO5: Diversify income, maintain financial sustainability and good governance					
Performance Indicator	**Actual Achievement 2018/19**	**Planned Target 2019/20**	**Actual Achievement 2019/20**	**Deviation from Planned Target to Actual Achievement for 2019/20**	**Comment on deviations**
KPI 24: Total Income (Rm)	2 582	2 859	2 764	-95	The gap in planned total income and actual total income, can be mainly attributed to the inability to secure and finalise a number of planned contracts.
KPI 25: Net Profit (Rm)	7.7	9.0	55	46	The target was exceeded by R46 million.
KPI 26: South African public sector income (% Total Income)	New KPI introduced in 2019/20	55	56	1	This was just exceeded.
KPI 27: South African private sector income (% Total Income)	New KPI introduced in 2019/20	8	5	-3	The gap can be mainly attributed to the inability to secure and finalise a number of planned contracts with the private sector and delayed conversion of prospects.

SO5: Diversify income, maintain financial sustainability and good governance					
Performance Indicator	**Actual Achievement 2018/19**	**Planned Target 2019/20**	**Actual Achievement 2019/20**	**Deviation from Planned Target to Actual Achievement for 2019/20**	**Comment on deviations**
KPI 28: International contract income (% Total Income)	New KPI introduced in 2019/20	8	5	-3	The gap can be mainly attributed to the inability to secure and finalise a number of planned contracts.
KPI 29: B-BBEE rating*	3	3	4	1	The main areas of concern are management control, as well as internal training and employee development. Measures are in place to improve performance.
KPI 30: Recordable incident rate*	New KPI introduced in 2019/20	2	1.82	-0.18	The organisation is continuously monitoring its safety risks and implementing appropriate response measures to address undesirable trends as and when identified. This includes safety minutes at the beginning of management meetings, numerous management safety walkabouts, safety articles published on our Intraweb and safety tips communicated with Secretariats of Safety, Health and Environment Committees.
KPI 31: Audit opinion	New KPI introduced in 2019/20	Unqualified audit opinion.	Unqualified audit opinion.	Unqualified audit opinion.	The CSIR achieved an unqualified audit opinion for FY 2018/19 from the AGSA in compliance with generally accepted accounting principles. The external audit for 2019/20 has currently not been finalised.

For the reporting year, the CSIR's total income amounted to R2 764 million and this was behind the budget of R 2 859 million, but better than 2018/19 performance of R2 584 million. The net profit at R55 million exceeded the budget by R46 million and the prior year's actuals by R47.4 million. Contract income amounted to R1.8 billion and this is R263.2 million or 12.5% below the budget. The gap can be mainly attributed to the inability to secure and finalise a number of planned contracts. Total expenditure amounted to R2 757 million and this was 4.6% below budget. Cost containment efforts paid off in 2019/20 and the CSIR managed to compensate for the gap in revenue by savings in running cost, remuneration, overheads and depreciation.

The largest portion of the CSIR's income, at 56%, is contract R&D from the public sector, and this is followed by the PG at 27%. Private sector and international incomes were at 5% each, during the reporting year. During 2020/21, the CSIR will continue to increase its focus on the private sector by aligning its offerings to their needs, and will also enhance collaborations and co-investment opportunities with this sector of the economy.

Regrettably, the CSIR regressed with regard to its B-BBEE rating level, from level 3 to level 4. Measures are being implemented to improve performance in this regard, and these include the CSIR now participating in the Youth Employment Service programme. During the reporting year, the recordable incidence rate, a performance measure for safety, was at 1.82 and this was below the set target of 2.

REVENUE COLLECTION

Sources of revenue	2019/2020			2018/2019		
	Estimate	Actual Amount Collected	(Over)/ Under Collection	Estimate	Actual Amount Collected	(Over)/ Under Collection
	R'000	R'000	R'000	R'000	R'000	R'000
Parliamentary Grant	758 068	731 202	26 866	766 760	752 149	14 611
Contract income	2 098 168	2 006 942	91 226	1 969 524	1 746 212	223 312
Royalty income	3 090	3 616	(526)	4 000	5 422	(1 422)
Total	**2 859 326**	**2 741 760**	**117 566**	**2 740 284**	**2 503 783**	**236 501**

The CSIR has earned less than the estimated PG over the two financial years due to reduction of budget votes by the National Treasury. The gap in contract income can be mainly attributed to the inability to secure and finalise a number of planned contracts.

CAPITAL INVESTMENT

Investing in infrastructure is a key intervention to achieve the objectives of the CSIR Strategy. On 27 May 2019, a Special Exco approved the 2019/20 CIP. Performance is reported on capital investment planning and the execution of capital projects as follows:

Table 1: CIP process

Category	Indicator
Capital Investment Plan	Approved capital projects
	Approved capital budget
	Percentage of investment in research infrastructure vs general facilities vs ICT projects
Capital Projects Execution	Planned vs actual schedule variance
	Budget and expenditure variance

This plan consists of investments in the following areas:

Table 2: CIP 2019/20 investment

Category	Value
Research and development infrastructure	R10 400 000
Facilities and general infrastructure	R49 322 059
ICT	R16 500 000

Of the 25 projects planned for FY 2019/20 (as at end of Quarter 4), and for which reports have been received, one project was still in the planning phase, two were in design, nine were in procurement, four were in construction, and nine are complete. The overall expenditure, as at end of the financial year for capital projects (RDI, FM and ICT), amounted to about R49.99 million. This is lower than the projected expenditure based on project duration and budget (project earned value), indicating that expenditure is relatively low.

Research and development capital projects:

By the end of the FY 2019/20, four of the five projects funded had been completed. Expenditure for FY 2019/20 amounted to R7 891 410 versus a budget of R10 400 000, which shows a 76% spend level.

Facilities and general infrastructure:

The facilities and general infrastructure category of the CIP 2019/20 had, by end of the financial year, a mix of projects

in planning, procurement and construction, with the majority in the planning and procurement stages. Planning and procurement can take some time to complete for facilities and general infrastructure projects, during which there is no or little expenditure. Once projects are through these stages, expenditure usually rises rapidly and the actual expenditure generally aligns better with mechanical projections. The total expenditure, to date, for this category of capital projects amounted to R25.6 million out of the R49.3 million allocated, which shows a 52% spend and delivery on projects. Of the 18 planned projects approved for the financial year, five are complete, one is in planning, six in construction, and another six are in the procurement stage. The projects, to date, have come in under budget.

ICT projects:

ICT projects funded by the CSIR internal infrastructure funds are all complete. These involve the purchase, installation and commissioning of equipment. However, the establishment of governance structures and procurement processes for the projects have taken longer than expected. A total of R16.3 million has been spent out of the allocated R16.5 million. This shows a 100% delivery on projects, and 98.8 % accuracy in funds requested. There are two externally funded projects, which are the National Department of Health Data Centre Hosting phase 1, which is complete, and phase 2, which has a progress of 50% and due to be completed in September 2020.

Priority projects

Gateway Business Case and feasibility study:

Progress has been made since there was a detailed review of a submitted draft of the feasibility study and the situational analysis, which needed to be reworked substantively in order to develop a document that creates a solid foundation, which can be provided to the fundraiser and potential partners. The document is currently being evaluated section by section with the aim of completing by end of quarter 1 of 2020/21.

Residential accommodation:

Appointment of the Transaction Advisor for Accommodation Project, to develop the strategic road map and way forward, issue the request for proposal (RFP) and evaluate bids from potential developers, develop the contracts and the technical aspects in the contracting process, as well as provide advice to the CSIR post the contract. This project is continuing cautiously amid the COVID-19 challenges.

Mega interdisciplinary Shared Laboratory Model:

Development of the RFP, in consultation with line management, to undertake needs and gap analysis to inform the concept development.

Pilot and pre-manufacturing facility:

Development of the RFP, in consultation with line management, to undertake needs and gap analysis to inform concept development

D GOVERNANCE

The CSIR Board, along with its various committees, is responsible for the oversight of the application of the CSIR mandate through delivering on the annual plan and the performance of the organisation. This section provides an overview of the governance systems, processes and controls in place to hold the organisation to account.

INTRODUCTION

Corporate governance embodies processes and systems that direct, control and hold public entities to account. In addition to legislative requirements based on a public entity's enabling legislation and the Companies Act, 2008 (Act 71 of 2008), when it comes to public entities, corporate governance, is applied through the precepts of the Public Finance Management Act (PFMA), 1999 (Act 1 of 1999) and associated regulations, and run in tandem with the principles contained in the King IV Report on Corporate Governance. While the King IV Report on Corporate Governance is not legally binding, it serves as a benchmark against which the conduct and performance of the CSIR's governance structures are measured, allowing the CSIR to act with independence and within the best interest of the organisation, and in support of its mandate to accelerate socio-economic prosperity through leading innovation.

Parliament, the Accounting Authority (CSIR Board of Directors) and the Accounting Officer (CSIR Chief Executive Officer (CEO) and delegated executives) are responsible for corporate governance.

PORTFOLIO COMMITTEES

The Chairperson of the Board and the Executive Management Committee (Exco) hold bilateral meetings with the Executive Authority to ensure that performance is in line with the Shareholder's Compact.

Table 1: Parliamentary engagements or activity FY 2019/20

2019/20	Activity	Detail	Type of Engagement	Presenter/ Responsible Party
CSIR High-level engagements				
28 June 2019	CSIR Shareholder's Compact 2019/20 tabling	Tabling of CSIR Shareholder's Compact announced in ATC No.15 of 28 June 2019. Parliamentary office supports CSIR Institutional Planning and reports detail to CEO/Exco.	Accountability	CEO/Exco
25 September 2019	Annual Report 2018/19 tabling	CSIR Annual Report tabled in ATC of 25 September, No. 68 of 2019, page 5	Accountability	CEO/Exco
9 October 2019	Annual Report 2018/19 briefing	CEO not present, Dr Maserumule acted as CEO.	Accountability	Prof. Thokozani Majozi, Board Chair Khungeka Njobe, GE: Business Excellence and Integration Dr Motodi Maserumule, GE: Mining, Manufacturing, Defence and Security (Acting CEO) Cheryl Howell, CFO (Acting) Andile Mabindisa, GE: Human Capital (Acting)
5 February 2020	Portfolio Committee on Higher Education, Science and Technology oversight visit	Objective of the visit: Future Production/Manufacturing 4IR, Advanced Agriculture and Food, and Next Generation Health.	Accountability	The CEO/delegated Exco representative
18 February 2020	CSIR Shareholder's Compact 2020/21 briefing	Briefing to the Minister of Higher Education, Science and Technology	Accountability	Board/Exco
19 March 2020	CSIR Shareholder's Compact 2020/21 tabling	Communicated tabling of the Compact in ATC No. 35 of 19 March 2020 to Board and Exco	Accountability	Board/Exco

EXECUTIVE AUTHORITY

The Executive Authority of the CSIR is the Minister of Higher Education, Science and Innovation. The Accounting Authority of the CSIR is the CSIR Board, duly appointed by the Minister. The Practice Note issued by National Treasury dealing with the Submission of Corporate Plans requires the inclusion of the following in the Corporate Plan:

- Five-year Strategic Plan
- Annual Performance Plan
- Governance Structures
- Risk Plan
- Fraud Plan
- Financial Plan
- Materiality/Significance Framework

The Executive Authority requires quarterly reporting from the CSIR on prescribed dates. For the 2019/20 financial year the following reports were submitted:

- Quarter 1 Report – 23 July 2019
- Quarter 2 Report – 21 October 2019
- Quarter 3 Report – 22 January 2020
- Quarter 4 Report – 20 April 2020

No issues were raised by the Executive Authority on reports submitted.

THE CSIR BOARD

INTRODUCTION

The governance infrastructure of the CSIR is the collection of governance operating models – the people, processes and systems – that have been put in place to govern daily organisational activities.

This infrastructure also includes the processes used to gather and report information to the Board and external stakeholders, as well as management.

The Board is responsible for oversight across the organisation, in areas such as business and risk strategy, organisational structure, financial soundness, and regulatory compliance.

The CSIR governance operating model assists the Board to engage management in providing the information that the Board requires to exercise governance and risk oversight. It ensures the requisite oversight needed and gives input on policies that ultimately influence the manner in which governance is conducted, and actively engages management on understanding governance activities that occur at various levels within the organisation, as well supports management in its efforts to enhance programme efficiency and effectiveness.

The Board Committees are governed by committee charters that define the committees' responsibilities and address linkages between the committee, the broader executive team, and the Board of Directors.

The CSIR organisational design and reporting structure provides a clear, comprehensive organisational structure that defines reporting lines for decision-making, risk management, financial and regulatory reporting, public disclosures, and crisis preparedness and response.

The Board of Directors, which constitutes the Accounting Authority, is responsible for the preparation and fair presentation of the consolidated and separate financial statements in accordance with International Financial Reporting Standards and the requirements of the PFMA, and for such internal control as the Accounting Authority determines is necessary to enable the preparation of consolidated and separate financial statements that are free from material misstatement, whether due to fraud or error. In preparing the consolidated and separate financial statements, the Accounting Authority is responsible for assessing the group's ability to continue as a going concern, disclosing, as applicable, matters relating to going concern and using the going concern basis of accounting.

The role of the Board is as follows:

The responsibilities of the Board are governed by the Scientific Research Council Act, 1988 (Act 46 of 1988) and the PFMA. The Board approves the strategy, goals, operating policies and priorities for the organisation and monitors compliance with policies, applicable legislation and achievement against objectives. Except for the CEO of the CSIR, all members of the Board are non-executive. Board members are actively involved in and bring independent judgement to bear on the Board's deliberations and decisions. The Board, whose current number of members adheres to the statutory minimum requirements, meets quarterly.

For the year under review, the Board met four times and the meetings were held on 16 April 2019, 18 July 2019, 15 October 2019 and 17 February 2020. A Board strategic session was held on 22 and 23 August 2019. The CSIR Board approved the audited AFS for the FY ending 31 March 2019 at the Board meeting held on 18 July 2019. The Board further engaged in various ad hoc meetings to be advised and provide specific input on matters of strategic importance.

The Board comprises three sub-committees, namely the Audit and Risk Committee, the Human Resources, Social and Ethics Committee, and the Research, Development and Innovation Committee (see page 92). These committees are selected according to the skills sets required for the committees to fulfil their functions. The Board has adopted formal Terms of Reference reflected in the Board Charter, whereas the Board committees are governed by their respective charters, which define the roles and responsibilities in their respective advisory capacities to the Board of Directors.

BOARD CHARTER

The CSIR Board Charter sets out the functions and responsibilities of the Board, along with certain matters relevant to the operations of the Board. These responsibilities are aligned and encompass the provisions of the Scientific Research Council Act PFMA, and the King IV Report on Corporate Governance.

The CSIR Board of Directors has decided to apply the corporate governance principles of the Protocol on Corporate Governance in the Public Sector, and the King IV Codes on Corporate Governance to their activities, in order to regularise and improve the corporate governance of the CSIR. This Board Charter sets out the corporate governance policies of the CSIR, as adopted by the Board and must be read with the Shareholder's Compact between the CSIR and the Minister of Higher Education, Science and Innovation.

While this Charter includes references to minimum acceptable standards of governance, in pursuit of its underlying ideals, it is critical that substance prevails over form. The Charter reaffirms the Board's intention to exceed these corporate governance standards wherever reasonable, having due consideration for:

- recognised standards of governance;
- best practice locally and internationally;
- the recommendations of the King IV Code on Governance;
- the Protocol on Governance of State-Owned Entities; and
- the objectives set out in Section 3 of the Scientific Research Council Act.

The Board Charter aims to regulate the parameters within which the Board will operate and ensure the application of the principles of good corporate governance in all dealings by, in respect and on behalf of the organisation.
The Board has made significant progress in compliance with the Charter in that the Board:

- Has guided the setting of the CSIR's values and standards of conduct and ensuring that these are adhered to through its input and oversight of the review and re-alignment of all CSIR policies. This is especially pertinent to create alignment with the CSIR Strategy and key strategic objectives;
- Provides leadership to the CSIR within a framework of prudent and effective controls that enable risk the assessment and management of risk;
- Reviews the CSIR's directions, strategies and financial objectives, annually, and ensures that the necessary resources are in place for the CSIR to meet its objectives, while assessing the progress made, quarterly;
- Oversees and ensures that the performance of CSIR Executive Management and the Board itself (and Committees) is assessed and monitored regularly; and
- Oversees information technology governance through quarterly engagements on business development, commercialisation and technology innovation through the Research, Development and Industrialisation Committee and annual interaction and reporting by the Research Ethics Committee.

CSIR BOARD MEMBERS

Prof. Thokozani Majozi
Chairperson of the CSIR Board
NRF/DST Chair: Sustainable Process Engineering, University of the Witwatersrand

Dr Thulani Dlamini
Chief Executive Officer, CSIR

Ms Phindile Baleni
Director-General, Gauteng Premier's Office

Ms Amber-Robyn Childs
Senior Lecturer at Rhodes University

Dr Ramatsemela Masango
Executive Director, Mzansi Energy Solutions and Innovations (Pty) Ltd

Mr Stafford Masie
Non-Executive Director and Shareholder, Thumbzup (South Africa, Australia/AsiaPac, London and USA)

Ms Tiny Mokhabuki
Chief Financial Officer, MICT SETA

Dr Vuyo Mthethwa
Senior Human Resources Director, Durban University of Technology

Mr Joel Netshitenzhe
Executive Director, Mapungubwe Institute for Strategic Reflection
Board Vice-Chairperson

Dr Christine Render
Independent Consultant

Mr Cassim Shariff
Executive Director at SDB GAS and Lirazest

Table 2: Composition of the Board

Name	Date appointed	Qualifications	Board Directorships	No. of Meetings attended
Prof. Thokozani Majozi Chairperson of the Board	2015	*University of Manchester Institute of Science and Technology* PhD (Process Integration) *University of Natal* MSc (Engineering) BSc (Chemical Engineering)	Director – A1 Consulting Engineers CC Zyblue Pty Ltd	5
Dr Thulani Dlamini	2017	*University of Witwatersrand* *BSc Chemistry* *BSc (Hons) Chemistry PhD Chemistry, Catalysis* *University of South Africa Master's in Business Leadership*	National Advisory Council on Innovation: Council Member Vumelana Trade 120 – Director Kusile Invest 125 – Director Mavela Consulting Services – Director	4
Ms Phindile Baleni	2015	*University of the Witwatersrand* *BProc LLB*	Wits University Council: Member (non-remunerative) IIASA NMO (RSA): Board Member (non-remunerative) Gauteng Provincial Government: Employee (Director General) First Rand Black Directors BEE Scheme/ Trust (shares) New Shelf (Pty) Ltd (shares) First Shelf (Pty) Ltd (Shares) Rev LW Mbethe Education Trust (Trustee – non remunerative)	2
Dr Amber-Robyn Childs	2019	*Rhodes University* PhD (Ichthyology) MSc (Cum Laude) (Ichthyology)		5
Dr Ramatsemela Masango	2015	*Pennsylvania State University* PhD (Nuclear Engineering) MSc (Nuclear Engineering) *Lyceum College* Diploma in Project Management *Cape Peninsula University of Technology* BTech Degree (Chemical Engineering)	*Executive Director* Mzansi Energy Solutions and Innovations (Pty) Ltd (Mzesi) Mzesi Energy Mzesi Academy Mzesi Holdings *Non-Executive Director* ArioGenix Face to Face Foundation Redhorn Holdings Mzesi Water & Construction Yonga Energy Tingo Technologies Amanzi Technologies Certo Project Integrators Africa Energy Wise Solutions Zondibex Miyezi Investments Vito	5

Name	Date appointed	Qualifications	Board Directorships	No. of Meetings attended
Mr Stafford Masie	2019		Thumbzup South Africa – Non Executive Director & Shareholder Thumbzup Australia/ AsiaPac – Non Executive Director & Shareholder Thumbzup International (London) – Non Executive Director & Shareholder Thumbzup USA – Non Executive Director & Shareholder Green Moon Transact – Shareholder/ Funder GATTACA – Executive Director & Shareholder/Funder SnapTutor – Executive Director & Shareholder/Funder Razorlogix – Executive Director & Owner/Shareholder LRXYM Fitness – Shareholder Advtech – Non Executive Director & Board Member Sauronai Holdings LLC (USA) : (South Africa)	4
Ms Tiny Mokhabuki	2019	*University of Kwa Zulu Natal* *PGDA (with CTA)* *University of the Witwatersrand* *University of the Witwatersrand Bachelor of Commerce* *Global Institute of Business Sciences* *Aspen Management Programme* *CA(SA)*	Business Entrepreneur Community - Director (Dormant, deregistration process) Equota – Director Mokhabuki Building and Construction – Director Sphimokha – Director Digiten – Director MICT SETA – Employee	4
Dr Vuyo Mthethwa	2019	*University of KwaZulu Natal* *PhD Higher Education Governance*	*Director* St Anne's College Highbury School *Member* HR REmCo for Mining Qualifications Authority Institute of Directors	5

Name	Date appointed	Qualifications	Board Directorships	No. of Meetings attended
Mr Joel Netshitenzhe	2015	*University of London* *MSc (Financial Economics)* *Post-graduate Diploma (Economic Principles)* *Institute of Social Sciences, Moscow* *Diploma (Political Science)*	Mapungubwe Institute of Strategic Reflection – Executive Director Nedbank Group – Director Nedbank – Director Life Healthcare Group – Director Lushote Trading (Fledgling) – Director Topaz Sky Trading 316 (Fledgling) – Director Betascape (Dormant) – Director Camel Rock Trading 434 (Dormant) – Member African National Congress – NEC Member Oliver & Adelaide Tambo Foundation – Patron Wits School of Governance – Visiting Professor	5
Dr Christine Render	2019	*PhD (Chemical Engineering)* *BSc Hons. (Chemical Engineering)*	Owner – Team Consultation Pty (Ltd): Partner/Shareholder	5
Mr Cassim Shariff	2019	*Leicester Business School, DeMontfort University* *Master's in Business Administration*		4

All members are currently active on the Board.

COMMITTEES

Table 3: List of Board Committees

Committee	No. of meetings held	No. of members	Names of members
Audit and Risk Committee	Four meetings were held. 9 April 2019 9 July 2019 8 October 2019 11 February 2020	5	Ms Tiny Mokhabuki – Chairperson Ms Phindile Baleni Mr Stafford Masie Dr Vuyo Mthethwa Dr Christine Render
Human Resources, Social and Ethics Committee	Four meetings were held. 9 April 2019 9 July 2019 8 October 2019 11 February 2020	4	Dr Vuyo Mthethwa – Chairperson Ms Phindile Baleni Dr Ramatsemela Masango Mr Cassim Shariff
Research, Development and Industrialisation Committee	Four meetings were held. 11 April 2019 11 July 2019 10 October 2019 13 February 2020	5	Dr Christine Render - Chairperson Dr Amber-Robyn Childs Dr Ramatsemela Masango Mr Joel Netshitenzhe Mr Cassim Shariff

Table 4: Remuneration of Board members

Name	Remuneration	Other allowance	Other re-imbursements	Total
Prof. Thokozani Majozi	R15 696 per meeting	None	None	R15 696 per meeting
Ms Phindile Baleni	None – Public servant (Office of the Premier – Guateng)			None
Dr Amber-Robyn Childs	R11 664 per meeting	Flight tickets R4 000 Car hire R240 Accommodation R1200		R17 104 per meeting
Dr Ramatsemela Masango	R11 664 per meeting	Subsistence for travel costs of R245.02 per meeting		R11 909.02 per meeting
Mr Stafford Masie	R11 664 per meeting	Subsistence for travel costs of R619.20 per meeting		R12 283.20 per meeting
Ms Tiny Mokhabuki	R11 664 per meeting	Subsistence for travel costs of R439.68		R12 103.68 per meeting
Dr Vuyo Mthethwa	R11 664 per meeting	Subsistence for travel costs R494 Flight tickets R3 500 Car hire R160 Accommodation R1 200		R16 858 per meeting
Mr Joel Netshitendzhe	R11 664 per meeting	None		R11 664 per meeting
Dr Christine Render	R11 664 per meeting	Subsistence for travel costs of R546.96		R12 210.96 per meeting
Mr Cassim Ebrahim Shariff	R11 664 per meeting	Subsistence for travel costs of R532.53		R12 196.53 per meeting

RISK MANAGEMENT

The Board is responsible for ensuring that there is a comprehensive and effective risk management process in place. Enterprise risk management in the CSIR is an ongoing process that focuses on identifying, assessing, managing and monitoring all known forms of risks across all operations and group companies. A structured process of enterprise risk management ensures that the goals and objectives of the CSIR are attained. This takes cognisance of the fact that the risks identified are often inter-linked and cannot be managed in isolation. CSIR systems review aspects of the economy, efficiency and effectiveness. The management of risk is assigned at appropriate levels throughout responsibility areas of activity across the entire organisation to ensure adequate responses.

