CSIR NEXTGEN ENTERPRISES AND INSTITUTIONS

Addressing the challenges and opportunities of public institutions and private service enterprises to enable their transition into a digitalised era that will support efficient and effective service and policy outcomes, as well as improved governance, transparency and accountability.

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

CSIR
Touching lives through innovation


Ai
Ai
4.0

ABOUT THE CSIR

The Council for Scientific and Industrial Research (CSIR) is a leading scientific and technology research organisation that 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. The CSIR is an entity of the Department of Science and Innovation.

The organisation plays a key role in supporting the public and private sectors through directed research that is aligned with the country's priorities, the organisation's mandate and its science, engineering and technology competences.

The nine high-impact sectors identified by the CSIR to achieve its aims are:

Industry advancement clusters

- Advanced Agriculture and Food
- NextGen Health
- Future Production: Chemicals
- Future Production: Mining
- Future Production: Manufacturing
- Defence and Security

Industry and society enabling clusters

- Smart Places
- Smart Mobility
- NextGen Enterprises and Institutions

ABOUT CSIR NEXTGEN ENTERPRISES AND INSTITUTIONS

CSIR NextGen Enterprises and Institutions creates information exchange platforms in the public and private sector by incorporating digitally enabled technologies, which contribute to improving operational efficiencies within organisations. The CSIR develops and applies capabilities in disruptive technologies such as artificial intelligence, internet of things, digitalisation, modelling and simulation, and distributed ledger technologies, amongst others, in industry and the public sector for enhanced effectiveness, competitiveness, productivity and sustainability.

FOCUS AREAS

DIGITALISATION OF GOVERNMENT to enable efficient and effective service delivery through the adoption of advanced digital, information and communication technologies, resulting in:

- Reduction of financial wastage in government;
- Lowered access barriers to government services, thereby contributing to increased transparency and trust in public institutions; and
- Enhanced government ability to effectively plan and monitor programmes.

RESEARCH, DEVELOPMENT AND INNOVATION in emerging and transformative technologies to support existing, and the formation of new private institutions.

IMPACT

- Effective financial management in public institutions.
- Enhanced access to public services.
- Effective planning and monitoring of government programmes.
- Improving operational efficiencies within public and private institutions and enterprises.
- Formulation and improvement of policy and regulation.
- Minimising of the socio-economic divide in South Africa.

APPROACH

- Increase cross-disciplinary collaboration to effectively harness enabling digital capabilities and domain expertise to respond to challenges in a wide range of application areas.
- Increase cross-cutting digital capabilities to respond to high-level problems across a whole spectrum of disciplines and application areas.
- Provide cross-cutting research, development and innovation capabilities on emerging fourth industrial revolution technologies in response to national challenges.

THE VALUE CHAIN

CSIR NextGen Enterprises and Institutions focuses predominantly on **building digital tools and systems, data generation and acquisition** as well as **data processing and analytics** in line with emerging trends in digitisation, digitalisation and digital transformation of government institutions and enterprises.

DIGITAL SYSTEMS

- Integrated platforms to digitise public institutions and private enterprises
- Intergovernmental/societal platforms

DATA

- Authentic, secure and distributed data acquisition and management (task specific)
- Digital representations and digital twins organisations

ANALYTICS

- Artificial intelligence (AI) to inform decision making
- AI-enabled data processing and analytics to drive autonomous decision making
- Generic/Non-task specific AI

THE VALUE CHAIN

Across the value chain, the CSIR has developed national-scale digital systems, data platforms and analytics platforms such as the:

- National Health Information System;
- Home Affairs Identification and Identity Systems;
- National Indigenous Knowledge Recordal System;
- Oceans and Coastal Information Management System;
- Advanced Fire Information System;
- RockPulse – an early-warning and monitoring device that constantly monitors rock-mass for micro-seismicity in mines; and
- Spectrum Access and Management System.

RESEARCH CENTRE

EMERGING DIGITAL TECHNOLOGIES FOR 4IR

The centre's main focus is research and development of emerging technologies underpinned by fourth industrial revolution (4IR) digital technology blocks, with the aim to enable digital disruption in local enterprises to keep South African organisations relevant and competitive. The centre incubates technologies in the areas of **artificial intelligence, advanced internet of things, augmented reality** and **distributed ledger technologies**, amongst others.

Objectives of the centre

The key objectives of the centre include:

- Developing capabilities (human capital, processes, technology tools and infrastructure) in 4IR digital technology blocks.
- Building demonstration tools and platforms that showcase the practical application of transformative technologies.
- Establishing and strengthening research, development and innovation communities of practice in the areas of 4IR digital technology blocks.
- Serving as the CSIR core for digital tools that enable the implementation of smart solutions in a variety of domains.