Documented and tested processes allow the CSIR to continue its critical business operations, in the event of interruptions that could possibly have an impact on its activities.

The CSIR has a Board-approved Risk Management Policy and a supporting framework. The Risk Management Policy and framework is operationalised through the implementation of the CSIR enterprise risk management system/tool.

The CSIR has an annual risk management plan that is approved by the Board and published as part of the CSIR Shareholder's Compact. An annual enterprise risk management business plan is also approved and monitored by Exco to ensure the effectiveness of the risk management system in the CSIR. The business plan is monitored on a quarterly basis through the CSIR Planning Office. Specific approved key performance indicators are implemented and monitored to ensure the achievement of the business plan.

The CSIR has repositioned the Enterprise Risk Management Services/portfolio to ensure alignment with the business needs and requirements. The new structure will become effective in the 2020/21 financial year.

Quarterly risk assessments are conducted to ensure an effective management of the existing business risks, as well as the identification and mitigation of emerging risks. The risk assessments are conducted by line management in the clusters, portfolios, strategic projects and key collaboration initiatives. The outcome of the various risk assessment is collated to formulate a CSIR risk register (commonly referred to as the CSIR top risks register).

The risk assessment process is structured to analyse and evaluate three key categories, namely:

Systemic risks:

These are risks that originate from macro-economic and national challenges affecting the National System of Innovation and the National Government Business Enterprise space in which the CSIR operates.

Strategic risks:

These are risks that have a direct impact on the ability of the CSIR to deliver on its mandate.

Operational risks:

These risks include financial, legal and compliance risks, and are those risks that affect the systems, people and processes through which the CSIR operates.

At present, the CSIR does not have a specific risk management committee and regular reviews of the effectiveness of the risk management system in the CSIR are conducted at Exco level. As part of re-positioning its support services to align with the CSIR Strategy, the organisation is establishing an independent Risk Management Committee that will be the key role-player in maturing the combined assurance model of the organisation.

Based on the internal audit reports, the organisational results achieved, the audit report on the annual financial statements and the management report of the Auditor-General, the Board is satisfied that the risk management system has been effective during the year under review.

INTERNAL AUDIT AND AUDIT COMMITTEES

The Group has an internal audit function that is responsible for reviewing the design and operating effectiveness of the organisation's governance, risk and internal control processes. The CSIR internal audit function reports to the Audit and Risk Committee, which is responsible for approving the Internal Audit Charter, the annual audit plan and budget to maintain its independence.

The annual audit plan is based on the key risks to the organisation, the outcome of the enterprise risk assessment conducted by management, as well as specific areas highlighted by internal audit and the Audit and Risk Committee. In addition, areas highlighted by the external auditors in the internal control reviews are incorporated into the internal audit plan for follow-up.

In line with the PFMA requirements, the internal audit activity assured the Audit Committee and management that the internal controls were appropriate and effective. This was achieved by means of objective appraisal and evaluation of the risk management processes, internal control and governance processes, as well as identifying corrective action and suggested enhancements to the controls and processes. A comprehensive report on the status of implementing the annual audit plan, the key findings identified and the status of resolving the previously reported internal and external audit findings is presented to the Audit and Risk Committee, quarterly.

The Internal Audit activity is fully supported by management, the Board and the Audit Committee, and has full, unrestricted access to all organisational activities, records, property and personnel.

For the period under review, Internal Audit performed an evaluation of the adequacy and effectiveness of controls in the following areas:

- Performance Reporting;
- Human Capital and Employee relations;
- Contract and project management;
- Financial management;
- Property Plant and Equipment;
- Supply Chain Management and Accounts Payable;
- Maintenance and Facilities Management; and
- Information, Communication and Technology.

KEY ACTIVITIES AND OBJECTIVES OF THE AUDIT COMMITTEE

The Audit Committees enhances the independence of the Internal Audit activity and provides oversight over risk management, governance and control processes. The Audit Committee assists the Board with the effective execution of its responsibilities, with the ultimate aim of achieving the CSIR's objectives. The CSIR Audit Committee continues to function and has met four times during the period under review. The Audit Committee is responsible for improving the operations of the organisations by overseeing the audit functions, internal controls and the financial reporting process.

The Audit Committee assists the CSIR to:

- Create and maintain an effective internal control environment, financial controls, accounting systems and reporting;
- Deal with all matters prescribed by the regulations issued regarding the PFMA and the Scientific Research Council Act;
- Identify material risks and management thereof;
- Agree on the scope and review the annual external audit plan and the work of the CSIR's internal auditors;
- Review and approve the Internal Audit Charter and the risk based on a three-year strategic internal audit plan and annual audit plan;
- Act in an unfettered way to understand the dynamics and performance of the organisation without restrictions;
- Ensure that the CSIR is able to prevent, detect and respond to fraud and allegations of fraud; and
- Discharge its responsibility relating to:
  - safeguarding of assets,
  - operation of adequate procedures and controls,
  - reviewing of the financial information and the preparation of the financial statements, and
  - attendance of Audit Committee meetings by Audit Committee members (Tabular form).

The table below provides relevant information on the Audit Committee members.

Table 5: Relevant information on the Audit Committee members

Name	Internal or external	If internal, position in the public entity	Date appointed	Date Resigned	No. of Meetings attended
Ms Phindile Baleni	External		2015	Active	2
Dr Thulani Dlamini	Internal	CEO	2015	Active	4
Mr Stafford Masie	External		2019	Active	2
Ms Tiny Mokhabuki	External		2019	Active	4
Dr Vuyo Mthethwa	External		2019	Active	4
Dr Christine Render	External		2019	Active	4

COMPLIANCE WITH LAWS AND REGULATIONS

Regulatory compliance requires the CSIR to continuously analyse its unique requirements and any mandates specific to the organisation and then develop processes to meet these requirements.

Typical steps to achieve regulatory compliance include the following:

- Identifying applicable regulations – determine which laws and compliance regulations apply to the CSIR's industries and operations;
- Determining requirements – identify the requirements in each regulation that are relevant to the organisation, and consider plans on how to implement these mandates;
- Documenting compliance processes – clearly document compliance processes, with specific instructions for each role involved in maintaining compliance;
- Monitoring changes and determining whether they apply – compliance requirements are updated constantly – changes are continuously monitored to determine if they are relevant to the CSIR and how best they should be integrated;
- Conducting in-house compliance audits to review the CSIR's adherence to regulatory guidelines; and
- Preparing in-house audits, which help to prepare for externally conducted, formal compliance audits carried out by independent third parties.

The repositioning of the CSIR's support resources during the year under review has allowed the development of a dedicated compliance functionality housed within the Legal and Compliance structure. The focus and mandate of the compliance functionality is targeted at developing a well-defined regulatory/compliance universe for the CSIR and ensuring that the policy and processes align to facilitate continued and effective compliance. Specific focus areas introduced also include privacy law compliance, trade compliance and corporate governance.

FRAUD AND CORRUPTION

The CSIR Fraud Prevention Plan (FPP) has been developed in compliance with section 3.2.1 of the Treasury Regulations of the PFMA. The CSIR subscribes to the principles of good corporate governance, which require business to be conducted in an honest, ethical and transparent manner. Consequently, the CSIR is committed to eradicating fraudulent behaviour at all levels within the organisation.

This FPP is premised on the CSIR's core ethical values driving its business, the development of its systems, policies and procedures, interactions with upstream and downstream stakeholders in its value chain and overall value proposition, including public and private sector customers, members of the public at large, suppliers and service providers, employees and its shareholder.

In alignment with the CSIR's core organisational values of excellence, being people-centred, integrity and collaboration (EPIC), this FPP is the cornerstone of promoting ethical conduct and determining how incidents or suspected incidents of fraud and corruption will be prevented, detected and investigated.

The FPP is a dynamic plan and it will continuously evolve as the CSIR drives to further promote ethics and prevent fraud.
The CSIR's FPP encompasses controls that have three strategic objectives:

- Prevent instances of fraud and corruption from occurring;
- Detect instances of fraud and corruption when they do occur; and
- Respond appropriately and take corrective action when fraud and corruption happens.

The policy of the CSIR is one of zero tolerance to fraud and corruption. All alleged cases of fraud and corruption will be investigated and followed up by the application of all remedies available, within the full extent of the law, and the implementation of appropriate prevention and detection measures. These measures include existing financial and related controls and verification mechanisms as prescribed in the systems, policies and procedures of the CSIR.

The CSIR wishes to facilitate a culture of disclosure of information relating to suspected fraud and related misconduct by employees in a responsible manner. Employees and stakeholders are encouraged to report suspicions of fraudulent activity without fear of reprisals or recriminations.

The efficient application of instructions contained in the regulations, policies and procedures of the CSIR is one of the most important duties of every employee in the execution of his/her daily tasks.

The CSIR's policy stance is currently encapsulated in various CSIR policies and procedures, including but not limited to, the CSIR Code of Conduct/Ethics, the CSIR Conditions of Service, CSIR Disciplinary Code and Procedure, CSIR Information Communication Technology Policy, the Information Security Policy and the CSIR Ethics Hotline Procedure.

The main principles, upon which the FPP of the CSIR is based, are as follows:

- Creating a corporate culture that is ethical, fair and intolerant to fraud and thereby aligned with the CSIR's core organisational EPIC values;
- Deterring fraud and corruption;
- Reporting suspicious fraudulent activity without fear of reprisals or recriminations;
- Detecting of fraud;
- Investigating any detected fraud;
- Taking appropriate action in the event of fraud, e.g. disciplinary action, recovery of losses and prosecution; and
- Applying sanctions, such as blacklisting of suppliers/service providers guilty of corrupt practices.

This plan applies to all allegations, attempts and incidents of fraud that have an impact or the potential to have an impact on the CSIR.

All CSIR employees and management must comply with the spirit and content of the plan.

A person who holds a position of authority as stipulated in section 34 of the Prevention and Combating of Corrupt Activities Act, 2004 (Act 12 of 2004) should report any suspected corrupt activity and/or an offence of theft/fraud to the police.

The CSIR's Audit and Risk Committee significantly influences the fraud control environment, particularly by overseeing the tone at the top of the organisation. This is achieved in the discharge of its duties in terms of the PFMA and Treasury Regulations.

The Audit and Risk Committee systematically oversees, and periodically reviews the internal controls established by the management of CSIR.

MINIMISING CONFLICT OF INTEREST

- Board members may not place themselves in a position in which their personal interests conflict, or may possibly conflict, with their duty to act in the best interests of the CSIR. This gives rise to the following duties:
  - To act bona fide in the interests of the CSIR;
  - Not to compete improperly with the CSIR; and
  - To disclose direct or indirect personal or private interests, as envisaged in the provisions of section 50 (3) (a) of the PFMA, which shall be duly recorded in the minutes at a Board Meeting.
- Board members are required to inform the Board, through the Board Secretary in advance, of any conflicts or potential conflicts of interest they may have in relation to particular items of business to be transacted at a meeting.
- Board members may not vote and must not be counted in the quorum of a meeting to pass a resolution in respect of any business where they have a direct or indirect interest.
- If any Board member wilfully or negligently fails to disclose an interest as required above or, if he/she participates in the proceedings of the Board notwithstanding any conflict of interest, the relevant proceedings of the Board may, at the discretion of the other Board members be declared null and void.
- In exceptional circumstances, the Board may decide that, in the light of interests disclosed by a Board member, such Board member shall not be entitled to receive any further information on any particular matter before the Board and shall instruct the Board Secretary accordingly. A Board member who is aggrieved by the Board's decision in this regard shall be entitled to make representations to the Board, which will refer the matter to an independent governance expert whose decision shall be final and binding on the parties.

CODE OF CONDUCT

The Board and the CSIR Executive Committee have approved and adopted a code of ethics that reflects their commitment to a policy of fair dealing and integrity in conducting their operations. The code is closely aligned to the CSIR set of values, compliance to laws and regulations, and requires all employees to maintain the highest ethical standards, ensuring that business practices are conducted in a manner that is beyond reproach. Monitoring ethical behaviour is devolved to operating unit level and transgressions are addressed through procedures detailed in the CSIR Conditions of Service and the PFMA. An Ethics Hotline has been established to facilitate anonymous reporting of ethical transgressions.

HEALTH, SAFETY AND ENVIRONMENTAL ISSUES

The CSIR's commitment to sustainable development as a strategic priority encompasses the organisation's commitment towards safety, health, environment and quality (SHEQ). In delivering on its mandate the CSIR ensures that its greatest consideration and priority is for the health and safety of colleagues, contractors, suppliers, customers and local communities, and the protection of the environment. The CSIR is committed to excellence in managing these areas through the SHEQ function.

The CSIR Board Audit and Risk Committee assists the Board to monitor the effectiveness of SHEQ management systems within the CSIR and to guide the Board in decision-making from a SHEQ perspective. A dedicated SHEQ department works with the business to ensure that the company has deliverable policies, is proactive in its risk assessment and professional in its remediation. In line with CSIR's re-positioning of its support services, the SHEQ structure is also now adapted to include a significant enhancement of operational oversight, advice and support.

In the year under review, the CSIR achieved its target to secure a recordable incident rate (RIR) of less than two, by achieving an RIR of 1.82. Despite this achievement, the CSIR is continuously monitoring its health and safety (H&S) risks and implementing appropriate response measures to address undesirable trends as and when identified. This includes numerous management safety walkabouts, H&S articles published on the Intraweb and safety tips communicated with secretariats of SHE committees in the clusters, centres, portfolios and regional sites to raise awareness on the number of recordable incidents that occurred during the year, the lessons learned and near misses.

BOARD SECRETARY

The Board Secretary's responsibilities shall include:

- Providing the Board and individual Board members with guidance as to the nature and extent of their duties and responsibilities and, how such duties and responsibilities must be properly discharged in the best interests of the CSIR and the Shareholder;
- Ensuring the induction of new and inexperienced Board members and, together with the Chairperson of the Board, developing mechanisms for providing continuous education and training for all Board members, in order to improve and maintain the effectiveness of the Board;
- Assisting the Chairperson in determining the Annual Calendar and Annual Board Plan and other issues of an administrative nature; and
- Providing a central source of guidance and advice to the Board on matters of business ethics and good governance – the Board Secretary's appointment is subject to the same 'fit and proper test' to which a new Board member's appointment is subject.

SOCIAL RESPONSIBILITY

The CSIR participated in 30 science festival/outreach programmes across the country between April 2019 and March 2020. This is in support of the Department of Science and Innovation's science engagement strategy, as well as supporting initiatives from the private sector. The details of the CSIR's engagement activities are on pages 54 and 55 of the Organisational Highlights' section.

AUDIT COMMITTEE REPORT

We are pleased to present our report for the financial year ended 31 March 2020.

AUDIT AND RISK COMMITTEE RESPONSIBILITY

The Audit and Risk Committee has complied with its responsibilities arising from Section 77 of the Public Finance Management Act and Treasury Regulation 27.1. The committee has adopted formal Terms of Reference as its charter, approved by the Board. Accordingly, the committee has conducted its affairs in compliance with this charter and has discharged its responsibilities as contained therein.

COMMITTEE MEMBERS AND ATTENDANCE

The Audit and Risk Committee consists of members as stated on page 92 of this report. In terms of its Terms of Reference, the Committee convened at least four meetings for the period under review. The meetings and schedule of attendance are shown on page 96 of this report.

The Chief Executive Officer, the Executive Management, and representatives of internal and external auditors attended Committee meetings by invitation. The Committee also periodically meets separately with internal and external auditors. The internal and external auditors have unrestricted access to the Committee.

THE EFFECTIVENESS OF INTERNAL CONTROL

The system of internal control that the CSIR applies over financial risk management is effective, efficient and transparent. In line with the PFMA and King IV, the internal audit provides the Committee and management with assurance that the internal controls are appropriate and effective. This is achieved by means of the risk management process, as well as the identification of mitigating measures and an on-going assessment thereof.

From the quarterly reports of the internal audit, the audit report on the annual financial statements and the management report of the Auditor-General of South Africa, it was noted that no matters that include any material deficiencies in the system of internal control or any deviations therefrom were reported. Accordingly, the committee can report that the system of risk management and internal control over financial reporting for the period under review was efficient and effective.

IN-YEAR MANAGEMENT AND QUARTERLY REPORTS

The Committee has noted and is satisfied with the content and quality of the Quarterly Reports prepared and issued by the CSIR during the year under review.

EVALUATION OF FINANCIAL STATEMENTS

Members of the Audit Committee, together with the Board, have reviewed the annual financial statements prepared by the CSIR for the year ended 31 March 2020. Based on the information provided, the CSIR complies, in all material respects, with the requirements with the requirements of the various acts governing disclosure and reporting on the annual financial statements.

AUDITOR'S REPORT

We have reviewed the public entity's implementation plan for audit issues raised in the prior year and we are satisfied that the matters have been adequately resolved.

The Audit Committee concurs and accepts the conclusions of the external auditor on the annual financial statements and is of the opinion that the audited annual financial statements be accepted and read together with the report of the auditor.

Ms Tiny Mokhabuki
Chairperson of the Audit Committee
CSIR
4 August 2020

B-BBEE COMPLIANCE PERFORMANCE INFORMATION

The following table has been completed in accordance with the compliance to the Broad-Based Black Economic Empowerment (B-BBEE) requirements of the B-BBEE Act, 2003 (Act 53 of 2013) and as determined by the Department of Trade, Industry and Competition.

Has the Department / Public Entity applied any relevant Code of Good Practice (B-BBEE Certificate Levels 1 – 8) with regard to the following:		
Criteria	**Response Yes / No**	**Discussion** *(include a discussion on your response and indicate what measures have been taken to comply)*
Determining qualification criteria for the issuing of licences, concessions or other authorisations in respect of economic activity in terms of any law?	No	The CSIR does not issue any licences/concessions or authorisations to allow economic activity in terms of any law. This would likely only apply to entities responsible for issuing trade licences or mining/ exploration licences and the like. I would suggest you indicate this as not applicable.
Developing and implementing a preferential procurement policy?	Yes	We developed and implemented a procurement policy, which incorporates preferential procurement, together with various templates, evaluation criteria, frameworks, etc. to ensure same is achieved. This is monitored monthly.
Determining qualification criteria for the sale of state-owned enterprises?	No	We do not generally engage in such sales, but when we do, certain criteria would be developed on a case-by-case basis to align with the nature of the asset/technology on sale and the CSIR mandate and to secure sustainable offerings in the interest of South Africa. A case in point is the sale of labs where we set criteria to secure a buyer that would allow for the service offering to remain sustainable and available in the South African context.
Developing criteria for entering into partnerships with the private sector?	No	Certain criteria would be developed on a case-by-case basis to align with the objective of the collaboration to align with the CSIR mandate and to secure sustainable offerings and commercialisation of technology in the interest of South Africa. In these instances, where the opportunity allows for feasible and sustainable commercialisation through SMMEs, criteria such as B-BBEE levels/status or black/female ownership could be included. There is no firm policy on this as the nature of the technology and available markets would determine the feasibility of such criteria.
Determining criteria for the awarding of incentives, grants and investment schemes in support of B-BBEE?	No	The award of grants, incentives and investments is not a core activity in the CSIR, and we do not make material investments in this context, save for the context of the YES programme application, bursary awards and corporate social investment initiatives that would target previously disadvantaged categories of individuals or institutions (such as schools, higher education institutions etc.)

E HUMAN RESOURCE MANAGEMENT

This section provides a detailed account of the strategies, programmes and interventions implemented in the year under review and the outcomes of these.

INTRODUCTION

A. OVERVIEW OF HUMAN RESOURCES (HR) MATTERS AT THE CSIR

The CSIR implemented the outcomes of Project Synapse on 1 April 2019. This entailed organisational change on a large scale, including change in the organisational strategy operating model and structure. The new Human Capital (HC) strategy, an integral part of the CSIR Strategy derived from the AT Kearney recommendations, culminated in the implementation of the new operating model with the onset and conclusion of the SET restructuring at level 5 and above. The organisational restructuring initiative included the implementation of the structural changes, the recruitment and appointment of staff in key executive leadership and management, senior management and business development positions to drive and support the implementation of the new operating model in all business entities, such as divisions, clusters, impact areas and research groups, followed by transitioning of staffing functions into the new structures.

The Human Capital strategy drivers included, among others, human capital development initiatives to build the pipeline and strengthen the SET base considering the CSIR's response to the 4IR and implementing the new industrial development strategy. The new HC strategy included a revision of existing and the development of new HC policies, guidelines and procedures and approval of key policies, guidelines and frameworks, such as succession planning, employment equity (EE) and skills development and others as frameworks to support the realisation of the strategy. Driving of organisational change initiatives, implemented through change agent forums, was aligned with and accompanied by embedment of the new EPIC values required for the successful implementation of the CSIR Strategy and operating model. These policy instruments, which provide the framework for the future, are detailed extensively later in the report. Along with policy implementation, changes to systems, processes, procedures, guidelines, templates and forms were implemented to put the policy changes into action. Focus on systems included improving systems and streamlining related processes, as well as transitioning geared towards the digital transformation of systems.

The new strategy included forging new partnerships with Sector Education and Training Authorities (SETAs) in building the CSIR's 4IR capabilities and strengthening the pipeline towards the acceleration of the industrialisation strategic objective. In response to other national strategic objectives, other key initiatives included approval and implementation of the Youth Employment Service (YES) programme and the Graduate-in-Training (GIT) programme, to enhance and support the transformation programme, improving the CSIR B-BBEE level, and uplifting and repositioning of the Corporate Social Investment profile to enhance the CSIR's contribution to the South African society.

In conjunction with hard strategy elements, soft strategy implementations included focus on employee wellness with specific articulation of social issues such as gender-based violence, a global and local phenomenon, and provision of employee counselling support services to staff during the restructuring process in alignment with the People-centred value of the CSIR, among others. The employee relations strategy focused on the reduction of the number of Employee Relations (ER) cases and proper case management, dealing successfully with labour relation issues and new trade union challenges for recognition, both internally at the CSIR, and externally at the CCMA and Labour Court.

The CSIR received external recognition as Employer of Choice from independent bodies and academic institutions, emphasising the achievement of external benchmarking requirements for recognition of preferred employers in a competitive market. Other achievements included completion of external audits, confirming good corporate governance, a clean ISO 9001 Quality Audit and 2018/19 External Audit.

B. SET HR PRIORITIES FOR THE YEAR UNDER REVIEW AND THE IMPACT OF THESE PRIORITIES

A summary of key HC strategic objectives and the HC operating model is included below:

Table 1: Human Capital Strategic Objectives

Build a diverse talent ecosystem and a sustainable future supply
• Develop and implement a talent-sourcing strategy; • Enhance the CSIR recruitment capability; • Develop an improved EE plan and implement supporting structures; and • Develop and implement the workforce plan and capability.
Strengthening leadership and deepening professionalism
• Revise and embed the Competency Development Framework (leadership; behavioural, technical and competencies); • Develop and implement leadership and management development programmes; • Enhance and reinforce the CILLA Academy blended approach offering to business; and • Provide a targeted, accelerated development programme for critical staff.
Improving individual and organisational performance
• Emphasis on simplifying the organisation to better integrate capability on a CSIR-wide basis and focusing on making the new structures work; • Supporting business' critical Synapse strategy; and • Enhancing employee engagement through mechanisms such as 360°evaluation and driving individual accountability further, supported by EPIC values.
Increased efficiency and effectiveness of HR systems and processes
• This is key to the standardisation and simplification of HR processes supported by IT solutions in response to the 4IR and further implementation of the HC operating model; and • This will be supported by focused benchmarking and targeted improvements.

The progress and impact achieved against the strategic objectives are outlined in the table below.

Table 2: Impact of Human Capital Strategic Objectives

Objective 1: Building a diverse talent ecosystem and a sustainable future supply:	
Interventions	**Impact**
Develop and implement a talent sourcing strategy.	A Talent sourcing strategy was developed and implemented, and as part of the strategy, LinkedIn was implemented as a recruitment sourcing portal.
Enhance pipeline development programmes.	The GIT programme was implemented. Ninety-nine percent of final year students in the bursary programme completed their studies. Overall performance of the students exceeded the target. The YES programme was implemented and 66 youths were appointed.
Enhance the CSIR's recruitment capability.	The recruitment process was redesigned and remapped with new timeframes; training to commence once system changes have been effected.
Develop an improved EE plan and implement supporting structures.	The EE Policy was approved by the Board; and EE targets are in the process of being developed, guided by the national Economic Active Population (EAP).
Develop and implement the workforce plan and capability.	Implementation of PeopleSoft position management system is in progress and will continue in the new financial year. The system set-up was done and planning completed. The system will provide functionality for better workforce planning in the organisation.
Strengthening key strategic partnerships with key institutions such as the Department of Science and Innovation (DSI), National Research Foundation (NRF), universities, SETAs, etc.	The target was exceeded. A Memorandum of Agreement (MOA) was signed with merSETA; the NRF is committed to continue with the funding for new and existing doctoral and postdoctoral candidates under the Professional Development Programme (PDP).

Objective 2: Strengthening leadership and deepening professionalism:	
Interventions	**Impact**
Bolster and embed the Competency Development Framework (leadership; behavioural; Environment, Health, Safety and technical competencies).	A competency framework was established and approved. Job profiles and job descriptions are in the process of being updated.
Develop and implement a targeted Leadership and Management Development Programme.	The request for proposal (RFP) process was finalised in March 2020. Service providers were identified for leadership development and executive coaching.
Revitalise the CILLA Academy blended approach offering to the business	A learning and development catalogue was compiled and implemented.
Provide a targeted accelerated development programme for critical staff.	The GIT programme and the Accelerated Researcher Development Programmes were implemented.
Develop exchange programmes with universities and industry.	Work on exchange programmes with universities and industry is in progress. The Staff Exchange Policy is to be reviewed.

Objective 3: Improving individual and organisational performance:	
Interventions	**Impact**
Develop Employee Value Proposition (EVP) (for attraction and retention) to EPIC values to establish a new culture.	Focus group sessions were conducted and a draft EVP document was compiled.
Develop Performance Management (reinforce a performance culture).	Performance management process training was provided and the reviewed Performance Management Policy was approved by the Executive Committee (Exco).
Develop a Talent Management Framework to enhance the talent pipeline and succession plans.	The Talent Management Framework was approved, a succession planning tool and template were designed and HR staff were trained. The Succession Planning Policy was approved by the Board.
Introduce 360° evaluation to encourage a culture of giving and receiving feedback.	The process to follow is to be agreed upon.
Reposition reward programmes to include tangible and intangible benefits.	The Remuneration Policy is in the process of being reviewed.
Formulate appropriate employment relations strategies, structures, policies, practices and procedures.	The EE Policy was approved by the Board.

Objective 4: Increased efficiency and effectiveness of HR systems and processes:	
Interventions	**Impact**
Implement the workforce planning system.	Implementation of PeopleSoft position management system is in progress and will continue in the next financial year. The system set-up and planning were completed.
Implement the Organisational Design Analytic tool.	The Orgvue System was implemented, users were trained and HC dashboards were developed.
Implement the LinkedIn system.	The LinkedIn system was implemented, usage is being monitored.
Implement an online onboarding revitalisation system.	An RFP process for an onboarding tool was commissioned. The project was not continued due to high cost.
Implement the e-Performance Management system.	The e-Performance System was setup and configuration was concluded. The system was implemented in 2020/21.
Improve the utilisation of the Business Information System for strategic engagements with business.	The new organisational structure was implemented. System access was reviewed and reports and new roles were expanded to HC practitioners.
Align HC policies and processes to create an enabling environment.	Seven policies were approved by the Board, five were submitted for April Board approval and five are to be submitted for July 2020 approval
Align systems to the new operating model.	PeopleSoft and BIS changes were completed.

C. WORKFORCE PLANNING FRAMEWORK AND KEY STRATEGIES TO ATTRACT AND RECRUIT A SKILLED AND CAPABLE WORKFORCE

Workforce planning in the CSIR is conducted annually, in conjunction with the annual planning process, which includes compilation of the Shareholder's Compact, divisional and portfolio plans, and the annual budget. Detailed workforce and staffing plans of positions for all divisions and portfolios are included in the annual budget submitted for approval and inclusion in the strategic and operational plans and the CSIR's Shareholder's Compact. The key strategies to attract and recruit a skilled and capable workforce are included above as included in the HC Strategic and Operational Plan for 2019/20.

The total staff headcount at the end of Q4 was 2 104, compared to 2 342 as at 31 March 2019, a decline of 238 (-10.16%) in the total number of CSIR staff for this financial year. The decline is a result of the organisational restructuring of SET and Support staff, in line with the new operating model and business strategy implemented on 1 April 2019. The CSIR headcount at the end of Q4, comprises 1 367 (64.97%) SET staff and 734 (34.07%) Support staff.

Key strategies to attract and recruit a skilled workforce included the implementation of a new talent sourcing strategy, in conjunction with the LinkedIn recruitment portal. The EE Policy and plans for the organisation were compiled in Q3 to address transformational aspects and the EE plan, which will inform the organisation's recruitment plan in 2020/21.

The support staff restructuring, which included HC staff, impacted HR activities such as talent acquisition and retention adversely as all affected HC staff were included in the consultation process during Q4. This resulted in loss of productive capacity and delays in the recruitment of new staff. The CSIR has appointed 63 staff members from the CSIR student pipeline, which reduced the impact of resignations to some extent. The table below includes the CSIR staff profile as at 31 March 2020, comprising SET, Support, and Student Pipeline staff.

Table 3: Staff Profile

STAFF CATEGORY	SET Staff	%	Support Staff	%	Total	%
Permanent	1 170	55.61%	680	32.32%	1 850	87.93%
Temporary	62	2.95%	23	1.09%	85	4.04%
Studentships	76	3.61%	0	0.00%	76	3.61%
GIT	22	1.05%	17	0.81%	39	1.85%
Interns	28	1.33%	12	0.57%	40	1.90%
In-Service Trainees	9	0.43%	5	0.24%	14	0.67%
Total	**1 367**	**64.97%**	**737**	**35.03%**	**2 104**	**100.00%**

The CSIR staff profile as at 31 March 2020 included 29.0% African males against the national (EAP profile (including South Africans) average of 42.7%, 2.9% coloured males against an average of 5.2%, 4.5% Indian males against an average of 1.7%, 14.6% white males against an average of 5.1%, 28.7% African females against an average of 35.8%, 2.4% coloured females against an average of 4.4%, 2.9% Indian females against an average of 1.1%, 10.2% white females against an average of 4.0%, 3.9% foreign males and 1,1% foreign females.

The table below reflects performance against national EAP targets and adjusted average performance, excluding the 5% of non-South African staff against the targets across all categories of staff.

i. Staff Transformation Profile

Table 4: CSIR EE performance against NEAP Targets

PERFORMANCE	AM	AF	CM	CF	IM	IF	WM	WF	Total SA	FM	FF	Total Foreign	Grand Total
Target %	42.7	35.8	5.2	4.4	1.7	1.1	5.1	4.0	100	0	0	0	100
Average %	29.0	28.7	2.9	2.4	4.5	2.9	14.6	10.2	97.1	3.9	1.1	5	100
Variance %	-13.7	-7.1	-2.3	-2	2.8	1.8	9.5	6.2	97.1	3.9	1.1	5	100
Adjusted Average %	30.5	30.2	3.1	2.5	4.7	3.0	15.4	10.7	100	0	0	0	100
Adjusted Variance %	-12.2	-5.6	-2.2	-1.9	3.0	1.9	10.3	6.7	100	0	0	0	100

ii. Staff Movements

1. Recruitment

A total of 206 employees, 156 (75.72%) black South Africans and 81 (39.32%) female South Africans were appointed from 1 April to 31 March 2020, which included 63 permanent appointments, 80 temporary appointments and 63 pipeline appointments

Table 5: CSIR Recruitment

CATEGORY	AM	AF	CM	CF	IM	IF	WM	WF	Total SA	FM	FF	Total Foreign	Grand Total
Top management	0	0	0	0	0	0	1	0	1	1	0	1	2
Senior management	3	0	1	0	0	0	0	0	4	0	0	0	4
Middle management	11	2	2	0	1	1	3	1	21	1	0	1	22
Skilled	18	5	0	1	1	0	2	3	30	0	0	0	30
Semi-skilled	4	1	0	0	0	0	0	0	5	0	0	0	5
Total permanent	**36**	**8**	**3**	**1**	**2**	**1**	**6**	**4**	**61**	**2**	**0**	**2**	**63**
Temporary	20	18	3	1	2	2	16	11	73	6	1	7	80
Pipeline	26	31	0	1	0	1	1	2	62	0	1	1	63
Grand total	**82**	**57**	**6**	**3**	**4**	**4**	**23**	**17**	**196**	**8**	**2**	**10**	**206**

2. Permanent Appointments

The 63 permanent appointments included 51 black, 10 white and two foreign staff members with permanent residence.

3. Temporary and Pipeline Appointments

The total 80 temporary appointments included 29 black, 25 white and seven foreign staff members. The 63 pipeline appointments included 59 black, three white and well as one foreign staff member.

Table 6: Appointments

CATEGORY	AM	AF	CM	CF	IM	IF	WM	WF	Total (SA)	FM	FF	Total (Foreign)	Grand Total
Permanent	36	8	3	1	2	1	6	4	61	2	0	2	63
Temporary	20	18	3	1	2	2	16	11	73	6	1	7	80
Pipeline	26	31	0	1		1	1	2	62	0	1	1	63
Total	**82**	**57**	**6**	**3**	**4**	**4**	**23**	**17**	**196**	**8**	**2**	**10**	**206**

4. Permanent Staff Exits

There were 252 permanent staff exits between 1 April and 31 March 2020, which included 142 black, 97 white, and 13 non-South African staff members, as reflected below.

Table 7: Permanent Staff Exits

CATEGORY	AM	AF	CM	CF	IM	IF	WM	WF	Total (SA)	FM	FF	Total (Foreign)	Grand Total
Top Management	0	3	0	0	0	0	0	0	3	0	0	0	3
Senior Management	0	1	1	1	0	1	5	2	11	1	0	1	12
Middle Management	23	17	2	3	12	5	48	29	139	6	6	12	151
Skilled	29	14	1	2	2	1	6	7	62	0	0	0	62
Semi-Skilled	13	5	1	5	0	0	0	0	24	0	0	0	24
Grand-Total	**65**	**40**	**5**	**11**	**14**	**7**	**59**	**38**	**239**	**7**	**6**	**13**	**252**

The permanent staff exits included six deceased staff members, one dismissal, 29 retrenchments, 177 resignations and 39 retirements (no-fault dismissals).

Table 8: Permanent Staff Exit Categories

CATEGORY	AM	AF	CM	CF	IM	IF	WM	WF	Total (SA)	FM	FF	Total (Foreign)	Grand Total
Deceased	3	1	0	0	0	0	1	1	6	0	0	0	6
Dismissal	1	0	0	0	0	0	0	0	1	0	0	0	1
No-Fault Dismissal	3	6	1	0	2	2	4	9	27	1	1	2	29
Resignation	52	31	3	7	12	5	35	22	167	5	5	10	177
Retirement	6	2	1	4	0	0	19	6	38	1	0	1	39
Total	**65**	**40**	**5**	**11**	**14**	**7**	**59**	**38**	**239**	**7**	**6**	**13**	**252**

The reasons provided by the 177 permanent staff members for leaving CSIR employment are in the table below. The majority of staff (87) indicated the reason for leaving as improved career development.

Table 9: Permanent Staff Resignation Reasons

Resignations – Reasons for leaving	Total
CSIR/personal goal not aligned	9
Dissatisfied with work conditions	5
Family circumstances	13
Further full-time study	4
Going abroad	15
Health reasons	2
Higher salary and benefits	12
Improved career development	87
Marriage	1
Relocation	10
Reorganisation	4
Settlement agreement	1
Starting own business	6
Unforeseen circumstances	3
Voluntary separation	5
Resignation Total	**177**

D. LEARNING AND DEVELOPMENT

The CSIR has implemented a number of interventions to build and strengthen its pipeline in order to ensure sustainability of the business, in line with the organisational strategy. These include student pipeline and professional development programmes. The numbers in the student pipeline programmes are illustrated in the diagram below, followed by the updates for each intervention.

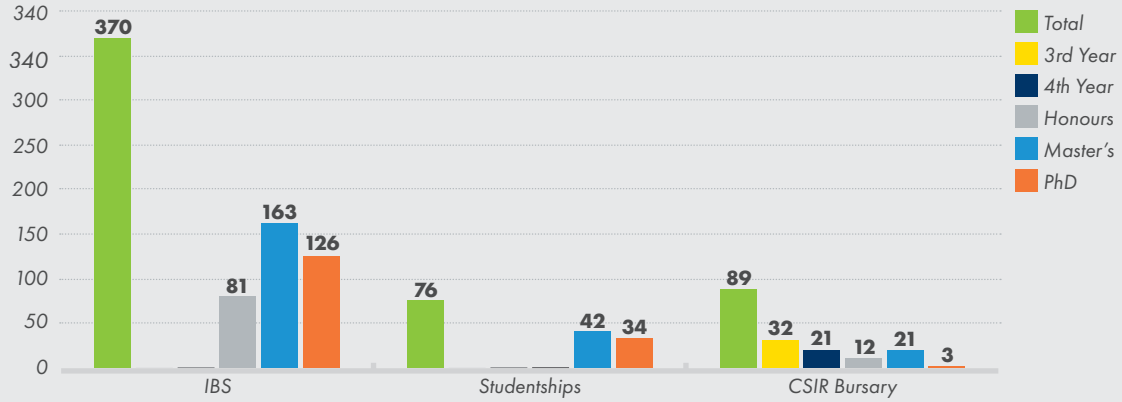


Figure 1: Number of Students in the Pipeline Programme

The bursary programme funds students from undergraduate to postgraduate levels. The DSI-funded Inter-Bursary Support (IBS) Programme supports postgraduate students from honours level upwards. The studentship programme supports Master's and PhD level students. The student pipeline of 535 at March 2020 includes 370 IBS students, 76 studentships and 89 bursary students.

i. CSIR Bursary Programme

A total of 114 students were funded in the CSIR bursary programme for undergraduate and postgraduate studies in the 2019 academic year, 82% black and 43% females. In 2020, the number declined to 89 because of students who have completed their studies. There were no new students recruited into the programme for the 2020 intake due to proper workforce planning initiative to align the Bursary Programme with the new CSIR Strategy and the implementation of the on-line Bursary Management System to manage all the bursary activities and track performance. The bursary applications will be opened on 1 June 2020 for the 2021 academic year.

The overall final year results for 2019 for all the students (114) in the bursary programme were analysed and the statistics are as follows: 88% pass rate across all levels, 11% failed two to three subjects and 1% failed more than five subjects. There were 42 students enrolled for their final year of study. All the final year students passed, except for one student who is waiting for his final year project resubmission mark. Of the 42 students, 20 decided to join the GIT programme (including the one with the outstanding results) and 22 are pursuing further studies at Honours and/or Master's levels.

Fifty students in the bursary programme were hosted for vacation work during the December 2019 holidays. The spread across the different clusters/centres is shown below. CSIR NextGen Enterprise hosted the majority of the students.

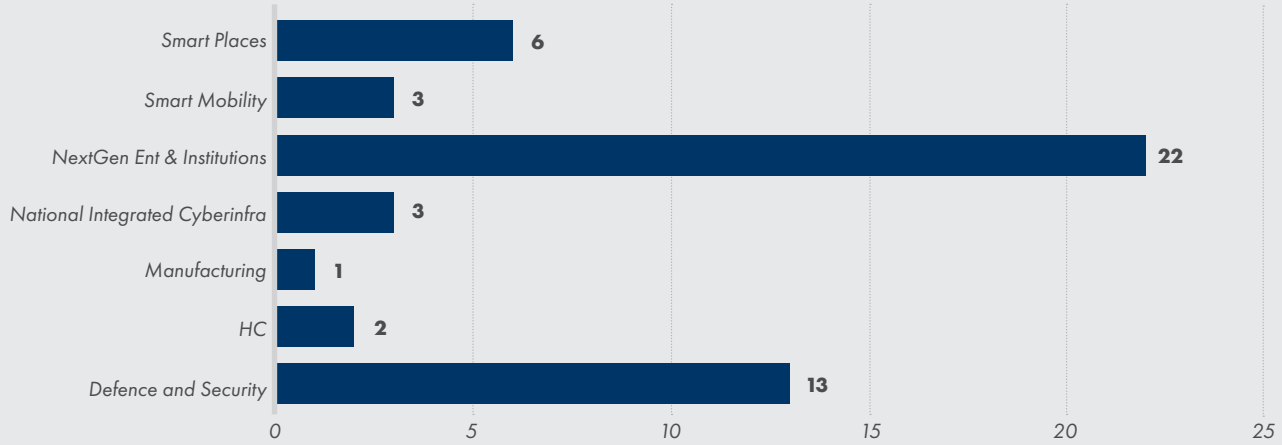


Figure 2. Number of students hosted for vacation work at various clusters/portfolios

ii. Studentships

The number of students in the studentship programme continues to decline, as the organisation is shifting towards postgraduate bursaries at Master's and PhD levels. New funding was allocated for 33 Master's and 19 Doctoral candidates for the 2020 academic year. There are currently 76 studentships, which includes 42 Master's and 34 PhD students.

iii. CSIR/merSETA Partnership

In March 2019, the CSIR was awarded funding to the amount of about R68 million over a four-year period by merSETA to develop capacity that is aligned to Industry 4.0 skills requirements. This includes funding for bursaries at undergraduate, Master's and PhD levels, work integrated learning, as well as the development of a learning factory that would provide the necessary practical training for students. All the 2019 bursary students (both undergraduate and postgraduate level) funded under merSETA have been contracted. This is a total of 24 undergraduates, seven Master's and seven PhD students.

iv. CSIR/DSI IBS Programme

The recruitment and selection of students for the 2020 academic year were concluded. A total of 370 students were recommended by the student selection committee representing the thematic areas of the programme. A four-year report for the programme, which included the progress of the programme, including the number of students funded, demographics and overall performance in terms of graduations was prepared and submitted to the DSI in January 2020. Discussions with DSI are ongoing for the three-year renewal of the programme.

v. Graduate In-Training Programme

This programme was established to provide appropriate formalised training and development for the CSIR's new graduates. The training is aligned to the requirements of professional bodies, such as the Engineering Council of South Africa (ECSA) and South African Council for Natural Scientific Professions. As the organisation transitions into the new industrial development strategy, there is a need to ensure that our training is aligned to industry standards and norms.

The programme had a new intake of 19 graduates from the bursary programme, an additional graduate will be appointed in May 2020. They commenced with the programme on 1 February 2020. From the previous year's cohort of 26 graduates, two resigned from the programme and two were appointed into permanent positions. This brings the number to a total of 41 candidates currently in the programme. The composition of the new intake is summarised below, 80% are black and 35% are females. An article profiling the new candidates was published on the Intraweb. Discussions continue with ECSA for the CSIR to enter into a partnership for the ECSA academies programme; this will provide the CSIR with support from ECSA for the GIT programme.

vi. Accelerated Researcher Development Programme (ARDP)

This programme was inaugurated in 2017/18 to grow the number of chief researchers who are black at the CSIR. There are eight candidates in the programme; three black males and five black females. Attempts were made to identify two more candidates to join the programme. Division 2 has identified one candidate (a black male), pending confirmation from Division 1. The progress

of the candidates is being monitored through progress reports and six-monthly feedback sessions where the candidates are provided with an opportunity to present their progress. The candidates have shown a positive trajectory to achieving their set objectives. Indications are still that two candidates will be eligible for promotion to chief researcher level in the 2020/21 financial year, the rest are still at Principal Level 1 (D3) and will submit for promotion to Principal Level 2 (D4).

E. PARTNERSHIPS AND RESOURCES

The CSIR continues to develop and maintain partnerships with key stakeholders to leverage additional resources for HC development. merSETA awarded the CSIR a contract of R68 million over a period of four years, R35.53 million goes towards pipeline development programmes, such a bursaries (under- and post-grad), GIT for training, as well as Work Integrated Learning. The partnership with the DSI continues through the IBS programme that is discussed under Pipeline Development. The programme has been in place for the past five years, with the current three-year contract ending in March 2021.

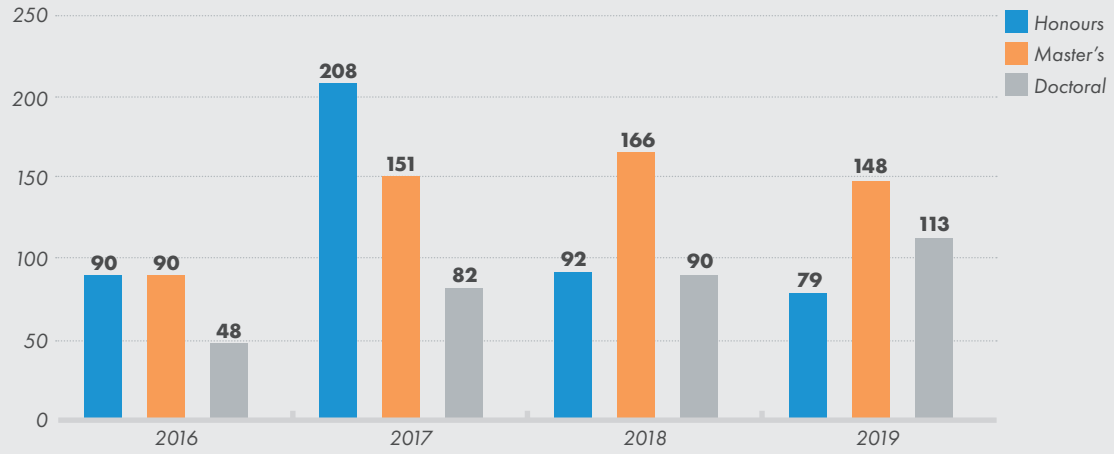


Figure 3. Students in the IBS programme from 2016-2019

The initial contract was R100 million and the current contract is about R110 million for the three years. Discussions have been held with DSI for the three-year renewal. The student supplement for the past four years is depicted below.

The relationship with the NRF continues, with CSIR staff participating in numerous NRF programmes, such as the PDP (to support PhDs and Postdocs), NRF-funded interns hosted by the CSIR, Thuthuka, NRF Ratings, etc. The CSIR leveraged R3.5 million for the PDP. The CSIR is a member of the South African Graduate Employers Association, a platform that allows access to insights and benchmarks for attraction, development and retention of graduates.

F. EXTERNAL RECOGNITION

In the Universum Survey, the CSIR was once again ranked first in the Natural Science category as the most attractive employer by students, this marks a third year in a row that the organisation has received this recognition. This is mainly due to the outreach programme that the organisation embarks upon to create awareness among students. The CSIR was also ranked first by professionals in this category, same as in 2017 and 2018. For the engineering category, the CSIR was ranked 13th in 2019 versus position 7th in 2018. The professional survey has no record of ranking in 2019, but we were ranked 6th in 2018. The lower ranking by engineering students is a cause for concern, given the organisation's new strategy towards industrial development. More targeted efforts will be made to create awareness and market the GIT programme with engineering students. The University of KwaZulu-Natal awarded the CSIR a recognition award for funding and supporting a number of students enrolled at this university.

G. EMPLOYEE PERFORMANCE MANAGEMENT FRAMEWORK

The CSIR has a performance management framework that measures individual and organisational performance. Performance evaluations are conducted in alignment with

performance contracts bi-annually. The Performance Management Policy was reviewed as part of the HC policy review process and the reviewed policy was submitted for Board approval in April 2020.

H. EMPLOYEE WELLNESS PROGRAMMES

The Employee Wellness Office initiated, implemented and supported several initiatives and activities during the 2019/2020 financial year, some of which were operationalised through the CSIR Sports Club, while others were supported at the instance of other CSIR divisions and portfolios. Employee Wellness events held during the year included:

- Employee Wellness Month;
- Executive Medical Health Screening;
- Flu Vaccine Campaign;
- SARS e-Filing Awareness and Services;
- Biggest Weight Loser Competition Launch;
- Woman's Health Talk (Collaboration with Bestmed) x 3 Sessions;
- Launch of Men's Conference as a platform through which CSIR men engage and pledge their support against Gender-based Violence –2 sessions were held in October and November 2019, respectively; and
- Psychological services for employees affected by reorganisation

The following Employee Wellness events were held in collaboration with the CSIR Sports Club:

- Tshwane Eagles Netball Tournament;
- Tshwane Corporate League Soccer Tournament;
- Comrades Marathon;
- Two Oceans Marathon;
- Volley ball Coaching Clinics; and
- Launch of the CSIR Soccer and Running Sub-Clubs in the Cape Town Regional Office.
- Other events supported by the Employee Wellness Office included the following:
- 16 Days of Activism against Gender-based Violence;
- HIV Voluntary Counselling and Testing;
- Prostate Cancer Testing;
- Stress Management Training;
- Employee Awareness Programme referrals;
- Financial Management Training;
- Monthly On-Boarding Presentations on Employee Wellness Office;
- Monthly On-Boarding Presentations on Sports and Recreation;
- HCD Student Development Programme Training;
- Walk-in Lay Counselling for Employees;
- Employee Wellness Month;
- Executive medical health assessments; and
- Intellectual property awareness session (Collaboration with IP office).

Sports Club Events

- Tshwane Eagles Netball Tournament;
- Tshwane Corporate League Soccer Tournament;
- Comrades Marathon;
- Two Oceans Marathon;
- Volley ball coaching clinic;
- IP awareness day (Collaboration); and
- Launch of the CSIR Soccer and Running club in Cape Town.

I. EMPLOYEE RELATIONS

The Employee Relations function initiated several objectives during the financial year under review. The most crucial of which was supporting the organisation in implementing and operationalising its new strategy and business operating model.

Employee Relations played an important role during the reorganisation of Support Services Staff aimed at aligning the organisation's strategy to recruit and retain employees who are fit for purpose.

A new Employee Relations Manager was appointed during the reorganisation process who played an important role in several Conciliation for Conciliation, Mediation and Arbitration (CCMA) dispute referrals, Labour Court and Constitutional Court applications launched by a newly established and registered trade union, NASA-Workers. The reorganisation process involved another trade union, Solidarity and nominated representatives of non-unionised employees, and was facilitated by the CCMA. Employee Relations was also instrumental in negotiating and concluding picketing rules with NASA-Workers during the CCMA conciliation process, which ensured that the strike organised by the trade union on 12 December 2019 had no material impact on the business operations of the organisation.

The Employee Relations function successfully implemented case management aimed at reducing the number of internal and external employee relations matters in the CSIR, as outlined below.

Table 10: Internal Employee Relations Matters

MATTERS	ATTENDED MATTERS	CONCLUDED MATTERS	PENDING MATTERS
Grievances	16	8	8
Investigations	28	12	16
Disciplinary	8	5	3
Incapacity	11	7	4
Total	**63**	**32**	**31**

Table 11: External Employee Relations Matters

MATTERS	ATTENDED MATTERS	CONCLUDED MATTERS	PENDING MATTERS
CCMA	6	2	4
Labour Court	2	1	1
Constitutional Court	1	1	0

Table 12: Support Staff Restructuring Progress

EMPLOYEE/PARTY	MATTER
Support Staff Restructuring	On 5 and 6 November 2019, section 189(3) notices were issued to the Support staff likely to be affected by the restructuring, and the CCMA facilitated the consultation process that has now been concluded. However, the CSIR and labour representatives are continuing with Task Team meetings, as and when required, and the CSIR has commenced with the placement of employees following the agreement with labour. The process stands as follows: **Total affected employees**: 232 **Placed employees (phase 1)**: 131 **Placed employees (phase 2)**: 24 **Approved voluntary severance package (VSP) applications**: 27 **Employees not yet placed**: 50 **Vacancies available in phase 3**: 56 **Deferred VSP applications**: 7 It is anticipated that the employees who have not yet been placed will be accommodated through the opportunities to be created once deferred VSP applications have been finalised and the vacancies available in phase 3 have been filled.

J. EMPLOYMENT EQUITY

The appointment of employees was guided by the principles espoused by the EE Act, 1998 (Act 55 of 1998) and implemented based on divisional and portfolio EE plans, which will lapse between June and September 2020.

The establishment of the EE and Skills Development Committee and associated Consultative Forums could not be achieved due to the on-going restructuring of the Support Services Staff, which was preceded by the restructuring of the SET Base Staff during the 2018/19 financial year. The organisation envisages having one central committee with several consultative forums in the clusters and portfolio to ensure that the EE Plan is implemented at cluster and portfolio levels.

Workshops were conducted on the Unfair Discrimination Policy, as and when required from time to time, to educate and raise awareness on issues of discrimination and equity.

Internal Audit conducted a compliance assessment about the application and enforcement of the EE Act, and the Employee Relations and Transformation Office made the required information available. The Office had already conducted a self-assessment, and identified areas that require attention. The EE Policy has been revised and approved by the Board. Education and awareness thereon will form part of the policy implementation plans in the new financial year.

K. POLICY DEVELOPMENT

A Human Capital task team was established to review and revise existing policies and compile new policies where there was a need. All policies were reviewed by the Policy Review and Development Committee (PRDC) before they were submitted to Exco. HC, together with the Planning Department, launched a new Vibe Consultation platform to ensure that staff are extensively consulted on policy matters, seek staff input and ensure proper documentation of the consultations, as well as staff input. This has proven to be a good platform for consultation as there was a high level of response and inputs received from staff that were incorporated into the policies that were presented to the Board. A summary of policy development progress is outlined in the table below:

Table 13: Policy Development Progress

POLICY	PRDC	OPCO	EXCO	HRSEC	CSIR BOARD	COMMENT
1. Conditions of Service						Approved - Jul 2019
2. Retrenchment					18/07	Approved - Jul 2019
3. Talent Management		24/07	17/09	08/10	15/10	Approved - Oct 2019
4. Skills Development		24/07	17/09	08/10	15/10	Approved - Oct 2019
5. Recruitment and Selection		24/07	17/09	08/10	15/10	Approved – Oct 2019
6. Succession Planning	4/09	11/09	19/09	08/10	15/10	Approved – Oct 2019
7. Employment Equity	4/09	11/09	19/09	08/10	15/10	Approved – Oct 2019
8. Performance Management	4/09	11/09	20/01	7/04	17/04	Approved by Exco
9. Incapacity due to Ill Health and Injury	3/03	11/03	17/03	7/04	17/04	Approved by Exco
10. Poor Work Performance	3/03	11/03	17/03	7/04	17/04	Approved by Exco
11. Relocation	3/03	11/03	17/03	7/04	17/04	Approved by Exco
12. Pipeline Development	2/06	10/06	18/06	7/07	17/07	Draft policy compiled
13. Professional Development	2/06	10/06	18/06	7/07	17/07	Draft policy compiled
14. Professional Registration	2/06	10/06	18/06	7/07	17/07	Draft policy compiled
15. Promotions	2/06	10/06	18/06	7/07	17/07	Draft policy compiled

i. Conditions of Service

The CSIR Board approved changes to the CSIR Conditions of Service implemented on 1 April 2013. The changes were necessitated by the ambit of the highly competitive market in which the CSIR operates and aimed to address key elements of the EVP. The changes to the Conditions of Service were informed by market trends and best practices, considering the changing needs of CSIR employees. The amended Conditions of Service relating to leave were implemented on 26 August 2019. Other changes to the Conditions of Service will become effective on 1 April 2020.

ii. Retrenchment Policy

The Retrenchment Policy was reviewed and amended, removing discriminatory elements embedded in the policy, which favoured employees with years of service in excess of 10 years. Further amendments included changing the calculation of severance pay from two weeks to one week for every year worked. The policy has not been effected because of the consultation process for Support Staff restructuring, which is part of the initial Synapse restructuring process.

iii. Talent Management Policy

A new Talent Management Policy was developed and implemented following approval thereof. The rationale for this policy is to govern talent management and the achievement of the CSIR's strategic objectives through a process of identifying, attracting, nurturing and retaining talent for key positions across the organisation. The policy will become effective on 1 April 2020.

iv. Skills Development Policy

A new policy was developed to regulate and manage skills development in the CSIR. As a knowledge-based organisation, skills development is critical in order to ensure continuous learning and development of current and future employees to enhance competency, performance and individual development, as well as advance EE. The policy will become effective on 1 April 2020.

v. Recruitment and Selection Policy

The objectives of the revised Recruitment and Selection Policy are to ensure that the organisation attracts relevant and diverse

skilled talent aligned to current and future workforce demands, ensure transformation in line with the EE Policy, and achieve organisational goals of building and transforming HC by promoting workplace diversity with employees who are suitably qualified and competent to perform the inherent requirements of the position. The policy will become effective on 1 April 2020.

vi. Succession Planning Policy

A new Succession Planning Policy was developed and implemented. The objective of the policy is to formalise the succession planning approach in the CSIR and govern the implementation thereof by enabling the HC role to meet the strategic objectives of capacitating and sustaining the organisation to ensure business continuity. The policy provides for the establishment of a talent pool, talent committees and identification of employees as potential successors. The policy elements are aimed at identifying, developing and preparing a pool of high-quality candidates to be available for succession who are able to continue delivering on the organisation's mandate, strategy and operational planning for leadership, scarce, critical and important strategic positions in the CSIR. The policy will become effective on 1 April 2020.

vii. Employment Equity Policy

A new EE Policy was developed and implemented. The EE Policy governs the implementation of the EE Act, as amended, in order to achieve equity within the CSIR by promoting equal opportunity and fair treatment through the elimination of unfair discrimination and implementing affirmative action measures to redress the disadvantaged designated groups in the past. The policy seeks to strengthen the organisation's efforts and commitment to transformation by ensuring that the employee profile reflects the demographics of the country's population, in order to enable delivery of the CSIR Strategy. This will be executed with workforce diversity and inclusion in the forefront, while ensuring alignment of the necessary skills and competencies. The policy will become effective on 1 April 2020.

viii. Promotions Policy

A new Promotions Policy was developed with the aim of governing the promotion of employees in recognition of career progression, job growth and preparedness to take on increased responsibility, in pursuit of the achievement of the organisational strategy. The objectives of this policy are to give effect to talent management initiatives; provide recognition for the advancement of job progression for all employees; regulate the process of career progression through a formalised and structured process; support employee retention efforts by allowing for regular opportunities to recognise job growth; encourage employee career development and personal growth; ensure that all positions are filled by employees who have the requisite qualifications, exposure and competence; and ensure equity, fairness and objectivity in matters relating to promotion. The policy was approved by Exco during January 2020. Following staff consultation and the inputs received, it was recommended that the draft policy statements be reviewed and re-submitted for Board approval during July 2020.

ix. Performance Management Policy

The Performance Management Policy provides the principles for consistent application in the measurement of individual employee performance against performance standards aligned with the organisation's objectives. The objectives of this policy are to provide for a formalised performance management process, confirm commitment to a performance-oriented culture; ensure setting of clear expectations between managers and employees; align individual's performance objectives with the strategic objectives of the organisation; reference the upholding of the organisational values and behaviours to attain the CSIR's vision and mission; provide for the achievement of objectives as per the individual development plan and provide for an appeals process. The policy will become effective on 1 April 2020.

x. Incapacity due to Ill Health Policy

The Incapacity due to Ill Health or Injury Policy was reviewed as part of the policy review process. The organisation seeks to create a process that is rehabilitative in design, make essential counselling and rehabilitative services accessible to employees, and ensure that the incapacity process is regulated and implemented in a lawful and fair manner at all times. The policy will be submitted for Board approval in April 2020.

xi. Poor Work Performance Policy

A new policy to address poor work performance was developed during the last quarter of the year. The purpose of the policy is to provide a policy framework for effective management of poor work performance; ensure consistent application of the poor work performance inquiry process in compliance with applicable laws, policies and procedures; maintain a balance between employees' right to be afforded an opportunity to improve performance and the need for business excellence. The policy will be submitted for Board approval during April 2020.

xii. Relocation Policy

The Relocation Policy was reviewed during the last quarter of the year. The policy is formalising the practice of relocation assistance according to the needs of the organisation and in line with changes in income tax legislation promulgated. Non-policy statements and procedural items were removed from the policy. The details of applicable relocation cost covered by the CSIR are now listed in an annexure to the new policy document. The policy will be submitted for Board approval during April 2020.

xiii. Guideline for Flexible Working Practices

The Guideline for Flexible Working Practices provides a consistent approach within the CSIR towards employees who may need to work remotely, as well as flexible working arrangements. Flexible working practices will promote a favourable environment that is supportive and flexible to employee and employer needs. The guideline was implemented in May 2019.

xiv. Guideline for Acting Appointments

The Guideline for Acting Appointments was reviewed and updated. The amended guideline outlines a consistent approach to managing acting appointments in the CSIR. The guideline was implemented in May 2019.

xv. Guideline for Retirement Functions

The Guideline for Retirement Functions was reviewed and amended with changes in accordance with the latest National Treasury Regulations published related to the retirement of employees. The purpose of this document is to provide guidelines regarding the retirement function management processes across the organisation to ensure consistency and compliance with National Treasury Regulations. The guideline was implemented in May 2019.

xvi. Guideline for Employee Transfers

This document provides guidelines on the process for the movement/transfer of employees within and outside the organisation, resulting from individual needs and business requirements as per CSIR Conditions of Service. The guideline was implemented in May 2019.

L. EMPLOYEE BENEFITS

As part of the drive to create awareness of the CSIR's EVP, national pension fund and benefits roadshows were conducted during April and May this year. Sessions were held in Cape Town, Durban. Johannesburg, Pretoria and Stellenbosch. Pension fund member trustee elections were conducted during June 2019. The term for new member elected trustees commenced on 1 July 2019.

An Employee Benefits Open Day was hosted at the main campus in October 2019. The purpose of the day was to create awareness of employee benefits and provide employees with easy access to various service providers.

M. HUMAN CAPITAL SYSTEMS

Table 14: HC System Progress

INITIATIVE	PROGRESS FEEDBACK
Building a diverse talent ecosystem and a sustainable future supply	
Talent management framework	Talent reviews on cluster, divisional and portfolio levels are to commence in June 2020.
Talent sourcing strategy	The Talent Management Policy was approved by the Board, published on the Intraweb and communicated to the organisation.
Strengthening leadership and deepening professionalism	
Job descriptions and competencies	The compilation of the job catalogue is overdue. Job descriptions for the Support Services restructuring process were finalised.
Increased efficiency and effectiveness of HR systems and processes	
Data analytics	OrgVue standard reports were created and data is being refreshed on a monthly basis.

INITIATIVE	PROGRESS FEEDBACK
System improvements and automation	The to-be processes, business rules, use cases and integration requirements for the manual HC processes (Acting and Long Service) were defined, business and systems analysis are in progress. The workflow front-end processes for reporting level changes, manager changes, delegations and terminations were developed and testing by Human Capital is in progress.
Leave system	Changes to the leave system have been implemented to provide for new leave categories approved by the Board. Further refinements and amendments to the leave system were made to automate leave administration and streamline the process of appointments and automatic creation of leave registration records.
Performance management system	System amendments were made to shorten and simplify the process. The user guideline document was finalised and an organisational communication sent out. Training sessions were to be held, but due to the current COVID-19 pandemic, alternative ways will be explored to train users.
PeopleSoft Position Management system	Technical system amendments were discussed and are being implemented. The position data to be loaded nave been gathered and the security set-ups agreed. Funding was requested to finalise the project in the new financial year.
PeopleSoft upgrade to version 9.2	The HC systems upgrade will re-commence after the completion of PeopleSoft modules as per the HC business plan.
Improving individual and organisational performance	
Employee Value Proposition	The draft EVP document was compiled and the outcomes of the focus group sessions summarised for discussion with Executive members.

N. HUMAN CAPITAL OPERATIONS AND REPORTING

The following operational processes have been completed as planned in the HC calendar of events:

- Annual and mid-year performance reviews;
- Promotions – Career Ladder reviews (completed, awaiting final Exco approval); and
- Annual increases – September (effective 1 October 2019).

Reports completed included the following, among others:

- Quarterly National Treasury (ENE and MTEP);
- EE report;
- Quarterly Stats SA (employment statistics);
- Exco monthly and quarterly HC performance reports;
- Board reports; and
- DSI reports.

O. CHANGE MANAGEMENT

With the CSIR implementing the new strategy and operating model, there were a number of initiatives that were embarked upon to support and facilitate a deep understanding and ownership of changes within the CSIR. The change objectives are:

- Creating awareness of why there is a need for change;
- Driving change within the organisation from both top and bottom;
- Rolling-out several interventions to enable change;
- Promoting a culture where leaders are held accountable for facilitating the change; and
- Building sustainable ownership.

To ensure that the above is achieved, the following initiatives were initiated:

i. Change Agent Forum Meetings

To engage with representatives of staff to share information, co-create change initiatives and gauge the pulse and change receptiveness on the ground.

The Change Agents meet every two weeks and have dealt with the following issues:

- Terms of reference of the Change Agents Forum (CAF);
- Identification of change barriers and mitigating factors;
- Defining the EPIC values, behaviours and developing icons;
- Defining participating in cluster Brown Bag sessions; and
- Participation in the Change Management RFP and Selection of the Change Service Provider.

A dedicated website with information relating to this CAF has been created for staff access and easy consultation.

ii. Values and Behaviours

The CSIR has introduced the new EPIC values. With the Change Agents, the behaviours and icons related to the values have been developed through various workshops. These values will drive how we do things within the CSIR and how we engage with staff, customers and stakeholders. These values have since been incorporated into the Performance Management System, as well as in meetings as value moments. A value moment is a specific topic relating to the values that is shared with teams at the beginning of a meeting for reflection and to drive the behaviour within the CSIR.

An important element of change is continuous engagement with staff and remaining transparent. To that effect, the CSIR has introduced the following engagement platforms with staff:

iii. Brown Bag sessions at Exco level and divisional/portfolio/cluster level

To engage openly and with transparency in an informal setting with staff and respond to any issues or ideas that staff may have. The Exco Brown Bag sessions are held once a quarter and are attended by Exco, all cluster Executives and any staff who choose to attend. They typically have an open agenda where staff may pose any questions – no restrictions – and leadership provides answers. These sessions have proceeded relatively well to date.

The Brown Bag sessions at divisional/cluster/portfolio level are held monthly in each division/cluster and support portfolio to address staff issues and share any information that leadership have to share. So far, this has only been adopted by some clusters and portfolios. The Project Management Office is planning to monitor and evaluate this more strictly and has requested leadership to provide dates of their planned engagements.

iv. Change Enablement within the CSIR

This is about:

- Creating awareness of why there is/was a need for change – that is, the rationale for change;
- What the role of individual staff is in the process – that is, how to own the change, have full understanding of what we are changing to as a new strategy and what it means for the CSIR;
- Building an understanding in the CSIR, that is shifting individual ownership of the change at the source, creating a deep understanding of the changes, getting mindsets to change from inward orientation to outward orientation, from self-centred to being focused on others and results;
- Understanding the details of the CSIR's Strategy, for example, the mandate, vision, mission, values, strategic objectives, strategy, operating model and measures, and;
- Creating internal capacity for sustaining change – imparting knowledge to Change Agents and managers (change is not a once-off event).

To this end, Price Waterhouse Coopers have been brought onboard to partner with the CSIR following an RFP process aimed at driving the change initiatives and creating a sustainable change capacity and capability within the CSIR.

HUMAN RESOURCE OVERSIGHT STATISTICS

Table 15: Personnel Cost by programme/ activity/ objective

Programme/activity/objective	Total expenditure for the entity (R'000)	Personnel expenditure (R'000)	Personnel expenditure as a % of total exp. (R'000)	No. of employees	Average personnel cost per employee (R'000)
Div 1: Chemicals, Agriculture, Food and Health	266 188	143 158	54%	282	508
Div 2: Mining, Manufacturing, Defence and Security	831 677	453 898	55%	714	636
Div 3: Natural Resources, Enabling Infrastructure, Public and Professional Services	940 075	483 381	51%	895	540
Portfolio: Business Excellence and Integration	195 765	50 196	26%	84	598
Portfolio: Finance	94 332	109 318	116%	185	591
Portfolio: Human Capital and Communications	129 106	69 473	54%	141	493
Portfolio: Legal, Compliance and Business Enablement	131 635	106 540	81%	271	393
Portfolio: Leadership Team	64 792	37 754	58%	29	1302
Total	**2 653 569**	**145 3718**	**55%**	**2601**	**559**

Table 16: Personnel cost by salary band

Level	Personnel expenditure (R'000)	Percentage of personnel expenditure to total personnel cost (R'000)	No. of employees	Average personnel cost per employee (R'000)
Top Management	43 601	3.00%	17	2565
Senior Management	160 537	11.04%	101	1589
Professional qualified	776 307	53.40%	912	851
Skilled	405 098	27.87%	1187	341
Semi-skilled	65 227	4.49%	357	183
Unskilled	2 948	0.20%	27	109
Total	**1 453 718**	**100.00%**	**2601**	**559**

Table 17: Performance Rewards

Programme/activity/ objective	Performance rewards	Personnel expenditure (R'000)	Percentage of performance rewards to total personnel cost (R'000)
Top Management	0	43 601	0%
Senior Management	0	160 537	0%
Professional qualified	0	776 307	0%
Skilled	0	405 098	0%

Programme/activity/objective	Performance rewards	Personnel expenditure (R'000)	Percentage of performance rewards to total personnel cost (R'000)
Semi-skilled	0	65 227	0%
Unskilled	0	2 948	0%
Total	**0**	**1 453 718**	**0%**

Table 18: Training Costs

Programme/activity/objective	Personnel expenditure (R'000)	Training expenditure (R'000)	Training expenditure as a percentage of personnel cost	No. of employees trained	Average training cost per employee (R'000)
Division 1: Chemicals, Agriculture, Food and Health	143 158	826	1%	144	6
Division 2: Mining, Manufacturing, Defence and Security	453 898	3 148	1%	321	10
Division 3: Natural Resources, Enabling Infrastructure, Public and Professional Services	483 381	3 495	1%	306	11
Portfolio: BEI	50 196	653	1%	49	13
Portfolio: Finance	109 318	321	0%	61	5
Portfolio: Human Capital and Communications	69 473	591	1%	72	8
Portfolio: LCBE	106 540	846	1%	128	7
Portfolio: Leadership Team	37 754	108	0%	21	5
Total	**1 453 718**	**9 988**	**1%**	**1 102**	**9**

Table 19: Employment and vacancies as at 31 March

Programme/activity/objective	2018/2019 No. of employees	2019/2020 Approved posts	2019/2020 No. of employees	2019/2020 Vacancies	Percentage of vacancies
Division 1: Chemicals, Agriculture, Food and Health	96	231	216	15	7%
Division 2: Mining, Manufacturing, Defence and Security	873	706	594	112	19%
Division 3: Natural Resources, Enabling Infrastructure, Public and Professional Services	718	758	658	100	15%
Portfolio: BEI	47	83	74	9	12%
Portfolio: Finance	215	182	168	14	8%
Portfolio: Human Capital and Communications	119	174	118	56	47%
Portfolio: LCBE	252	306	251	55	22%
Portfolio: Leadership Team	22	28	25	3	12%
Total	**2 342**	**2 468**	**2 104**	**364**	**17%**

The total number of staff as at 31 March 2020 was 2 104 compared to 2 342 at 31 March 2019. The decline in staff numbers resulted from restructuring and staff exits during the 2019/20 year. There was a negative growth in staff numbers due to staff exits following the restructuring processes of SET and Support staff, as well as business taking a strategic approach in balancing growing SET base and financial sustainability (ability to manage income and prioritising recruitment) supported by strategic workforce planning.

Table 20: Employment and vacancies by occupational category as at 31 March

Programme/activity/objective	2018/2019 No. of employees	2019/2020 Approved posts	2019/2020 No. of employees	2019/2020 Vacancies	Percentage of vacancies
Top Management	13	16	14	2	14%
Senior Management	88	101	89	12	13%
Professional qualified	1 144	924	777	147	19%
Skilled	788	1 058	935	123	13%
Semi-skilled	280	342	262	80	31%
Unskilled	29	27	27	0	0%
Total	**2 342**	**2 468**	**2 104**	**364**	**17%**

Mitigating actions were implemented to address the decline in staff headcount in the ambit of the organisational changes implemented. These included the following:

- Re-alignment of staff to new business model completed;
- Recruitment aligned to the business model and applying workforce planning balancing a growing SET base and financial sustainability (ability to manage income and prioritising recruitment);
- Conditions of Service reviewed to enhance EVP focusing on attraction and retention;
- Recruitment process streamlining to reduce recruitment turnaround time to support continuity, reduce loss of productivity and improve the quality of the selection process;
- Focused and targeted recruitment of SET staff – increased recruitment of new staff during August and September;
- Career Ladder review process to include assessment of ARDP candidates to yield the appointment of black staff as chief researchers; and
- Divisions and clusters with high turnover impacting targets were tracked continuously.

Employment changes

The CSIR experienced a decline in staff due the SET staff restructuring process in Q1 and Q2, as well as the Support staff restructuring process in Q3 and Q4, which resulted in resignations, retirements and retrenchments. The decline in staff exits levelled out at the end of Q2, but further continued to decline during Q3 and Q4. The decline in Q3 and Q4 can be attributed to internal and external factors, including, but not limited to, job security, job satisfaction, organisational uncertainty, a competitive external market and demand for the highly skilled staff of the CSIR.

Table 21: Employment changes 2019/20

Salary Band	Employment at beginning of period	Appointments	Terminations	Employment at end of the period
Top Management	13	2	4	14
Senior Management	88	9	17	89
Professional qualified	1 144	50	190	777
Skilled	788	112	191	935
Semi-skilled	280	34	45	262
Unskilled	29	2	0	27
Total	**2 342**	**209**	**447**	**2 104**

** 31 March 2019 - start ** 31 March 2020 - end

The total number of staff as at 31 March 2020 of 2 104 included 206 new appointments and 3 staff members absorbed as vacation students compared to 2 342 at 31 March 2019. The decline in staff numbers resulted from restructuring and staff exits during the 2019/20 year. The 447 staff exits included 197 resignations, 165 contracts which came to an end, 6 deceased staff members, 1 dismissal, 48 retirements, 1 case of incapacity and 29 retrenchments.

Table 22: Reasons for staff leaving

Reason	Number	% of total no. of staff leaving
Death	6	1.34%
Resignation	197	44.07%
Dismissal	1	0.22%
Retirement	48	10.74%
Ill health	1	0.22%
End of contract	165	36.91%
Retrenchments	29	6.49%
Total	**447**	**100.00%**

Table 23: Labour Relations: Misconduct and disciplinary action

Nature of disciplinary Action	Number
Verbal Warning	
Written Warning	
Final Written warning	
Dismissal	1

Equity Target and EE Status

Employment Equity targets were not achieved during the year due to restructuring, reorganisation, and the implementation of a new organisational structure and strategy. The restructuring included retrenchment of staff and alignment to newly set objectives, which include achievement of transformation and Employment Equity targets.

Table 24: Performance against employment equity targets

OCCUPATIONAL LEVELS	MALE							
	African		Coloured		Indian		White	
	Current	Target	Current	Target	Current	Target	Current	Target
Top Management	6	4	0	0	0	0	4	2
Senior Management	28	28	3	5	12	13	25	24
Professional qualified	196	263	23	39	58	59	234	355
Skilled	300	313	22	32	34	36	61	88
Semi-skilled	121	125	14	24	1	1	0	8
Unskilled	12	24	1	3	0	1	0	0
Total	**663**	**757**	**63**	**103**	**105**	**110**	**324**	**482**

OCCUPATIONAL LEVELS	FEMALE							
	AFRICAN		COLOURED		INDIAN		WHITE	
	Current	Target	Current	Target	Current	Target	Current	Target
Top Management	3	3	0	1	0	0	1	1
Senior Management	9	16	1	2	1	2	10	9
Professional qualified	115	167	11	31	27	37	113	149
Skilled	369	331	27	41	34	40	88	112
Semi-skilled	105	117	12	23	2	5	7	13
Unskilled	14	20	0	1	0		0	4
Total	**615**	**654**	**51**	**99**	**64**	**85**	**219**	**288**

OCCUPATIONAL LEVELS	DISABLED STAFF			
	Male		Female	
	Current	Target	Current	Target
Top Management	0	1	0	1
Senior Management	0	1	1	1
Professional qualified	7	7	3	4
Skilled	8	9	4	5
Semi-skilled	0	0	0	0
Unskilled	0	0	0	0
Total	**15**	**18**	**8**	**11**

F CONSOLIDATED FINANCIAL STATEMENTS

This section provides the reporting on consolidated financial statements, which have been prepared on the going concern basis. These were approved by the CSIR Board.

REPORT OF THE AUDITOR-GENERAL
FOR THE YEAR ENDED **31 MARCH 2020**

REPORT ON THE AUDIT OF THE CONSOLIDATED AND SEPARATE FINANCIAL STATEMENTS

Opinion
I have audited the consolidated and separate financial statements of the Council for Scientific and Industrial Research and its subsidiaries set out on pages 132 to 172, which comprise the consolidated and separate statement of financial position as at 31 March 2020, consolidated and separate statement of profit or loss and other comprehensive income, statement of changes in equity and statement of cash flows for the year then ended, as well as the notes to the consolidated and separate financial statements, including a summary of significant accounting policies.

In my opinion, the consolidated and separate financial statements present fairly, in all material respects, the consolidated and separate financial position of the group as at 31 March 2020, and their financial performance and cash flows for the year then ended in accordance with International Financial Reporting Standards (IFRS) and the requirements of the Public Finance Management Act of South Africa, 1999 (Act No. 1 of 1999) (PFMA).

Basis for opinion
I conducted my audit in accordance with the International Standards on Auditing (ISAs). My responsibilities under those standards are further described in the auditor-general's responsibilities for the audit of the consolidated and separate financial statements section of this auditor's report.

I am independent of the group in accordance with sections 290 and 291 of the *Code of ethics for professional accountants* and parts 1 and 3 of the *International Code of Ethics for Professional Accountants (including International Independence Standards)* of the International Ethics Standards Board for Accountants (IESBA codes) as well as the ethical requirements that are relevant to my audit in South Africa. I have fulfilled my other ethical responsibilities in accordance with these requirements and the IESBA codes.

I believe that the audit evidence I have obtained is sufficient and appropriate to provide a basis for my opinion.

Emphasis of matter
I draw attention to the matter below. My opinion is not modified in respect of this matter.

Restatement of corresponding figures
As a result of an error on the financial statements of the entity for the year ended 31 March 2019, the corresponding figures for 31 March 2020 have been restated as a result of an error in the financial statements of the entity for the year ended 31 March 2019.

Responsibilities of the accounting authority for the financial statements
The accounting authority is responsible for the preparation and fair presentation of the consolidated and separate financial statements in accordance with IFRS and the requirements of the PFMA, and for such internal control as the accounting authority determines is necessary to enable the preparation of consolidated and separate financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the consolidated and separate financial statements, the accounting authority is responsible for assessing the group's ability to continue as a going concern, disclosing, as applicable, matters relating to going concern and using the going concern basis of accounting unless the appropriate governance structure either intends to liquidate the group or to cease operations, or has no realistic alternative but to do so.

Auditor-general's responsibilities for the audit of the consolidated and separate financial statements
My objectives are to obtain reasonable assurance about whether the consolidated and separate financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes my opinion. Reasonable assurance is a high level of assurance but is not a guarantee that an audit conducted in accordance with the ISAs will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these consolidated and separate financial statements.

A further description of my responsibilities for the audit of the consolidated and separate financial statements is included in the annexure to this auditor's report.

REPORT ON THE AUDIT OF THE ANNUAL PERFORMANCE REPORT

Introduction and scope

In accordance with the Public Audit Act of South Africa 2004 (Act No. 25 of 2004) (PAA) and the general notice issued in terms thereof, I have a responsibility to report on the usefulness and reliability of the reported performance information against predetermined objectives for selected objective presented in the annual performance report. I performed procedures to identify material findings but not to gather evidence to express assurance.

My procedures address the usefulness and reliability of the reported performance information, which must be based on the approved performance planning documents of the entity. I have not evaluated the completeness and appropriateness of the performance indicators included in the planning documents. My procedures do not examine whether the actions taken by the entity enabled service delivery. My procedures also do not extend to any disclosures or assertions relating to planned performance strategies and information in respect of future periods that may be included as part of the reported performance information. Accordingly, my findings do not extend to these matters.

I evaluated the usefulness and reliability of the reported performance information in accordance with the criteria developed from the performance management and reporting framework, as defined in the general notice, for the following selected objective presented in the annual performance report of the entity for the year ended 31 March 2020:

Objectives	Pages in the annual performance report
SO1 – Conduct research, development and innovation (RD&I), localise transformative technologies and accelerate their diffusion.	71–73

I performed procedures to determine whether the reported performance information was consistent with the approved performance planning documents. I performed further procedures to determine whether the indicators and related targets were measurable and relevant, and assessed the reliability of the reported performance information to determine whether it was valid, accurate and complete.

I did not identify any material findings on the usefulness and reliability of the reported performance information for the selected objective.

Other matter

I draw attention to the matter below.

Achievement of planned targets

Refer to the annual performance report on pages 64 to 83 for information on the achievement of planned targets for the year.

Adjustment of material misstatements

I identified material misstatements in the annual performance report submitted for auditing. These material misstatements were in the reported performance information SO1 – Conduct research, development and innovation (RD&I), localise transformative technologies and accelerate their diffusion. As management subsequently corrected the misstatements, I did not raise any material findings on the usefulness and reliability of the reported performance information.

REPORT OF THE AUDITOR-GENERAL
FOR THE YEAR ENDED **31 MARCH 2020** (CONTINUED)

REPORT ON THE AUDIT OF COMPLIANCE WITH LEGISLATION

Introduction and scope

In accordance with the PAA and the general notice issued in terms thereof, I have a responsibility to report material findings on the entity's compliance with specific matters in key legislation. I performed procedures to identify findings but not to gather evidence to express assurance.

I did not identify any material findings on compliance with the specific matters in key legislation set out in the general notice issued in terms of the PAA.

OTHER INFORMATION

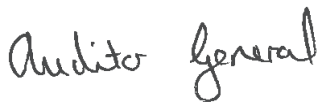
The accounting authority is responsible for the other information. The other information comprises the information included in the annual report. The other information does not include the consolidated and separate financial statements, the auditor's report and those selected objectives presented in the annual performance report that have been specifically reported in this auditor's report.

My opinion on the financial statements and findings on the reported performance information and compliance with legislation do not cover the other information and I do not express an audit opinion or any form of assurance conclusion thereon.

In connection with my audit, my responsibility is to read the other information and, in doing so, consider whether the other information is materially inconsistent with the consolidated and separate financial statements and the selected objectives presented in the annual performance report, or my knowledge obtained in the audit, or otherwise appears to be materially misstated.

I did not receive the other information prior to the date of this auditor's report. When I do receive and read this information, if I conclude that there is a material misstatement therein, I am required to communicate the matter to those charged with governance and request that the other information be corrected. If the other information is not corrected, I may have to retract this auditor's report and re-issue an amended report as appropriate. However, if it is corrected this will not be necessary.
Internal control deficiencies

I considered internal control relevant to my audit of the consolidated and separate financial statements, reported performance information and compliance with applicable legislation; however, my objective was not to express any form of assurance on it. I did not identify any significant deficiencies in internal control.



Pretoria
30 September 2020

AUDITOR-GENERAL
SOUTH AFRICA

Auditing to build public confidence

ANNEXURE – AUDITOR-GENERAL'S RESPONSIBILITY FOR THE AUDIT

As part of an audit in accordance with the ISAs, I exercise professional judgement and maintain professional scepticism throughout my audit of the consolidated and separate financial statements and the procedures performed on reported performance information for selected objectives and on the entity's compliance with respect to the selected subject matters.

Financial statements

In addition to my responsibility for the audit of the consolidated and separate financial statements as described in this auditor's report, I also:

- identify and assess the risks of material misstatement of the consolidated and separate financial statements, whether due to fraud or error; design and perform audit procedures responsive to those risks; and obtain audit evidence that is sufficient and appropriate to provide a basis for my opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations or the override of internal control
- obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control
- evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by the accounting authority
- conclude on the appropriateness of the accounting authority use of the going concern basis of accounting in the preparation of the financial statements. I also conclude, based on the audit evidence obtained, whether a material uncertainty exists relating to events or conditions that may cast significant doubt on the ability of the Council for Scientific and Industrial Research and its subsidiaries to continue as a going concern. If I conclude that a material uncertainty exists, I am required to draw attention in my auditor's report to the related disclosures in the financial statements about the material uncertainty or, if such disclosures are inadequate, to modify my opinion on the financial statements. My conclusions are based on the information available to me at the date of this auditor's report. However, future events or conditions may cause a entity to cease operating as a going concern
- evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and determine whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation
- obtain sufficient appropriate audit evidence regarding the financial information of the entities or business activities within the group to express an opinion on the consolidated financial statements. I am responsible for the direction, supervision and performance of the group audit. I remain solely responsible for my audit opinion.

Communication with those charged with governance

I communicate with the accounting authority regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that I identify during my audit.

I also confirm to the accounting authority that I have complied with relevant ethical requirements regarding independence, and communicate all relationships and other matters that may reasonably be thought to have a bearing on my independence and, where applicable, actions taken to eliminate threats or safeguards applied.

CONSOLIDATED STATEMENT OF PROFIT OR LOSS AND OTHER COMPREHENSIVE INCOME

FOR THE YEAR ENDED **31 MARCH 2020**

		Group		CSIR	
		2020	2019 Restated	2020	2019 Restated
	Note(s)	R '000	R '000	R '000	R '000
Revenue	2	2 758 713	2 578 633	2 758 713	2 578 633
Other income		4 799	2 990	4 790	2 980
Total operating income		2 763 512	2 581 623	2 763 503	2 581 613
Expenses					
Employees' remuneration		(1 454 565)	(1 586 816)	(1 454 565)	(1 586 816)
Depreciation		(62 068)	(65 121)	(62 068)	(65 121)
Operating expenses		(1 240 683)	(970 402)	(1 240 742)	(970 675)
Operating profit (loss)		**6 196**	**(40 716)**	**6 128**	**(40 999)**
Finance income	3	51 423	48 286	50 968	47 830
Finance expense	4	(1 549)	-	(1 549)	-
Share of loss of joint ventures and associates		(98)	(312)	-	-
Profit for the year		**55 972**	**7 258**	**55 547**	**6 831**
Other comprehensive income:					
Items that will not be reclassified to profit or loss:					
Remeasurement of post-retirement medical benefit obligation		(45)	934	(45)	934
Gains on property revaluation		12 965	-	12 965	-
Total items that will not be reclassified to profit or loss		**12 920**	**934**	**12 920**	**934**
Other comprehensive income for the year net of taxation		**12 920**	**934**	**12 920**	**934**
Total comprehensive income for the year		**68 892**	**8 192**	**68 467**	**7 765**

CONSOLIDATED STATEMENT OF FINANCIAL POSITION

AS AT **31 MARCH 2020**

	Note(s)	Group 2020 R '000	Group 2019 R '000	CSIR 2020 R '000	CSIR 2019 R '000
Assets					
Non-current Assets					
Property, plant and equipment	5	756 619	758 672	756 619	758 672
Right-of-use assets	6	17 390	-	17 390	-
Investments in subsidiaries	8	-	-	4 650	4 650
Investments in joint ventures	7	2 417	5 081	2 418	5 083
Trade and other receivables	9	-	292	-	292
		776 426	**764 045**	**781 077**	**768 697**
Current Assets					
Inventories	20	2 726	1 384	2 726	1 384
Other receivables from contracts with customers	21	112 466	116 470	112 466	116 470
Trade and other receivables	9	297 090	195 708	297 054	195 688
Contract assets	22	9 927	6 918	9 927	6 918
Cash and cash equivalents	16	1 253 837	1 241 468	1 245 991	1 234 024
		1 676 046	**1 561 948**	**1 668 164**	**1 554 484**
Total Assets		**2 452 472**	**2 325 993**	**2 449 241**	**2 323 181**
Equity and Liabilities					
Equity					
Reserves		12 965	-	12 965	-
Retained income		1 058 398	1 002 471	1 055 151	999 649
		1 071 363	**1 002 471**	**1 068 116**	**999 649**
Liabilities					
Non-current Liabilities					
Lease liabilities	6	13 871	-	13 871	-
Retirement benefit obligation	11	11 800	10 906	11 800	10 906
		25 671	**10 906**	**25 671**	**10 906**
Current Liabilities					
Trade and other payables	10	391 959	384 977	391 975	384 987
Lease liabilities	6	5 673	-	5 673	-
Advances on contracts with customers	24	945 342	916 452	945 342	916 452
Provisions	23	12 464	11 187	12 464	11 187
		1 355 438	**1 312 616**	**1 355 454**	**1 312 626**
Total Liabilities		**1 381 109**	**1 323 522**	**1 381 125**	**1 323 532**
Total Equity and Liabilities		**2 452 472**	**2 325 993**	**2 449 241**	**2 323 181**

CONSOLIDATED STATEMENT OF CHANGES IN EQUITY

FOR THE YEAR ENDED **31 MARCH 2020**

	Revaluation reserve	Retained income	Total equity
	R '000	R '000	R '000
Group			
Balance at 1 April 2018	**-**	**994 279**	**994 279**
Profit for the year	-	7 258	7 258
Other comprehensive income	-	934	934
Total comprehensive income for the year	**-**	**8 192**	**8 192**
Balance at 1 April 2019	**-**	**1 002 471**	**1 002 471**
Profit for the year	-	55 972	55 972
Other comprehensive income	12 965	(45)	12 920
Total comprehensive income for the year	**12 965**	**55 927**	**68 892**
Balance at 31 March 2020	**12 965**	**1 058 398**	**1 071 363**
CSIR			
Balance at 1 April 2018	**-**	**991 884**	**991 884**
Profit for the year	-	6 831	6 831
Other comprehensive income	-	934	934
Total comprehensive income for the year	**-**	**7 765**	**7 765**
Balance at 1 April 2019	**-**	**999 649**	**999 649**
Profit for the year	-	55 547	55 547
Other comprehensive income	12 965	(45)	12 920
Total comprehensive income for the year	**12 965**	**55 502**	**68 467**
Balance at 31 March 2020	**12 965**	**1 055 151**	**1 068 116**

CONSOLIDATED STATEMENT OF CASH FLOWS

FOR THE YEAR ENDED **31 MARCH 2020**

	Note(s)	Group 2020 R '000	Group 2019 Restated R '000	CSIR 2020 R '000	CSIR 2019 Restated R '000
Cash flows from operating activities					
Cash receipts from external customers		1 918 973	1 836 551	1 918 994	1 836 540
Parliamentary Grant received		758 068	760 092	758 068	760 092
Cash paid to suppliers and employees		(2 676 689)	(2 466 116)	(2 676 657)	(2 466 261)
Cash generated from operations	15	352	130 527	405	130 371
Finance income received		51 955	49 684	51 500	49 363
Finance expense		(103)	-	(103)	-
Net cash from operating activities		**52 204**	**180 211**	**51 802**	**179 734**
Cash flows from investing activities					
Purchase of property, plant and equipment	5	(44 009)	(40 172)	(44 009)	(40 172)
Sale of property, plant and equipment	5	750	686	750	686
Movement in investments (incl subs, JVs & Assoc)		-	(2 067)	-	(2 067)
Loans to Group companies repaid		-	-	-	47
Proceeds from liquidation of Ellipsoid		-	1 150	-	1 150
Net cash from investing activities		**(43 259)**	**(40 403)**	**(43 259)**	**(40 356)**
Cash flows from financing activities					
Payment on lease liabilities		(675)	-	(675)	-
Net cash from financing activities		**(675)**	**-**	**(675)**	**-**
Unrealised exchange gains/(losses) on foreign cash balances		4 099	1 051	4 099	1 051
Total cash movement for the year		**12 369**	**140 859**	**11 967**	**140 429**
Cash at the beginning of the year		1 241 468	1 100 609	1 234 024	1 093 595
Total cash at end of the year	**16**	**1 253 837**	**1 241 468**	**1 245 991**	**1 234 024**

ACCOUNTING POLICIES

ENTITY INFORMATION

The CSIR is a national government business enterprise (enacted by The Scientific Research Council Act, 1988 (Act 46 of 1988) domiciled in the Republic of South Africa. The address of the CSIR's principal place of business is Meiring Naudé Road, Brummeria, Pretoria. The CSIR undertakes directed and particularly multidisciplinary research and technological innovation, to foster, in the national interest and in fields which, in its opinion, should receive preference, industrial and scientific development, either by itself or in co-operation with principals from the private or public sectors, and thereby to contribute to the improvement of the quality of life of the people of the Republic.

The consolidated annual financial statements of the Group as at and for the year ended 31 March 2020 comprise the entity and its subsidiaries (together referred to as the Group) and the Group's interest in associates and jointly controlled entities.

1. SIGNIFICANT ACCOUNTING POLICIES

The principal accounting policies applied in the preparation of these consolidated and separate financial statements are set out below.

1.1 Basis of preparation

The consolidated and separate financial statements have been prepared on the going concern basis in accordance with, and in compliance with, International Financial Reporting Standards ("IFRS") and International Financial Reporting Interpretations Committee ("IFRIC") interpretations issued and effective at the time of preparing these consolidated financial statements and the Public Finance Management Act, 1999 (Act 1 of 1999) as amended by Act 29 of 1999.

These consolidated financial statements comply with the requirements of the South African Institute of Chartered Accountants Financial Reporting Guides as issued by the Accounting Practices Committee and the Financial Reporting Pronouncements as issued by the Financial Reporting Standards Council.

The consolidated financial statements have been prepared on the historic cost convention, unless otherwise stated in the accounting policies, which follows and incorporates the principal accounting policies set out below. They are presented in Rands, which is the Group and entity's functional currency.

These accounting policies are consistent with the previous period, except for policies discussed in changes in accounting policy note.

1.2 Consolidation

Basis of consolidation

The consolidated financial statements incorporate the separate financial statements of the CSIR and all subsidiaries. Subsidiaries are entities (including structured entities) that are controlled by the Group.

The Group has control of an entity when it is exposed to or has rights to variable returns from involvement with the entity and it has the ability to affect those returns through the use of its power over the entity.

The results of subsidiaries are included in the consolidated consolidated financial statements from the effective date of acquisition to the effective date of disposal.

All inter-company transactions, balances, and unrealised gains on transactions between Group companies are eliminated in full on consolidation. Unrealised losses are also eliminated, unless the transaction provides evidence of an impairment of the asset transferred.

Investments in subsidiaries in the separate financial statements

In the CSIR's separate financial statements, investments in subsidiaries are carried at cost less any accumulated impairment losses.

1.3 Joint arrangements

A joint arrangement is an arrangement where two or more parties have joint control. Joint control is the contractually agreed sharing of control of an arrangement, which exists only when decisions about the relevant activities require the unanimous consent of the parties sharing control. A joint arrangement is either a joint operation or a joint venture.

ACCOUNTING POLICIES
1.3 JOINT ARRANGEMENTS (CONTINUED)

A joint operation is a joint arrangement whereby the parties that have joint control of the arrangement have rights to the assets,and obligations for the liabilities, relating to the arrangement. A joint venture is a joint arrangement whereby the parties that have joint control of the arrangement have rights to the net assets of the arrangement. The Group has assessed the nature of its joint arrangements and determined them to be joint ventures.

Joint ventures
An interest in a joint venture is accounted for using the equity method. Under the equity method, interests in joint ventures are carried in the statement of financial position at cost adjusted for post acquisition changes in the CSIR's share of net assets of the joint venture, less any impairment losses.

The Group's share of post-acquisition profit or loss is recognised in profit or loss, and its share of movements in other comprehensive income is recognised in other comprehensive income with a corresponding adjustment to the carrying amount of the investment. Losses in a joint venture in excess of the Group's interest in that joint venture, including any other unsecured losses, are recognised only to the extent that the Group has incurred a legal or constructive obligation to make payments on behalf of the joint venture.

Profits or losses on transactions between the Group and a joint venture are eliminated to the extent of the Group's interest therein. Unrealised losses are eliminated, unless the transaction provides evidence of an impairment of the asset transferred. Accounting policies of joint ventures have been changed where necessary to ensure consistency with the policies adopted by the Group.

Investments in joint ventures in the separate financial statements
In the company's separate financial statements, investments in joint ventures are carried at cost less any accumulated impairment losses.

1.4 Investments in associates

An associate is an entity over which the Group has significant influence and which is neither a subsidiary nor a joint arrangement. Significant influence is the power to participate in the financial and operating policy decisions of the investee but has no control or joint control over those policies. It generally accompanies a shareholding of between 20% and 50% of the voting rights.

Investments in associates are accounted for using the equity method. Under the equity method, investments in associates are carried in the Statement of Financial Position at cost adjusted for post-acquisition changes in the Group's share of net assets of the associate, less any impairment losses.

The Group's share of post-acquisition profit or loss is recognised in profit or loss, and its share of movements in other comprehensive income is recognised in other comprehensive income with a corresponding adjustment to the carrying amount of the investment. Losses in an associate in excess of the Group's interest in that associate, including any other unsecured losses, are recognised only to the extent that the Group has incurred a legal or constructive obligation to make payments on behalf of the associate.

Profits or losses on transactions between the Group and an associate are eliminated to the extent of the Group's interest therein. Unrealised losses are eliminated unless the transaction provides evidence of an impairment of the asset transferred. Accounting policies of associates have been changed where necessary to ensure consistency with the policies adopted by the Group.

1.5 Significant judgements and sources of estimation uncertainty

The preparation of consolidated financial statements in conformity with IFRS requires management, from time to time, to make judgements, estimates and assumptions that affect the application of policies and reported amounts of assets, liabilities, income and expenses. These estimates and associated assumptions are based on experience and various other factors that are believed to be reasonable under the circumstances. Actual results may differ from these estimates. The estimates and underlying assumptions are reviewed on an ongoing basis. Revisions to accounting estimates are recognised in the period in which the estimates are revised and in any future periods affected.

Critical judgements in applying accounting policies
The critical judgements made by management in applying accounting policies, apart from those involving estimations, that have the most significant effect on the amounts recognised in the financial statements, are outlined as follows:

ACCOUNTING POLICIES

1.5 SIGNIFICANT JUDGEMENTS AND SOURCES OF ESTIMATION UNCERTAINTY (CONTINUED)

Lease classification

The Group is party to leasing arrangements, both as a lessee and as a lessor. The treatment of leasing transactions in the consolidated financial statements is mainly determined by whether the lease is considered to be an operating lease or a finance lease. In making this assessment, management considers the substance of the lease, as well as the legal form, and makes a judgement about whether substantially all of the risks and rewards of ownership are transferred. Arrangements that do not take the legal form of a lease but that nevertheless convey the right to use an asset are also covered by such assessments.

Revenue recognition

The nature of the CSIR's business is varied in that there are contracts with customers which give rise to single performance obligations, and others which give rise to multiple performance obligations. Judgement is applied in the determination of distinct performance obligations, as well as to when transfer of control of the identified performance obligations is satisfied. In identifying distinct performance obligations, judgement was applied in assessing whether certain deliverables are separately identifiable from other items to be transferred to the customer in terms of the contract.

Key sources of estimation uncertainty

Impairment of financial assets

As at 31 March 2020, the Group had R35 million (2019: R25 million) in allowance for doubtful accounts for trade and other receivables. The allowance for doubtful accounts is based on assumptions about risk of default and expected loss rates. The Group uses judgement in making these assumptions and selecting the inputs to the calculation of the allowance for doubtful accounts, based on the expected credit losses model (used in IFRS 9).

Impairment testing

Impairment of property, plant and equipment.

At each reporting date, property, plant and equipment in use are assessed for impairment. To assess whether any impairment exists, estimates of expected future cash flows are used. Actual outcomes could vary significantly from such estimates. Factors such as changes in discount rates, the planned use of buildings, machinery or equipment or closure of facilities and technical obsolescence could lead to shorter useful lives or impairment.

Useful lives of property, plant and equipment

Management assess the appropriateness of the useful lives of property, plant and equipment at the end of each reporting period. The useful lives of motor vehicles, furniture and computer equipment are determined based on Group replacement policies for the various assets.

When the estimated useful life of an asset differs from previous estimates, the change is applied prospectively in the determination of the depreciation charge.

Provisions

Provisions are inherently based on assumptions and estimates using the best information available. Additional disclosure of these estimates of provisions are included in note 24.

Estimates of employee benefit liabilities

An updated actuarial valuation is carried out at the end of each financial year for the post-employment liabilities of the Group. Key assumptions used to determine the net assets and liabilities of these obligations and their sensitivities are set out in note 11.

1.6 Property, plant and equipment

Property, plant and equipment are tangible assets that the Group holds for its own use or for rental to others and that are expected to be used for more than one year.

An item of property, plant and equipment is recognised as an asset when it is probable that future economic benefits associated with the item will flow to the Group, and the cost of the item can be measured reliably.

ACCOUNTING POLICIES

1.6 PROPERTY, PLANT AND EQUIPMENT (CONTINUED)

Property, plant and equipment is initially measured at cost. Cost includes all of the expenditure that is directly attributable to the acquisition or construction of the asset, including the capitalisation of borrowing costs on qualifying assets and adjustments in respect of hedge accounting, where appropriate.

Expenditure incurred subsequently for major services, additions to or replacements of parts of property, plant and equipment are capitalised if it is probable that future economic benefits associated with the expenditure will flow to the Group and the cost can be measured reliably. Day to day servicing costs are included in profit or loss in the year in which they are incurred.

Major inspection costs that are a condition of continuing use of an item of property, plant and equipment and that meet the recognition criteria are included as a replacement in the cost of the item of property, plant and equipment. Any remaining inspection costs from the previous inspection are derecognised.

Major spare parts and stand-by equipment that are expected to be used for more than one year are included in property, plant and equipment.

Property, plant and equipment is subsequently stated at cost less accumulated depreciation and any accumulated impairment losses, except for land which is stated at revalued amount less any accumulated impairment losses.

Depreciation of an asset commences when the asset is available for use as intended by management. Depreciation is charged to write off the asset's carrying amount over its estimated useful life to its estimated residual value, using a method that best reflects the pattern in which the asset's economic benefits are consumed by the Group. Leased assets are depreciated in a consistent manner over the shorter of their expected useful lives and the lease term. Depreciation is not charged to an asset if its estimated residual value exceeds or is equal to its carrying amount. Depreciation of an asset ceases at the earlier of the date that the asset is classified as held for sale, or derecognised.

The useful lives of items of property, plant and equipment have been assessed as follows:

Item	Depreciation method	Average useful life
Buildings	Straight line	90 years
Furniture and fixtures	Straight line	3 to 20 years
Motor vehicles	Straight line	10 years
Office equipment	Straight line	3 to 20 years
IT equipment	Straight line	3 to 5 years
Land	Straight line	Indefinite

The residual value, useful life and depreciation method of each asset are reviewed at the end of each reporting year. If the expectations differ from previous estimates, the change is accounted for prospectively as a change in accounting estimate.

Each part of an item of property, plant and equipment with a cost that is significant in relation to the total cost of the item is depreciated separately.

The depreciation charge for each year is recognised in profit or loss, unless it is included in the carrying amount of another asset.

Impairment tests are performed on property, plant and equipment when there is an indicator that they may be impaired. When the carrying amount of an item of property, plant and equipment is assessed to be higher than the estimated recoverable amount, an impairment loss is recognised immediately in profit or loss to bring the carrying amount in line with the recoverable amount.

An item of property, plant and equipment is derecognised upon disposal or when no future economic benefits are expected from its continued use or disposal. Any gain or loss arising from the derecognition of an item of property, plant and equipment, determined as the difference between the net disposal proceeds, if any, and the carrying amount of the item, is included in profit or loss when the item is derecognised.

ACCOUNTING POLICIES

1.7 Financial instruments

Financial instruments held by the Group are classified in accordance with the provisions of IFRS 9 Financial Instruments.

Broadly, the applicable classification possibilities, which are adopted by the Group , are as follows:

Financial assets, which are debt instruments:
- Amortised cost. (This category applies only when the contractual terms of the instrument give rise, on specified dates, to cash flows that are solely payments of principal and interest on principal, and where the instrument is held under a business model whose objective is met by holding the instrument to collect contractual cash flows).

Financial liabilities:
- Amortised cost

Note 14 Financial instruments and risk management presents the financial instruments held by the Group based on their specific classifications.

All regular way purchases or sales of financial assets are recognised and derecognised on a trade date basis. Regular way purchases or sales are purchases or sales of financial assets that require the delivery of assets within the time frame established by regulation or convention in the marketplace.

The specific accounting policies for the classification, recognition and measurement of each type of financial instrument held by the Group are presented below:

Trade and other receivables

Classification
Trade and other receivables, excluding, when applicable, VAT and prepayments, are classified as financial assets subsequently measured at amortised cost (note 9).

They have been classified in this manner because their contractual terms give rise, on specified dates, to cash flows that are solely payments of principal and interest on the principal outstanding.The Group's business model is to collect the contractual cash flows on trade and other receivables.

Recognition and measurement
Trade and other receivables are recognised when the Group becomes a party to the contractual provisions of the receivables. They are measured, at initial recognition, at fair value plus transaction costs, if any.

They are subsequently measured at amortised cost.

The amortised cost is the amount recognised on the receivable initially, minus principal repayments, plus cumulative amortisation (interest) using the effective interest method of any difference between the initial amount and the maturity amount, adjusted for any loss allowance.

Impairment
The Group recognises a loss allowance for expected credit losses on trade and other receivables, excluding VAT and prepayments. The amount of expected credit losses is updated at each reporting date.

The Group measures the loss allowance for trade and other receivables at an amount equal to lifetime expected credit losses (lifetime ECL), which represents the expected credit losses that will result from all possible default events over the expected life of the receivable.

Measurement and recognition of expected credit losses
The Group applies the simplified approach to trade receivables, contract assets and lease receivables of measuring the loss allowance at an amount equal to lifetime expected credit losses in terms of IFRS 9. The Group applies the ECL valuation model as follows:
- It rebuts the more than 30 days past due presumption, instead the CSIR presumes that there is a significant increase in credit risk when

ACCOUNTING POLICIES
1.7 FINANCIAL INSTRUMENTS (CONTINUED)

payments are more than 90 days outstanding from dates of invoices. Based on historical experience for most of the CSIR's debtors if contractual payments become more than 30 days past due, this does not represent a significant increase in the credit risk of a financial instrument. It is rather due to their extensive administrative systems for local debtors, or timing differences in moving money outside of the borders of their countries for international customers instead of financial difficulty of the debtors.

- When a receivable (i.e, an invoice) is more than 90 days outstanding, an allowance for loss is raised, for 100% of the outstanding amount excluding Value Added Tax (thus a 100% loss probability is assumed). However, no allowance is raised when there is a firm commitment by the debtor that they will settle the amount due even if the receivable is more than 90 days outstanding.
- An allowance for loss is raised even if a receivable (invoice) is less than 90 days outstanding when there is evidence indicating a significant increase in credit risk of a debtor.

Write off policy
The Group writes off a receivable when there is information indicating that the counterparty is in severe financial difficulty and there is no realistic prospect of recovery, e.g. when the counterparty has been placed under liquidation or has entered into bankruptcy proceedings. Receivables written off may still be subject to enforcement activities under the Group recovery procedures, taking into account legal advice where appropriate. Any recoveries made are recognised in profit or loss.

Credit risk
Details of credit risk are included in the trade and other receivables note (note 9) and the financial instruments and risk management note (note 14).

Derecognition
Refer to the derecognition section of the accounting policy for the policies and processes related to derecognition.

Trade and other payables

Classification
Trade and other payables (note 10), excluding VAT and amounts received in advance, are classified as financial liabilities subsequently measured at amortised cost.

Recognition and measurement
They are recognised when the Group becomes a party to the contractual provisions, and are measured, at initial recognition, at fair value plus transaction costs, if any.

Trade and other payables expose the Group to liquidity risk and possibly to interest rate risk. Refer to note 14 for details of risk exposure and management thereof.

Trade and other payables denominated in foreign currencies
When trade payables are denominated in a foreign currency, the carrying amount of the payables are determined in the foreign currency. The carrying amount is then translated to the Rand equivalent using the spot rate at the end of each reporting period. Any resulting foreign exchange gains or losses are recognised in profit or loss.

Details of foreign currency risk exposure and the management thereof are provided in the financial instruments and risk management note (note 14).

Derecognition
Refer to the "derecognition" section of the accounting policy for the policies and processes related to derecognition.

Financial guarantee contracts
A financial guarantee contract is a contract that requires the issuer to make specified payments to reimburse the holder for a loss it incurs because a specified debtor fails to make payments when due in accordance with the terms of a debt instrument.

Financial guarantee contracts issued by the Group are initially measured at their fair values and, if not designated as at Fair Value Through Profit or Loss and do not arise from a transfer of a financial asset, are subsequently measured at the higher of:

- The amount of the loss allowance determined in accordance with IFRS 9; and

ACCOUNTING POLICIES
1.7 FINANCIAL INSTRUMENTS (CONTINUED)

- The amount initially recognised less, where appropriate, cumulative amount of income recognised in accordance with the revenue recognition policies.

Refer to note 27 for details of financial guarantee contracts.

Cash and cash equivalents
Cash and cash equivalents are stated at carrying amount which is deemed to be fair value.

Derecognition

Financial assets
The Group derecognises a financial asset only when the contractual rights to the cash flows from the asset expire, or when it transfers the financial asset and substantially all the risks and rewards of ownership of the asset to another party. If the Group neither transfers nor retains substantially all the risks and rewards of ownership and continues to control the transferred asset, the Group recognises its retained interest in the asset and an associated liability for amounts it may have to pay. If the Group retains substantially all the risks and rewards of ownership of a transferred financial asset, the Group continues to recognise the financial asset and also recognises a collateralised borrowing for the proceeds received.

Financial liabilities
The Group derecognises financial liabilities when, and only when, the Group obligations are discharged, cancelled or they expire. The difference between the carrying amount of the financial liability derecognised and the consideration paid and payable, including any non-cash assets transferred or liabilities assumed, is recognised in profit or loss.

1.8 Tax

Income tax
The CSIR is exempt from South African income tax in terms of section 10 (1) (t) (i) of the Income Tax Act, 1962 (Act 58 of 1962).

1.9 Leases

The group assesses whether a contract is, or contains a lease, at the inception of the contract.

A contract is, or contains a lease if the contract conveys the right to control the use of an identified asset for a period of time in exchange for consideration.

In order to assess whether a contract is, or contains a lease, management determine whether the asset under consideration is "identified", which means that the asset is either explicitly or implicitly specified in the contract and that the supplier does not have a substantial right of substitution throughout the period of use. Once management has concluded that the contract deals with an identified asset, the right to control the use thereof is considered. To this end, control over the use of an identified asset only exists when the group has the right to substantially all of the economic benefits from the use of the asset as well as the right to direct the use of the asset.

In circumstances where the determination of whether the contract is or contains a lease requires significant judgement, the relevant disclosures are provided in the significant judgments and sources of estimation uncertainty section of these accounting policies.

Group as lessee
A lease liability and corresponding right-of-use asset are recognised at the lease commencement date, for all lease agreements for which the group is a lessee, except for short-term leases of 12 months or less, or leases of low value assets. For these leases, the group recognises the lease payments as an operating expense on a straight-line basis over the term of the lease unless another systematic basis is more representative of the time pattern in which economic benefits from the leased asset are consumed.

The various lease and non-lease components of contracts containing leases are accounted for separately, with consideration being allocated to each lease component on the basis of the relative stand-alone prices of the lease components and the aggregate stand-alone price of the non-lease components (where non-lease components exist).

ACCOUNTING POLICIES
1.9 LEASES (CONTINUED)

However as an exception to the preceding paragraph, the group has elected not to separate the non-lease components for leases of land and buildings.

Details of leasing arrangements where the group is a lessee are presented in note 6 Leases (group as lessee).

Lease liability
The lease liability is initially measured at the present value of the lease payments that are not paid at the commencement date, discounted by using the rate implicit in the lease. If this rate cannot be readily determined, the group uses its incremental borrowing rate.

Lease payments included in the measurement of the lease liability comprise the following:
- fixed lease payments, including in-substance fixed payments, less any lease incentives;
- variable lease payments that depend on an index or rate, initially measured using the index or rate at the commencement date;
- the amount expected to be payable by the group under residual value guarantees;
- the exercise price of purchase options, if the group is reasonably certain to exercise the option;
- lease payments in an optional renewal period if the group is reasonably certain to exercise an extension option; and
- penalties for early termination of a lease, if the lease term reflects the exercise of an option to terminate the lease.

Variable rents that do not depend on an index or rate are not included in the measurement of the lease liability (or right-of-use asset). The related payments are recognised as an expense in the period incurred and are included in operating expenses (note 6).

The lease liability is presented as a separate line item on the Statement of Financial Position.

The lease liability is subsequently measured by increasing the carrying amount to reflect interest on the lease liability (using the effective interest method) and by reducing the carrying amount to reflect lease payments made. Interest charged on the lease liability is included in finance expense (note 4).

The group remeasures the lease liability (and makes a corresponding adjustment to the related right-of-use asset) when:
- there has been a change to the lease term, in which case the lease liability is remeasured by discounting the revised lease payments using a revised discount rate;
- there has been a change in the assessment of whether the group will exercise a purchase, termination or extension option, in which case the lease liability is remeasured by discounting the revised lease payments using a revised discount rate;
- there has been a change to the lease payments due to a change in an index or a rate, in which case the lease liability is remeasured by discounting the revised lease payments using the initial discount rate (unless the lease payments change is due to a change in a floating interest rate, in which case a revised discount rate is used);
- there has been a change in expected payment under a residual value guarantee, in which case the lease liability is remeasured by discounting the revised lease payments using the initial discount rate;
- a lease contract has been modified and the lease modification is not accounted for as a separate lease, in which case the lease liability is remeasured by discounting the revised payments using a revised discount rate.

When the lease liability is remeasured in this way, a corresponding adjustment is made to the carrying amount of the right-ofuse asset, or is recognised in profit or loss if the carrying amount of the right-of-use asset has been reduced to zero.

Right-of-use assets
Right-of-use assets are presented as a separate line item on the Statement of Financial Position.

Lease payments included in the measurement of the lease liability comprise the following:
- the initial amount of the corresponding lease liability;
- any lease payments made at or before the commencement date;
- any initial direct costs incurred;
- any estimated costs to dismantle and remove the underlying asset or to restore the underlying asset or the site on which it is located, when the group incurs an obligation to do so, unless these costs are incurred to produce inventories; and
- less any lease incentives received.

Right-of-use assets are subsequently measured at cost less accumulated depreciation and impairment losses.

ACCOUNTING POLICIES
1.9 LEASES (CONTINUED)

Right-of-use assets are depreciated over the shorter period of lease term and useful life of the underlying asset. However, if a lease transfers ownership of the underlying asset or the cost of the right-of-use asset reflects that the group expects to exercise a purchase option, the related right-of-use asset is depreciated over the useful life of the underlying asset. Depreciation starts at the commencement date of a lease.

For right-of-use assets which are depreciated over their useful lives, the useful lives are determined consistently with items of the same class of property, plant and equipment. Refer to the accounting policy for property, plant and equipment for details of useful lives.

The residual value, useful life and depreciation method of each asset are reviewed at the end of each reporting year. If the expectations differ from previous estimates, the change is accounted for prospectively as a change in accounting estimate. Each part of a right-of-use asset with a cost that is significant in relation to the total cost of the asset is depreciated separately.

The depreciation charge for each year is recognised in profit or loss unless it is included in the carrying amount of another asset.

Group as lessor
Leases for which the group is a lessor are classified as finance or operating leases. Whenever the terms of the lease transfer substantially all the risks and rewards of ownership to the lessee, the contract is classified as a finance lease. All other leases are classified as operating leases. Lease classification is made at inception and is only reassessed if there is a lease modification.

When the group is an intermediate lessor, it accounts for the head lease and the sublease as two separate contracts. The sublease is classified as a finance or operating lease by reference to the right-of-use asset arising from the head lease. If the head lease is a short-term lease to which the group applies the exemption described previously, then it classifies the sub-lease as an operating lease.

The various lease and non-lease components of contracts containing leases are accounted for separately, with consideration being allocated by applying IFRS 15.

1.10 Inventories

Inventories are measured at the lower of cost and net realisable value on the weighted average method.

Net realisable value is the estimated selling price in the ordinary course of business less the estimated costs of completion and the estimated costs necessary to make the sale.

The cost of inventories comprises of all costs of purchase, costs of conversion and other costs incurred in bringing the inventories to their present location and condition.

Inventories includes a "right to returned goods asset" which represents the group right to recover products from customers where customers exercise their right of return under the group returns policy. The group uses its accumulated historical experience to estimate the number of returns on a portfolio level using the expected value method. A corresponding adjustment is recognised against cost of sales.

1.11 Other receivables from contracts with customers

This accounting policy needs to be read in conjuction with the accounting policies for revenue from contracts with customers, contract assets and advances on contracts with customers. The Group presents as an asset the gross amount due from customers for contract work for all contracts in progress for which costs incurred plus recognised profits (less recognised losses) exceed progress billings. These are included in other receivables from contracts with customers under current assets. Progress billings that are invoiced but not yet paid by customers are included in trade and other receivables.

1.12 Impairment of assets

At each end of the reporting period, the Group assesses at each end of the reporting period whether there is any indication that an asset may be impaired. If any such indication exists, the Group estimates the recoverable amount of the asset.

ACCOUNTING POLICIES
1.12 IMPAIRMENT OF ASSETS (CONTINUED)

Irrespective of whether there is any indication of impairment, the Group also:
- tests intangible assets with an indefinite useful life or intangible assets not yet available for use for impairment annually by comparing its carrying amount with its recoverable amount. This impairment test is performed during the annual period and at the same time every period.
- tests goodwill acquired in a business combination for impairment annually.

If there is any indication that an asset may be impaired, the recoverable amount is estimated for the individual asset. If it is not possible to estimate the recoverable amount of the individual asset, the recoverable amount of the cash-generating unit to which the asset belongs is determined.

The recoverable amount of an asset or a cash-generating unit is the higher of its fair value less costs to sell and its value in use.

If the recoverable amount of an asset is less than its carrying amount, the carrying amount of the asset is reduced to its recoverable amount. That reduction is an impairment loss.

An impairment loss of assets carried at cost less any accumulated depreciation or amortisation is recognised immediately in profit or loss.

An entity assesses at each reporting date whether there is any indication that an impairment loss recognised in prior periods for assets other than goodwill may no longer exist or may have decreased. If any such indication exists, the recoverable amounts of those assets are estimated.

The increased carrying amount of an asset other than goodwill attributable to a reversal of an impairment loss does not exceed the carrying amount that would have been determined had no impairment loss been recognised for the asset in prior periods.

A reversal of an impairment loss of assets carried at cost less accumulated depreciation or amortisation other than goodwill is recognised immediately in profit or loss. Any reversal of an impairment loss of a revalued asset is treated as a revaluation increase.

1.13 Employee benefits

Short-term employee benefits
The cost of short-term employee benefits, (those payable within 12 months after the service is rendered, such as paid vacation leave and sick leave, bonuses, and non-monetary benefits such as medical care), are recognised in the period in which the service is rendered and are not discounted.

The expected cost of compensated absences is recognised as an expense as the employees render services that increase their entitlement or, in the case of non-accumulating absences, when the absence occurs.

Defined contribution plans
Payments to defined contribution retirement benefit plans are charged as an expense as they fall due.

Pension fund

The Group operates a defined contribution plan, the assets of which are held in a separate trustee-administered fund. The benefits payable by the fund in the future, due to retirements and withdrawals from the fund, are contributions to the fund together with fund interest at a rate determined by the valuator with the consent of the trustees. The rate is so determined that the value of the total of the fund shall not exceed the value of the total assets of the fund.

Post-retirement benefits other than pensions

The Group provides post-retirement medical benefits to qualifying employees, which is deemed to be a defined benefit plan. The expected costs of these benefits are determined using the projected unit credit method, with actuarial valuations being carried out at each reporting date. Contributions are made to the relevant funds over the expected service lives of the employees entitled to those funds. The estimated cost of providing such benefits is charged to profit or loss on a systematic basis over the employees' working lives within the Group.

ACCOUNTING POLICIES
1.13 EMPLOYEE BENEFITS (CONTINUED)

Actuarial gains and losses are recognised in other comprehensive income in the year when actuarially determined. The amount recognised in the statement of financial position represents the present value of the post-retirement medical fund benefit obligation. Any asset resulting from this calculation is limited to actuarial losses and the present value of available refunds and reductions in future contributions to the plan.

Defined benefit plans
For defined benefit plans the cost of providing the benefits is determined using the projected unit credit method.

Actuarial valuations are conducted on an annual basis by independent actuaries separately for each plan.

Consideration is given to any event that could impact the funds up to the end of the reporting period where the interim valuation is performed at an earlier date.

Past service costs are recognised immediately to the extent that the benefits are already vested, and are otherwise amortised on a straight line basis over the average period until the amended benefits become vested.

To the extent that, at the beginning of the financial year, any cumulative unrecognised actuarial gain or loss exceeds ten percent of the greater of the present value of the projected benefit obligation and the fair value of the plan assets (the corridor), that portion is recognised in profit or loss over the expected average remaining service lives of participating employees.

Actuarial gains or losses within the corridor are not recognised. Actuarial gains and losses are recognised in the year in which they arise, in other comprehensive income.

Gains or losses on the curtailment or settlement of a defined benefit plan is recognised when the group is demonstrably committed to curtailment or settlement.

When it is virtually certain that another party will reimburse some or all of the expenditure required to settle a defined benefit obligation, the right to reimbursement is recognised as a separate asset. The asset is measured at fair value. In all other respects, the asset is treated in the same way as plan assets. In profit or loss, the expense relating to a defined benefit plan is presented as the net of the amount recognised for a reimbursement.

The amount recognised in the statement of financial position represents the present value of the defined benefit obligation as adjusted for unrecognised actuarial gains and losses and unrecognised past service costs, and reduces by the fair value of plan assets.

Any asset is limited to unrecognised actuarial losses and past service costs, plus the present value of available refunds and reduction in future contributions to the plan.

1.14 Provisions and contingencies

Provisions are recognised when:
- The Group has a present obligation as a result of a past event;
- It is probable that an outflow of resources embodying economic benefits will be required to settle the obligation; and
- A reliable estimate can be made of the obligation.

The amount of a provision is the present value of the expenditure expected to be required to settle the obligation.

A constructive obligation to restructure arises only when an entity:
- Has a detailed formal plan for the restructuring, identifying at least:
  - The business or part of a business concerned;
  - The principal locations affected;
  - The location, function, and approximate number of employees who will be compensated for terminating their services;
  - The expenditures that will be undertaken; and
  - When the plan will be implemented; and
- Has raised a valid expectation with those affected that it will carry out the restructuring by starting to implement that plan or announcing its main features to those affected by it.

Contingent assets and contingent liabilities are not recognised. Contingencies are disclosed in note 13.

ACCOUNTING POLICIES

1.15 Government grants

Government grants are recognised when there is reasonable assurance that:
- The Group will comply with the conditions attached to them; and
- The grants will be received.

Government grants are recognised as income over the periods necessary to match them with the related costs that they are intended to compensate.

A government grant that becomes receivable as compensation for expenses or losses already incurred or for the purpose of giving immediate financial support to the entity with no future related costs is recognised as income for the period in which it becomes receivable.

Government grants related to assets, including non-monetary grants at fair value, are presented in the statement of financial position by deducting the grant to arrive at the carrying amount of the asset.

Grants related to income are presented as a credit in the profit or loss and other comprehensive income.

1.16 Revenue from contracts with customers

The Group derives revenue from contracts with customers for the following:
- Contract income, including CSIR International Convention Centre revenue.
- Operating leases
- Royalty income

The Group measures and accounts for revenue based on the specifications of each individual contract with a customer, excluding any amounts received on behalf of third parties, and based on the contractual obligations either accounts for the revenue at a specific point in time or over time as control of the goods or services are transferred to the customer.

The Group recognises revenue over time if a customer simultaneously receives and consumes all of the benefits provided by the Group. The Group recognises revenue at a point in time if the over time criteria is not met. Revenue is recognised when control is transferred to the customer which is usually when legal title passes to the customer and the business has the right to payment. Refer below for further explanation of the different products and services and when control is transferred to the customer and when the Group has right to payment.

Contract income (including CSIR International Convention Centre revenue).

Contract income comprises the consideration received or receivable on contracts entered into with customers in the ordinary course of the CSIR's activities. Revenue is shown net of amounts collected on behalf of third parties (e.g. VAT). Revenue is recognised at the amount of the transaction price that is allocated to each performance obligation, determined at an amount that depicts the consideration to which CSIR expects to be entitled in exchange for transferring the goods and services promised to the customer. Where a contract contains multiple performance obligations, the transaction price is allocated to each performance obligation based on their relative stand-alone selling prices.

Contract income is recognised when the transfer of control of the identified performance obligation(s) has been satisfied. In term contracts, where milestones and invoicing dates are not aligned, revenue is recognised according to the stage of completion. Stage of completion is measured based on costs incurred as a percentage of total estimated costs required to satisfy the performance obligation.

Operating leases

Contract income from operating leases is recognised on a straight-line basis over the lease term.

Royalty income

Royalties income is recognised when the underlying transactions triggering their payment occurs. Royalty income is measured at the rate per customer contract.

ACCOUNTING POLICIES

1.17 Contract assets and advances on contracts with customers

The accounting policy for contract assets needs to be read in conjunction with the accounting policy for revenue from contract with customers. Contract assets arise on the basis that costs are incurred to satisfy performance obligations, the related payment timing is determined based on each individual contract. These costs include costs to fulfil a contract and includes costs such as direct labour, materials, professional/consulting services and allocation of overhead cost which relate directly to satisfy performance obligations of the contract.

Contract assets are recovered from the customer when the relevant performance obligations are completed and payment can be obtained from the customer. If costs are incurred on a contract without a corresponding payment received it is shown as contract asset at the reporting period.

If the customer has paid in advance for performance obligations it is shown as an advance on contract with customers within current liabilities. The Group presents as a liability the gross amount due to customers for contract work for all contracts in progress for which progress billings exceed costs incurred plus recognised profits (less recognised losses).

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS AS AT **31 MARCH 2020**

	Group		CSIR	
	2020	2019 Restated	2020	2019 Restated
	R '000	R '000	R '000	R '000
2. REVENUE				
Revenue				
Parliamentary Grant	731 202	752 149	731 202	752 149
Contract income	1 834 929	1 610 470	1 834 929	1 610 470
Royalty income	3 616	5 422	3 616	5 422
Other government grants	188 966	210 592	188 966	210 592
	2 758 713	**2 578 633**	**2 758 713**	**2 578 633**
The group disaggregates revenue from customers as follows:				
Parliamentary Grant				
Parliamentary Grant received	758 068	760 092	758 068	760 092
Less:				
Grant received for projects started before year-end but not completed	(46 043)	(19 177)	(46 043)	(19 177)
Add:				
Grant received in prior year for projects completed in this year	19 177	11 234	19 177 1	1 234
	731 202	**752 149**	**731 202**	**752 149**
Contract income				
Local private sector	175 197	188 695	175 197	188 695
Local public sector	1 530 257	1 318 084	1 530 257	1 318 084
International sector (including Africa)	129 475	103 691	129 475	103 691
	1 834 929	**1 610 470**	**1 834 929**	**1 610 470**
Royalty income				
Royalty income	3 616	5 422	3 616	5 422
Other government grants				
Other goverment grants	188 966	210 592	188 966	210 592
Total revenue	**2 758 713**	**2 578 633**	**2 758 713**	**2 578 633**
Parliamentary Grant				
Parliamentary Grant received	27%	29%	27%	29%
Contract income				
Local private sector	5%	7%	5%	7%
Local public sector	56%	51%	56%	51%
International sector (including Africa)	5%	4%	5%	4%
Other government grants				
Other government grants	7%	9%	7%	9%
	100%	**100%**	**100%**	**100%**

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS AS AT **31 MARCH 2020**

2. REVENUE (CONTINUED)

Included in public sector contract income is R74 million (2019: R78 million) ring-fenced allocation from the Department of Science and Innovation for specific initiatives managed through memorandums of agreement.

Included in contract income is rental income amounting to R54 million (2019: R54 million) and revenue of R36,7 million (2019: R35,8 million) earned by the CSIR International Convention Centre.

Estimates on Parliamentary Grant recognition are based on cost to completion, budgets and percentage of completion.

Other government grants relate to income from contracts with government that impose specified performance conditions on the CSIR .

	Group		CSIR	
	2020	2019	2020	2019
	R '000	R '000	R '000	R '000
3. FINANCE INCOME				
Interest income				
Investments in financial assets:				
Interest on bank balances and investments	51 423	48 286	50 968	47 830
Finance income				
Interest on bank balances and investments	51 343	47 955	50 888	47 499
Interest on trade and other receivables	80	331	80	331
Total	**51 423**	**48 286**	**50 968**	**47 830**
4. FINANCE EXPENSE				
Finance leases	1 549	-	1 549	-

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS AS AT **31 MARCH 2020**

5. PROPERTY, PLANT AND EQUIPMENT

Figures in Rand thousand	2020 Cost or revaluation	2020 Accumulated depreciation	2020 Carrying value	2019 Cost or revaluation	2019 Accumulated depreciation	2019 Carrying value
Group						
Land	138 400	-	138 400	125 435	-	125 435
Buildings	517 917	(85 568)	432 349	502 059	(79 951)	422 108
Furniture and fixtures	15 870	(12 351)	3 519	15 807	(11 449)	4 358
Motor vehicles	8 401	(6 539)	1 862	8 549	(6 410)	2 139
Office equipment	538 187	(397 612)	140 575	528 030	(368 168)	159 862
IT equipment	197 217	(157 303)	39 914	197 095	(152 325)	44 770
Total	**1 415 992**	**(659 373)**	**756 619**	**1 376 975**	**(618 303)**	**758 672**

Figures in Rand thousand	2020 Cost or revaluation	2020 Accumulated depreciation	2020 Carrying value	2019 Cost or revaluation	2019 Accumulated depreciation	2019 Carrying value
CSIR						
Land	138 400	-	138 400	125 435	-	125 435
Buildings	517 917	(85 568)	432 349	502 059	(79 951)	422 108
Furniture and fixtures	15 870	(12 351)	3 519	15 807	(11 449)	4 358
Motor vehicles	8 401	(6 539)	1 862	8 549	(6 410)	2 139
Office equipment	538 187	(397 612)	140 575	528 030	(368 168)	159 862
IT equipment	197 217	(157 303)	39 914	197 095	(152 325)	44 770
Total	**1 415 992**	**(659 373)**	**756 619**	**1 376 975**	**(618 303)**	**758 672**

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS AS AT **31 MARCH 2020**

5. PROPERTY, PLANT AND EQUIPMENT (CONTINUED)

Reconciliation of property, plant and equipment - Group - 2020

	Opening balance	Additions	Disposals	Revaluations	Depreciation	Total
Land	125 435	-	-	12 965	-	138 400
Buildings	422 108	15 858	-	-	(5 617)	432 349
Furniture and fixtures	4 358	132	(8)	-	(963)	3 519
Motor vehicles	2 139	-	-	-	(277)	1 862
Office equipment	159 862	13 337	(97)	-	(32 527)	140 575
IT equipment	44 770 1	4 682	(349)	-	(19 189)	39 914
	758 672	**44 009**	**(454)**	**12 965**	**(58 573)**	**756 619**

Reconciliation of property, plant and equipment - Group - 2019

	Opening balance	Additions	Disposals	Depreciation	Total
Land	125 435	-	-	-	125 435
Buildings	417 150	10 417	-	(5 459)	422 108
Furniture and fixtures	4 894	559	(15)	(1 080)	4 358
Motor vehicles	1 920	552	-	(333)	2 139
Office equipment	174 944	20 220	(313)	(34 989)	159 862
IT equipment	60 020	8 424	(414)	(23 260)	44 770
	784 363	**40 172**	**(742)**	**(65 121)**	**758 672**

Reconciliation of property, plant and equipment - CSIR - 2020

	Opening balance	Additions	Disposals	Revaluations	Depreciation	Total
Land	125 435	-	-	12 965	-	138 400
Buildings	422 108	15 858	-	-	(5 617)	432 349
Furniture and fixtures	4 358	132	(8)	-	(963)	3 519
Motor vehicles	2 139	-	-	-	(277)	1 862
Office equipment	159 862	13 337	(97)	-	(32 527)	140 575
IT equipment	44 770	14 682	(349)	-	(19 189)	39 914
	758 672	**44 009**	**(454)**	**12 965**	**(58 573)**	**756 619**

Reconciliation of property, plant and equipment - CSIR - 2019

	Opening balance	Additions	Disposals	Depreciation	Total
Land	125 435	-	-	-	125 435
Buildings	417 150	10 417	-	(5 459)	422 108
Furniture and fixtures	4 894	560	(15)	(1 081)	4 358
Motor vehicles	1 920	552	-	(333)	2 139
Office equipment	174 944	20 220	(313)	(34 989)	159 862
IT equipment	60 020	8 423	(414)	(23 259)	44 770
	784 363	**40 172**	**(742)**	**(65 121)**	**758 672**

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS AS AT **31 MARCH 2020**

5. PROPERTY, PLANT AND EQUIPMENT (CONTINUED)

Revaluations

The group's land is stated at revalued amounts, being the fair value at the date of revaluation, less any subsequent accumulated impairment losses. Revaluations are performed every five years and in intervening years if the carrying amount of the land differs materially from their fair value.

The fair value measurements as of Tuesday, 31 March 2020 were performed by Mr Potela Peter Mabelane, an independent valuer not related to the group. Mr Mabelane is a member of the South African Council for the Property Valuers Profession and has the appropriate qualifications and recent experience in the fair value measurement of properties in the relevant locations.

	Group		CSIR	
	2020	2019	2020	2019
	R '000	R '000	R '000	R '000
The carrying value of the revalued assets under the cost model would have been:				
Land	125 435	125 435	125 435	125 435

Details of properties

Land and buildings are unencumbered and full details of the titles are available at the registered office of the CSIR.

A change in the depreciation estimate due to a change in the useful lives of equipment, ICT equipment, furniture and fittings and vehicles resulted in a R3,9 million (2019: R4,7 million) decrease in the depreciation amount for the current financial year.

During the current financial year, assets to the value of R41,9 million (2019: R34,1 million) were purchased with Government grant funds. At year-end, the cumulative value of assets purchased with Government grant funds and shown at a nil cost is R762,3 million (2019: R728,6 million).

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS AS AT **31 MARCH 2020**

6. LEASES (GROUP AS LESSEE)

The group leases several assets, including buildings, motor vehicles and office equipment. The average lease term is four years.

Details pertaining to leasing arrangements, where the group is lessee are presented below:

The group adopted IFRS 16 for the first time in the current financial period. Comparative figures have been accounted for in accordance with IAS 17. The information presented in this note for right-of-use assets therefore only includes the current period.

	Group		CSIR	
	2020	2019	2020	2019
	R '000	R '000	R '000	R '000
Net carrying amounts of right-of-use assets				
The carrying amounts of right-of-use assets are included in the following line items:				
Buildings	16 544	-	16 544	-
Motor vehicles	625	-	625	-
Office equipment	221	-	221	-
	17 390	**-**	**17 390**	**-**
Additions to right-of-use assets				
Buildings	19 357	-	19 357	-
Motor vehicles	1 252	-	1 252	-
Office equipment	276	-	276	-
	20 885	**-**	**20 885**	**-**
Depreciation recognised on right-of-use assets				
Depreciation recognised on each class of right-of-use assets, is presented below.				
Buildings	2 813	-	2 813	-
Motor vehicles	627	-	627	-
Office equipment	55	-	55	-
	3 495	**-**	**3 495**	**-**
Other disclosures				
Interest expense on lease liabilities	1 549	-	1 549	-
Lease liabilities				
The maturity analysis of lease liabilities is as follows:				
Within one year	6 335	-	6 335	-
Two to five years	16 507	-	16 507	-
More than five years	1 858		1 858	
	24 700	**-**	**24 700**	**-**
Non-current liabilities	13 871	-	13 871	-
Current liabilities	5 673	-	5 673	-
	19 544	**-**	**19 544**	**-**

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS AS AT **31 MARCH 2020**

7. INTEREST IN JOINT VENTURE AND ASSOCIATE

	Group		CSIR	
	2020	2019	2020	2019
	R '000	R '000	R '000	R '000
Joint venture and associate				
Cost of investments	25 254	25 254	26 325	26 325
Loans to joint venture and associate	18 116	18 116	18 116	18 116
Share of post-acquisition losses of joint venture	(14 879)	(14 993)	-	-
Share of post-acquisition losses of associate	(5 746)	(5 455)	-	-
Subtotal	22 745	22 922	44 441	44 441
Impairment of joint venture and associate	(20 328)	(17 839)	(42 023)	(39 358)
	2 417	**5 083**	**2 418**	**5 083**

The loans to joint venture and associate are interest free, unsecured and have no fixed terms of repayment. In substance, they form part of the Group's net investment in joint venture and associate.

On 11 April 2018, liquidation of the Group's joint venture, Ellipsoid (Pty) Ltd, was completed. CSIR had 50% ownership interest in the joint venture. A liquidation dividend of R 1,15 million was received. The loss on liquidation of R 0,43 million was recognised in other expenses in 2019.

Joint venture and associate

The following tables list all of the joint venture and associate in the group:

Group

Name of company	Place of incorporation	Principal activity	Financial year-end	% ownership interest	% ownership interest	Carrying amount	Carrying amount
				2020	2019	2020	2019
Joint venture							
Sera (Pty) Ltd	South Africa	Commercialisation and licensing of patents	31 March	50,00 %	50,00 %	3 238	3 123
Associate							
Persomics AB	Sweden	Commercialisation of novel printing technology	31 December	35,03 %	38,02 %	19 508	19 799
Impairment of investment						22 746 (20 329)	22 922 (17 839)
						2 417	**5 083**

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS AS AT **31 MARCH 2020**

7. INTEREST IN JOINT VENTURE AND ASSOCIATE (CONTINUED)

The following are details of the significant joint venture and associate assets, liabilities, income and expenses:

	JOINT VENTURE		ASSOCIATE	
	2020	2019	2020	2019
Current assets	4 826	4 638	284	218
Non-current assets	33 665	33 665	7 511	22 901
Current liabilities	33 693	33 693	898	840
Non-current liabilities	36 232	36 232	6 304	6 521
Income	252	225	6	-
Expenses	24	24	621	1 149

8. INTERESTS IN SUBSIDIARIES INCLUDING CONSOLIDATED STRUCTURED ENTITIES

	Group		CSIR	
	2020	2019	2020	2019
	R '000	R '000	R '000	R '000
Shares at cost less impairment losses	-	-	4 650	4 650
Indebtedness				
- by subsidiaries	-	-	7 976	7 976
- impairment of loans	-	-	(7 976)	(7 976)
	-	**-**	**4 650**	**4 650**

Indebtedness
The loans to subsidiaries are interest free, unsecured and have no fixed terms of repayment.

Agreements have been entered into between the CSIR and certain subsidiaries to subordinate the loans made to those subsidiaries. The subordination agreements will remain in force for as long as the liabilities of the relevant subsidiaries exceed their assets, fairly valued. The following table lists the entities that are controlled directly by the CSIR, and the carrying amounts of the investments in the CSIR's separate financial statements.

CSIR

Name of company	Held by	% voting power	% voting power	% holding	% holding	Carrying amount	Carrying amount
		2020	2019	2020	2019	2020	2019
Technology Finance Corporation SOC Ltd	CSIR	100,00 %	100,00 %	100,00 %	100,00 %	4 650	4 650
Technovent SOC Ltd	CSIR	100,00 %	100,00 %	100,00 %	100,00 %	-	-
						4 650	**4 650**

Subsidiaries under the process of de-registration
Subsidiary Technovent SOC is being deregistered. Request for deregistration was filed at the Companies and Intellectual Property Commission on Thursday, 5 March 2020.

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS AS AT **31 MARCH 2020**

9. TRADE AND OTHER RECEIVABLES

	Group		CSIR	
	2020	2019	2020	2019
	R '000	R '000	R '000	R '000
Financial instruments:				
Trade receivables	288 824	78 407	288 798	178 399
Accrued income	10	12	-	-
Loss allowance	(35 208)	(25 006)	(35 208)	(25 006)
Trade receivables at amortised cost	253 626	153 413	253 590 1	53 393
Other receivables	2 727	10 192	2 727	10 192
Non-financial instruments:				
Prepayments	40 737	32 395	40 737	32 395
Total trade and other receivables	**297 090**	**196 000**	**297 054**	**195 980**
Split between non-current and current portions				
Non-current assets	-	292	-	292
Current assets	297 090	195 708	297 054	195 688
	297 090	**196 000**	**297 054**	**195 980**

Trade receivables are shown net of impairment losses. Refer to note 14 for more details on trade receivables. Included in other receivables is an amount of R0,60 million (2019: R0,87 million) relating to the sale of an associate in the 2015/16 financial year. The initial payment of R10 million was received in April 2016 with the balance of R1,75 million being payable by 29 September 2020. Also included in other receivables in 2019 is an amount of R1,72 million for the sale of Erf 1281 Summerstrand. The CSIR and Nelson Mandela Metropolitan University (NMMU) entered into an agreement to sell Erf 1281 Summerstrand to NMMU in the 2016/17 financial year.

	Group		CSIR	
	2020	2019	2020	2019
	R '000	R '000	R '000	R '000
Rand Amount				
Rand	256 353	-	256 317	-

10. TRADE AND OTHER PAYABLES

	Group		CSIR	
	2020	2019	2020	2019
	R '000	R '000	R '000	R '000
Financial instruments:				
Trade payables	283 104	295 642	283 120	295 652
Salary related payables	52 752	49 572	52 752	49 572
Non-financial instruments:				
VAT	56 103	39 763	56 103	39 763
	391 959	**384 977**	**391 975**	**384 987**

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS AS AT **31 MARCH 2020**

11. RETIREMENT BENEFITS OF EMPLOYEES

CSIR Pension Fund

The fund is registered in terms of the Pension Funds Act, 1956 (Act 24 of 1956), and is a defined contribution plan. The CSIR's liability to the fund was limited to paying the employer contributions up until 29 February 2016. The impact of the tax reform effective from 1 March 2016 is that the CSIR package structure was changed to reflect all retirement fund contributions as employee contributions. All permanent CSIR employees are members of the fund.

Employee contributions of R178,1 million (2019: R191,4 million) were expensed during the year.

Associated Institutions Pension Fund (AIPF)

The fund is a defined benefit plan. The formula used to determine pensions is based on the pensionable earnings of the final year, and the aggregate period of uninterrupted membership.

The CSIR has one employee (2019: one employee) who is a member of the AIPF as at 31 March 2020. The fund is controlled by the state, which has assumed responsibility for the unfunded portion of this fund.

Employee contributions of R12 101 (2019: R13 855) were expensed during the year.

Post-retirement medical benefits

The CSIR has a post-retirement medical benefit obligation to certain qualifying retired CSIR employees (pensioners) who joined the CSIR prior to 30 September 1996. An offer was made to qualifying pensioners in December 2005 to accept an annuity, payable from an independent source, equivalent to the value of their medical subsidy. The pensioners who accepted the offer are no longer entitled to a subsidy from the CSIR.

The accumulated benefit obligation and the annual cost of accrual of benefits are assessed by independent, qualified actuaries using the projected unit credit method. The estimated present value of the anticipated expenditure for the remaining 18 continuation members (2019: 18 continuation members) was recalculated by the actuaries as at 31 March 2020 and will be funded through cash and cash equivalents. These cash and cash equivalents have not been set aside specifically for this benefit.

The amount included in the statement of financial position arising from the CSIR's obligation in respect of post-retirement medical benefits is as follows:

	Group		CSIR	
	2020	2019	2020	2019
	R '000	R '000	R '000	R '000
Carrying value				
Present value of the defined benefit obligation-wholly unfunded	(11 800)	(10 906)	(11 800)	(10 906)

Amounts recognised in the statement of profit or loss and other comprehensive income in respect of the scheme are as follows:

Net amount recognised				
Interest cost	849	877	849	877
Actuarial (gain) loss	45	(934)	45	(934)
	894	**(57)**	**894**	**(57)**
Movements for the year				
Opening balance	10 906	10 963	10 906	10 963
Net expense recognised in profit or loss	894	(57)	894	(57)
Net liability at the end of the year	**11 800**	**10 906**	**11 800**	**10 906**

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS AS AT **31 MARCH 2020**

11. RETIREMENT BENEFITS OF EMPLOYEES (CONTINUED)

	Group		CSIR	
	2020	2019	2020	2019
	R '000	R '000	R '000	R '000
Key assumptions used				
Principal actuarial assumptions at the reporting date.				
Discount rates used	9,73 %	8,00 %	9,73 %	8,00 %
Expected rate of return on assets	4,42 %	5,80 %	4,42 %	5,80 %

The above results are sensitive to changes in the assumed future rate of medical inflation.

Defined contribution plan

The effect of a one percent increase in the assumed future rate of medical inflation would have the following effects.

The total group contribution to such schemes	636	694	636	694

The effect of a one percent decrease in the assumed future rate of medical inflation would have the following effects:

Effect on defined benefit obligation	(583)	(526)	(583)	(526)

The above sensitivity analyses are based on a change in an assumption while all other assumptions are assumed to remain unchanged. This may not always be realistic as some of the assumptions tend to be correlated. When calculating the sensitivity of the defined benefit obligation to significant actuarial assumptions, the same method (present value of the defined benefit obligation calculated with the projected unit credit method at the end of the reporting period) has been applied as when calculating the liability recognised within the statement of financial position.

Historical information (R'000):	2020	2019	2018	2017	2016
Present value of the defined benefit obligation	11 800	10 906	10 963	10 764	10 695

The average term (undiscounted) of the defined benefit obligation is 8.8 years (2019: 8.2 years) and the average duration (discounted) of the defined benefit obligation is 5.6 years (2019: 5.7 years).

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS AS AT **31 MARCH 2020**

12. BOARD MEMBERS, DIRECTORS AND EXECUTIVE MANAGEMENT'S REMUNERATION

2020	Emoluments	Other benefits*	Compensation for loss of office	Directors' fees	Total
Board members and Executive Directors					
Dr TH Dlamini	5 001	-	-	-	5 001
Non-executive Board members					
Prof. T Majozi	-	-	-	439	439
Dr AR Childs	-	-	-	128	128
Dr R Masango	-	-	-	163	163
Mr S Masie	-	-	-	105	105
Ms T Mokhabuki	-	-	-	93	93
Dr Mthethwa	-	-	-	175	175
Mr J Netshitenzhe	-	-	-	101	101
Dr C Render	-	-	-	175	175
Mr CE Shariff	-	-	-	175	175
Executive Management					
Mrs C Howell (acting CFO 1 July to 6 December 2019)	950	50	-	-	1 000
Ms SM Bhengu	33	-	3 000	-	3 033
Dr RK Chikwamba	3 255	-	-	-	3 255
Dr MS Maserumule	3 565	-	-	-	3 565
Ms ZL Ngwepe	519	10	-	-	529
Mr MC Mabindisa (acting HR Executive from 1 April 2019)	1 977	-	-	-	1 977
Mrs PN Monama (acting CFO from 6 December 2019)	705	-	-	-	705
Ms K Njobe (from 1 March 2019)	2 620	-	-	-	2 620
Adv. E Kennedy	2 610	-	-	-	2 610
	21 235	**60**	**3 000**	**1 554**	**25 849**

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS AS AT **31 MARCH 2020**

12. BOARD MEMBERS, DIRECTORS AND EXECUTIVE MANAGEMENT'S REMUNERATION (CONTINUED)

2019	Emoluments	Other benefits*	Directors' fees	Total
Board members and Executive Directors				
Dr TH Dlamini	4 675	-	-	4 675
Non-executive Board members				
Prof. T Majozi	-	-	475	475
Adv. G Badela	-	-	94	94
Dr AR Childs	-	-	35	35
Dr PH Goyns	-	-	176	176
Dr A Llobell	-	-	47	47
Dr R Masango	-	-	187	187
Ms M Maseko	-	-	35	35
Ms T Mokhabuki	-	-	35	35
Mr S Masie	-	-	35	35
Dr V Mthethwa	-	-	47	47
Mr J Netshitenzhe	-	-	132	132
Ms A Noah	-	-	94	94
Dr C Render	-	-	23	23
Mr CE Shariff	-	-	47	47
Ms SM Bhengu	2 794	-	-	2 794
Dr RK Chikwamba	2 840	-	-	2 840
Dr M Motuku	2 413	87	-	2 500
Ms ZL Ngwepe	2 398	-	-	2 398
Adv E Kennedy (from 1 August 2018)	1 686	-	-	1 686
Ms K Njobe (from 1 March 2019)	212	-	-	212
	17 018	**87**	**1 462**	**18 567**

** Accrued leave paid out at end of contract.*

13. CONTINGENCIES

In the nature of the CSIR's business, agreements with complex deliverables may be entered into. All necessary steps are taken to manage the risks inherent to these transactions. If and when it is evident that there is a reasonable probability that a dispute on a transaction could lead to costs against the CSIR, such costs will be disclosed. Refer to note 27 for financial guarantees issued by the CSIR.

14. FINANCIAL INSTRUMENTS AND RISK MANAGEMENT

Financial risk management

Overview

The group is exposed to the following risks from its use of financial instruments:

- Credit risk;
- Liquidity risk; and
- Market risk (currency risk, interest rate risk and price risk).

This note presents information about the Group's exposure to each of the above risks and the Group's objectives, policies and processes for measuring and managing risk. Further quantitative disclosures are included throughout these consolidated financial statements.

The Board has overall responsibility for the establishment and oversight of the Group's risk management framework.

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS AS AT **31 MARCH 2020**

14. FINANCIAL INSTRUMENTS AND RISK MANAGEMENT (CONTINUED)

The Group's risk management policies are established to identify and analyse the risks faced by the Group to set appropriate risk limits and controls, and monitor risks and adherence to limits. Risk management policies and systems are reviewed regularly to reflect changes in market conditions and the Group's activities. The Group, through its training and management standards and procedures, aims to develop a disciplined and constructive control environment in which all employees understand their roles and obligations.

The Audit and Risk Committee oversees how management monitors compliance with the Group's risk management policies and procedures and reviews the adequacy of the risk management framework in relation to the risks faced by the Group. The Group Audit and Risk Committee is assisted in its oversight role by Internal Audit. Internal Audit undertakes both regular and ad hoc reviews of risk management controls and procedures, the results of which are reported to the Audit and Risk Committee.

The estimated net fair values, as at the reporting date, have been determined using available market information and appropriate valuation methodologies as outlined below. This value is not necessarily indicative of the amounts that the Group could realise in the normal course of business. The fair values of the financial assets and financial liabilities are sensitive to exchange rate movements. A sensitivity analysis of a 10% increase/decrease in exchange rate fluctuation on the bank balances held in foreign currency bank accounts as at 31 March 2020 is performed. The fair value of receivables, bank balances, repurchase agreements and other liquid funds, payables and accruals, approximate their carrying amount due to the short-term maturities of these instruments.

14.1 Market risk

Market risk is the risk that changes in market prices, such as foreign exchange rates and interest rates, which affect the Group's income or the value of its holdings of financial instruments. The objective of market risk management is to manage and control market risk exposures within acceptable parameters, while optimising the return.

Foreign currency risk

The Group is exposed to currency risk on sales and purchases that are denominated in a currency other than the respective functional currency of the Group entities.

The Group enters into forward exchange contracts to buy specified amounts of foreign currencies in the future at a predetermined exchange rate.

Forward exchange contracts are entered into mainly to cover import orders. The Group has no policy to enter into forward exchange contracts for anticipated foreign receipts. The Group does not use derivative financial instruments for speculative purposes.

The Group's exposure to foreign currency risk was as follows:

	ZAR	EURO	USD	GBP	OTHER	Total
31 March 2020	R'000	R'000	R'000	R'000	R'000	R'000
Trade receivables	201 322	22 099	45 886	2 323	737	272 367
Bank accounts	52 505	4 597	15 903	4 563	1 523	79 091
Trade and other payables	(391 393)	(176)	(387)	-	-	(391 956)
Gross statement of financial position exposure	(137 566)	26 520	61 402	6 886	2 260	(40 498)
Net exposure	**(137 566)**	**26 520**	**61 402**	**6 886**	**2 260**	**(40 498)**

	ZAR	EURO	USD	GBP	OTHER	Total
31 March 2019	R'000	R'000	R'000	R'000	R'000	R'000
Trade receivables	137 170	3 518	9 807	2 239	679	153 413
Bank accounts	93 986	1 030	26 299	5 964	733	128 012
Trade and other payables	(383 199)	(413)	(938)	(419)	-	(384 969)
Gross statement of financial position exposure	137 170	137 170	137 170	137 170	137 170	(103 544)
Net exposure	**(152 043)**	**4 135**	**35 168**	**7 784**	**1 412**	**(103 544)**

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS AS AT **31 MARCH 2020**

14.1 MARKET RISK (CONTINUED)

The following closing exchange rates were applied at reporting date:

	Group	
	2020	2019
	R '000	R '000
Rand per unit of foreign currency:		
USD	18,158	14,213
Euro	20,045	15,919
GBP	22,438	18,438

Sensitivity analysis

A 10% strengthening of the rand against the following currencies at 31 March would have decreased profit or loss by the amounts shown below. This analysis assumes that all other variables remain constant. The analysis is performed on the same basis for 2019.

Euro	(2 652)	(141)
USD	(6 140)	(3 517)
GBP	(689)	(778)
Other	(74)	(141)

Interest rate risk

Interest rate exposure and investment strategies are evaluated by management on a regular basis. Interest-bearing investments are held with several reputable banks in order to minimise exposure.

At the reporting date, the interest rate profile of the Group's interest-bearing financial instruments was as follows:

Fixed rate instruments: Carrying amount		
Financial assets: Fixed deposits	1 078 656	1 072 842

The Group does not account for any fixed rate financial assets and liabilities at fair value through profit or loss, and the Group does not designate derivatives as hedging instruments under a fair value hedge accounting model. Therefore, a change in interest rates at the reporting date would not affect profit or loss.

Variable rate instruments: Carrying amount		
Financial assets: Call deposits	97 500	40 500
Financial assets: Bank balances	77 567	128 012
	175 067	**168 512**

Sensitivity analysis

An increase of 100 basis points in interest rates at the reporting date would have increased the equity and profit and loss by the amounts shown below. This analysis assumes that all other variables, in particular foreign currency rates, remain constant. The analysis is performed on the same basis for 2019.

Variable rate instruments	1 751	1 685

A decrease of 100 basis points would have had the equal but opposite effect to the amounts shown above

14.2 Credit risk

Credit risk is the risk of financial loss to the Group if a customer or counterparty to a financial instrument fails to meet its contractual obligations, and arises principally from the Group's bank balances and deposits, trade and other receivables and loans to joint ventures, associates and subsidiaries.

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS AS AT **31 MARCH 2020**

14.2 CREDIT RISK (CONTINUED)

Trade and other receivables and loans to joint ventures, associates and subsidiaries

Trade and other receivables and loans to joint ventures, associates and subsidiaries are presented net of impairment losses. Credit risk with respect to trade receivables is limited due to the large number of customers comprising the Group's customer base and their dispersion across different industries and geographical areas.

Bank balances and deposits

The Group's bank balances and cash are placed with high credit, quality financial institutions with no significant exposure to any one financial institution.

Guarantees

Refer to note 27 for details on bank guarantees issued with respect to facilities.

Exposure to credit risk

The carrying amount of financial assets represents the maximum credit exposure.

	Group	
	2020	2019
	R '000	R '000
The maximum exposure to credit risk at the reporting date was:		
Current fixed deposits	1 078 656	1 072 842
Call deposits	97 500	40 500
Bank balances	77 567	128 012
Cash on hand and cash deposits	114	114
Trade and other receivables	297 090	196 000
Contracts in progress less provision for losses	112 466	116 470
	1 663 393	**1 553 938**

The maximum exposure to credit risk for trade receivables at the reporting date by type of customer was:

Local public sector	121 083	84 588
Local private sector	38 532	53 278
International sector	77 545	15 215
	237 160	**153 081**

The Group's most significant customers are various local public sector customers.

The aging of the Group's trade receivables at the reporting date was:

	Gross	Impairment	Gross	Impairment
	2020	2020	2019	2019
	R'000	R'000	R'000	R'000
Not past due	195 594	-	95 876	-
Past due 0 – 30 days	19 833	250	31 977	111
Past due 31 – 120 days	20 590	4 068	12 782	1 280
Past due more than 120 days	36 350	30 889	37 418	23 623
	272 367	**35 207**	**178 053**	**25 014**

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS AS AT **31 MARCH 2020**

14.2 CREDIT RISK (CONTINUED)

The movement in the allowance for impairment in respect of trade receivables during the year was as follows:

	Group 2020 R'000	Group 2019 R'000
Balance at 1 April	25 006	17 252
Movement for the year		
Recoveries	(248)	(4 601)
Utilisation	(6 324)	12 217
New impairment allowances	16 773	138
Balance at 31 March	**35 207**	**25 006**

The allowance account in respect of trade receivables is used to record impairment losses, unless the Group is satisfied that no recovery of the amount owing is possible. At that point, the amount considered irrecoverable is written off against the financial asset directly.

The fully performing trade receivables are considered to be of high credit quality.

14.3 Liquidity risk

Liquidity risk is the risk that the Group will not be able to meet its financial obligations as these fall due. The Group's approach to managing liquidity is to ensure, as far as possible, that it will always have sufficient liquidity to meet its liabilities when due, under both normal and stressed conditions, without incurring unacceptable losses or risking damage to the Group's reputation.

The Group monitors its cash flow on a daily basis. Typically, the Group ensures that it has sufficient cash on demand to meet expected operational expenses for a period of 60 days, including the servicing of financial obligations; this excludes the potential impact of extreme circumstances that cannot be predicted reasonably, such as natural disasters.

The following are the contractual maturities of financial liabilities, including interest payments, but excluding the impact of netting agreements for the Group:

	2020			2019		
	Contractual cash flows			Contractual cash flows		
Non-derivative financial liabilities	Carrying amount	6 months or less	6 - 12 months	Carrying amount	6 months or less	6 - 12 months
	R'000	R'000	R'000	R'000	R'000	R'000
Trade and other payables	(391 956)	(391 956)	-	(384 975)	(384 975)	-

14.4 Fair values

As at 31 March 2020 the carrying amount of bank balances and cash, deposits, trade and other receivables, contracts in progress and trade and other payables approximated their fair values due to the short-term maturities of these assets and liabilities.

Basis for determining fair values

Trade and other receivables and trade and other payables

The fair value of trade and other receivables and trade and other payables is calculated based on the present value of future cash flows, discounted at the average return on investment rate at the reporting date.

Forward exchange contracts

The fair value of forward exchange contracts is determined using forward exchange rates at the Statement of Financial Position date, with the resulting value discounted back to present value.

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS AS AT **31 MARCH 2020**

15. RECONCILIATION OF OPERATING PROFIT TO CASH GENERATED FROM OPERATING ACTIVITIES

	Group		CSIR	
	2020	2019	2020	2019
	R '000	R '000	R '000	R '000
Profit before taxation	55 972	7 259	55 547	6 832
Adjustments for:				
Depreciation and amortisation	62 068	65 121	62 068	65 121
(Profit)/losses on disposal and write-off of property, plant and equipment	(307)	57	(307)	57
Gains on foreign exchange	(16 517)	(8 063)	(16 517)	(8 063)
Bad debt written off	982	1 665	982	1 665
Interest income	51 423	(48 286)	50 968	(47 830)
Finance expense	1 549	-	1 549	-
Impairments (reversal of impairments)	12 644	12 370	12 866	12 708
Movements in retirement benefit assets and liabilities	849	877	849	877
Movements in provisions	1 277	11 187	1 277 1	1 187
Leave accrual	10 558	5 119	10 558	5 119
Share of losses from joint venture and associate	98	312	-	-
Other non-cash items	24 569	-	24 445	-
Changes in working capital:				
Inventories	(1 342)	51	(1 342)	51
Trade and other receivables	(119 696)	15 991	(119 680)	15 782
Contract assets	(3 009)	(6 918)	(3 009)	(6 918)
Other receivables from contracts with customers	(1 379)	1 117	(1 379)	1 117
Trade and other payables	(3 582)	4 073	(3 575)	4 071
Advances on contracts with customers	27 041	68 595	27 041	68 595
	352	**130 527**	**405**	**130 371**

16. CASH AND CASH EQUIVALENTS

Cash and cash equivalents consist of:				
Cash on hand	114	114	114	114
Bank balances	77 567	128 012	76 877	127 410
Short-term deposits	1 176 156	1 113 342	1 169 000	1 106 500
	1 253 837	**1 241 468**	**1 245 991**	**1 234 024**

Cash on hand comprises petty cash.

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS AS AT **31 MARCH 2020**

17. RELATED PARTIES

Relationships

The CSIR is a schedule 3B National Government Business Enterprise in terms of the Public Finance Management Act,1999 (Act 1 of 1999) as amended by Act 29 of 1999, and therefore falls within the national sphere of government. As a consequence, the CSIR has a significant number of related parties, being entities that fall within the national and provincial sphere of government. Amounts due from/to these entities are subject to the same terms and conditions as normal trade receivables and trade payables.

In addition, the CSIR has a related party relationship with its subsidiaries and joint ventures and associates (see note 7). Unless specifically disclosed, these transactions are concluded at arm's length and the Group is able to transact with any entity.

Transactions with related parties

	Group		CSIR	
	2020	2019	2020	2019
	R '000	R '000	R '000	R '000
Constitutional institutions				
Services rendered	-	1 955	-	1 955
Sevices received	5 710	-	5 710	-
Amount due (to) from	454	1 700	454	1 700
Major public entities				
Services rendered	-	277 863	-	277 863
Services received	190 770	92 958	190 770	92 958
Amount due from	41 652	30 495	41 652	30 495
National public entities				
Services rendered	-	134 296	-	134 296
Services received	16 458	24 819	16 458	24 819
Amount due from	20 297	21 904	20 297	21 904
National government business enterprises				
Services rendered	-	3 226	-	3 226
Services received	899	423	899	423
Amount due from	600	271	600	271
Provincial public entities				
Services rendered	-	7 439	-	7 439
Amount due from	703	1 154	703	1 154
Provincial government business enterprises				
Services received	1 050	410	1 050	410
Government departments				
Services rendered	1 736 901	1 743 005	1 736 901	1 743 005
Services received	4 601	6 229	4 601	6 229
Amount due from	26 140	26 342	26 140	26 342
Subsidiaries				
Amount due (to)/from	-	-	(13)	(13)

The above is a summary of transactions with related parties during the year and balances due at year-end.

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS AS AT **31 MARCH 2020**

17. RELATED PARTIES (CONTINUED)

Transactions with key management

Total remuneration of key management is included in employees' remuneration (refer to note 12 for Executive Management's remuneration).

18. IRREGULAR AND FRUITLESS AND WASTEFUL EXPENDITURE

	Group		CSIR	
	2020	2019	2020	2019
	R '000	R '000	R '000	R '000
Irregular expenditure				
Opening balance	7 905	7 420	7 905	7 420
Irregular expenditure relating to the 2019/20 financial year:				
– Non-compliance to PPPFA and/or PFMA*	1 369	5 704	1 369	5 704
Irregular expenditure relating to prior financial years:				
– Non-compliance to PPPFA and/or PFMA*	1 852	620	1 852	620
Amounts condoned	(1 238)	(5 839)	(1 238)	(5 839)
	9 888	**7 905**	**9 888**	**7 905**

Included in the balance of R9,8 million above is a total of R4,5 million worth of transgressions that the CSIR Board has requested National Treasury to condone. At the time of the preparation of these financial statements, the CSIR was waiting for confirmation of condonation.

* *No loss was incurred by the CSIR.*

Corrective actions taken by the CSIR:

* *During the 2018/19 year, training was provided to the staff regarding procurement processes and special emphasis was placed on compliance with the PPPFA and National Treasury Instruction Notes relating to procurement of goods and services.*

* *During the 2018/19 financial year, 10 transgressions that consitute irregular expenditure were detected. Procurement training and awereness has been provided to the employees concerned relating to eight offences, while no action was taken for two instances because the employees have left the employ of the CSIR and no loss was suffered by the public entity.*

* *During the 2019/20 financial year, four transgressions that consitute irregular expenditure were detected. Of the four transgression detected in the current year, one the offences was committed prior to 2019/20 year. Disciplinary action has been against officials who committed two of the four offences, while no action was taken for two instances because the employees have left the employ of the CSIR and no loss was suffered by the public entity.*

Fruitless and wasteful expenditure

	Group		CSIR	
	2020	2019	2020	2019
	R '000	R '000	R '000	R '000
Balance at the beginning of the year	174	79	174	79
Amount incurred in the current year	-	95	-	95
	174	**174**	**174**	**174**

Fruitless and wasteful expenditure of R72 960 (due to settlement of an employee's liability for recruitment fee towards a recruitment agent in leiu of retaining the employee as a key resource to the organisation) and R22 127 (unnecessary service rendered to CSIR due to lack of consultation of line manager by an employee) was incurred in the 2018/19 financial year.

Fruitless and wasteful expenditure of R42 526 (due to a cancellation fee and interest paid) and R36 416 (due to two suppliers being appointed and paid for the same project) was incurred in the 2017/18 financial year.

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS AS AT **31 MARCH 2020**

19. CHANGES IN ACCOUNTING POLICY

The separate and consolidated financial statements have been prepared in accordance with International Financial Reporting Standards on a basis consistent with the prior year, except for the adoption of IFRS 16: *Leases.*

In the current year, the CSIR and Group have adopted IFRS 16 Leases with the date of initial application being 1 April 2019. IFRS 16 replaces IAS 17 Leases. IFRS 16 introduces new requirements with respect to lease accounting. It introduces significant changes to the lessee accounting by removing the distinction between operating and finance leases and requiring the recognition of a right- of- use asset and a lease liability at the lease commencement for all leases, except for short-term leases and leases of low value assets.

The impact of the adoption of IFRS 16 on the CSIR's and Group's annual financial statements is described below. The group has applied the practical expedient available in IFRS 16 which provides that for contracts which exist at the initial application date, an entity is not required to reassess whether they contain a lease. This means that the practical expedient allows an entity to apply IFRS 16 to contracts identified by IAS 17 as containing leases; and to not apply IFRS 16 to contracts that were not previously identified by IAS 17 as containing leases.

IFRS 16 has been adopted by applying the modified retrospective approach, whereby the comparative figures are not restated.

The group undertook the following at the date of initial application for leases which were previously recognised as operating leases:

- Recognised a lease liability, measured at the present value of the remaining lease payments, discounted at the interest rate implicit in the lease where it was applicable or incremental borrowing rate at the date of initial application
- Recognised right-of-use assets measured on a lease by lease basis, at an amount equal to the lease liability adjusted for accruals relating to that lease prior to the date of initial application;
- Recognised depreciation on the right-of-use asset over the remaining period of the lease term; and
- Incurred finance cost on the lease liability.

A retrospective application was impractical for the Company and Group and a modified retrospective approach was adopted, which has no effect on the corresponding figures.

The CSIR and Group applied IAS 36 to consider if these right-of-use assets are impaired as at the date of initial application and no impairment indicators existed.

As an exception to the above, no adjustments were made on initial application of IFRS 16 for leases previously classified as operating leases for which the underlying asset is of low value. From the date of initial application, these leases are accounted for in accordance with paragraph 6 of IFRS 16 by recognising the lease payments on a straight-line basis or another systematic basis which is more representative of the pattern of benefits consumed.

The group applied the following practical expedients when applying IFRS 16 to leases previously classified as operating leases in terms of IAS 17. Where necessary, they have been applied on a lease by lease basis.

When a portfolio of leases contained reasonably similar characteristics, the group applied a single discount rate to that portfolio.

Leases which were expiring within 12 months of 1 April 2019 were treated as short term leases, with remaining lease payments recognised as an expense on a straight-line basis or another systematic basis which is more representative of the pattern of benefits consumed.

Hindsight was applied where appropriate. This was specifically the case for determining the lease term for leases which contained extension or termination options.

No onerous leases existed that needed to be included in the calculation. Therefore, no impairment calculation was needed on the Right-of-use asset as at transition date.

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS AS AT **31 MARCH 2020**

20. NEW STANDARDS AND INTERPRETATIONS

20.1 Standards and interpretations not yet effective

The Group has decided against the early adoption of the following standards and interpretations, which have been published and are mandatory for the Group's accounting periods beginning on or after 1 June 2020 or later periods:

- IFRS 16: COVID-19-Related Rent Concessions: Amendment providing lessees with an exemption from assessing whether a COVID-19-related rent concession (a rent concession that reduces lease payments due on or before 30 June 2021) is a lease modification. Impact of the amendment could not be reliably estimated at the time of reporting.

21. INVENTORIES

	Group		CSIR	
	2020	2019	2020	2019
	R '000	R '000	R '000	R '000
Finished goods	2 726	1 384	2 726	1 384

22. OTHER RECEIVABLES FROM CONTRACTS WITH CUSTOMERS

Contracts in progress at the end of the reporting period				
Other receivables from contracts with customers	112 466	116 470	112 466	116 470

Other receivables from contracts with customers arise as a result of the time lag between customer billing and revenue recognition. Contract assets (refer to note 22) constitute capitalised costs on point in time contracts with customers. Advances received in excess of work completed are included in advances on contracts with customers under current liabilities.

23. CONTRACT ASSETS

Contract assets	9 927	6 918	9 927	6 918
Summary of contract assets				
Contract assets	9 927	6 918	9 927	6 918
Reconciliation of contract assets				
Opening balance	6 918	-	6 918	-
New contracts	3 009	6 918	3 009	6 918
	9 927	**6 918**	**9 927**	**6 918**

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS AS AT **31 MARCH 2020**

24. PROVISIONS

Reconciliation of provisions - Group - 2020	Opening balance	Additions	Total
Restructuring	11 187	1 277	12 464

Reconciliation of provisions - Group - 2019	Opening balance	Additions	Total
Restructuring	-	11 187	11 187

Reconciliation of provisions - CSIR - 2020	Opening balance	Additions	Total
Restructuring	11 187	1 277	12 464

Reconciliation of provisions - CSIR - 2019	Opening balance	Additions	Total
Restructuring	-	11 187	11 187

The restructuring provision relates to redundancy costs incurred as result of the reorganisation that took place at the CSIR. On 13 April 2018, the Board approved a targeted intervention that focused on the aspects of the CSIR operations that were not sustainable.

25. ADVANCES ON CONTRACTS WITH CUSTOMERS

Advances from customers constitute income received from customers in advance.

26. CAPITAL COMMITMENTS

	Group		CSIR	
	2020	2019	2020	2019
	R '000	R '000	R '000	R '000
Property, plant and equipment	41 734	21 140	41 734	21 140

27. FINANCIAL GUARANTEES

Local and foreign payments and performance guarantees issued as at 31 March	38 530	32 889	38 530	32 889

28. PRIOR PERIOD ERRORS

Revenue and related expenses of one of the contracts with customers were not included in the total revenue and operating expenses figures which were presented on the statement of profit or loss and other comprehensive income. Instead these items were accounted for on the statement of financial position. However, revenue and expenses are equal and thus there was no impact on the opening retained earnings, assets or liabilities. The effect of the error was an understatement of revenue and operating expenses figures per prior year statement of profit or loss and other comprehensive income.

The correction of the error results in adjustments as follows:

Profit or Loss				
Revenue	-	74 850	-	74 850
Operating expenses	-	(74 850)	-	(74 850)

29. FAIR VALUE INFORMATION

Fair value hierarchy

The table below analyses assets and liabilities carried at fair value. The different levels are defined as follows:

Level 1: Quoted unadjusted prices in active markets for identical assets or liabilities that the group can access at measurement date.

Level 2: Inputs other than quoted prices included in level 1 that are observable for the asset or liability either directly or indirectly.

Level 3: Fair value measurements are derived from valuation techniques that include inputs (such as recent transactions for similar assets) that are not based on observable market data.

Reconciliation of assets and liabilities measured at level 3

	Note(s)	Opening balance	Gains (losses) recognised in other comprehensive income	Closing balance
Group - 2020				
Assets				
Property, plant and equipment	5			
Land		125 435	12 965	138 400
Total		**125 435**	**12 965**	**138 400**

 # Gains and losses recognised in other comprehensive income are included in Gains and losses on property revaluation.

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CSIR
Touching lives through innovation

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