HOSTED **PROGRAMMES**

THE NATIONAL INTEGRATED CYBER INFRASTRUCTURE SYSTEM

The Department of Science and Innovation (DSI) has been investing in the development of the National Integrated Cyberinfrastructure System (NICIS) since 2007. NICIS comprises the Centre for High Performance Computing (CHPC), the South African National Research Network (SANReN), and the Data Intensive Research Initiative of South Africa (DIRISA).

Objectives of the NICIS

Key objectives of NICIS include the following:

- Establishing and maintaining a world-class and relevant national integrated cyberinfrastructure system that supports research, innovation and teaching. The system comprises a **high-performance computing, high-speed networking and data infrastructure and management system** that are seamlessly accessible and interconnected with global cyberinfrastructures.
- Enabling and promoting eResearch and eLearning to accelerate and promote new forms of research, innovation and education that address national development priorities. This includes the fostering of national and international collaboration in research and teaching by supporting research ecosystems and virtual communities.
- Positioning South Africa to take part in, host and lead large-scale global research and science projects, with a specific focus on grand science initiatives such as the Square Kilometre Array or experiments by the European Council for Nuclear Research, through continental leadership in cyberinfrastructure.
- Providing thought leadership to South Africa's evolving cyberinfrastructure strategy and facilitating uptake of cyberinfrastructure.
- Fostering the development of human capacity in cyberinfrastructure and the application of cyberinfrastructure, and contributing to the transformation of this sector.

CENTRE FOR THE FOURTH INDUSTRIAL REVOLUTION SOUTH AFRICA

The Centre for the Fourth Industrial Revolution South Africa (C4IR SA) was established to support government and industry with developing and piloting the policy protocols, standards and other regulatory instruments necessary for the implementation of the 4IR technologies prioritised by key stakeholders. As the host, the CSIR is optimally positioned to support the implementation of the country's 4IR strategy, which has been developed through the Presidential Commission on 4IR.

THE BRICS INSTITUTE FOR FUTURE NETWORKS

BRICS is the acronym coined to associate five major emerging economies: Brazil, Russia, India, China, and South Africa. BRICS ministers of communications in 2016 established the BRICS Institute for Future Networks (BIFN), which serves as a cooperation and collaboration institute for research, innovation and commercialisation of Future Networks Intellectual Properties for the collective benefit. The South African chapter of the BIFN will be hosted at the CSIR.

Once established, the Institute will:

- Provide a joint research and innovation networking platform;
- Develop a roadmap for future networks and partner with world partnerships in concerted efforts on the subject;
- Build collaboration platform for research and development in future networks among various institutions and organisations in BRICS economies;
- Collaborate and coordinate with BRICS Standard Development Organisations for standardisation of network elements, devices; and
- Enable new network trials.

IMPACT **AREAS**

E-GOVERNMENT

The e-Government Impact Area focuses on digital enablement of public institutions to facilitate e-Government. Specific focus areas include technology implementation, monitoring and evaluation, software architectures and solutions, spatial information systems, digital/ICT systems interoperability.

Objectives

- Building relevant capabilities and capacity to position the CSIR as a champion for the implementation of e-Government.
- Developing frameworks for integrated electronic government services to optimise government channels.
- Assisting government departments, enterprises and institutions with conceptualisation and/or development of information and communications technologies for migration from manual, inefficient or disparate systems to digitally integrated and efficient systems.

OPERATIONAL INTELLIGENCE

The Operational Intelligence Impact Area focuses on enabling effective decision-making in private enterprises and public institutions through the development and implementation of bespoke digital, data-informed intelligent systems and tools. Specific areas focus on design and optimisation, data science and geospatial modelling and analysis.

Objectives

- Developing and applying computational and mathematical tools to enable effective decision-making that informs design and optimisation of complex systems.
- Developing predictive, descriptive, prescriptive analytical and visualisation computational tools to aid decision-making in prioritisation of challenges, resource allocation, planning, monitoring and evaluation.
- Developing and applying earth observation, computational and mathematical tools to enhance decision-making, planning and situational assessment of hazards and disasters.
- Capacitating graduates and organisations with data analytics and modelling skills to develop and implement digital, data-informed computational tools.

IMPACT **AREAS**

NETWORK SYSTEMS AND APPLICATIONS

The Networked Systems and Applications Impact Area focuses on supporting enterprises and institutions through the development of capabilities in digital signal processing, natural language processing, machine learning, controlled natural language processing, spectrum modelling, spectrum engineering, network engineering, media coding, cloud platform development, software engineering, agile software development methodology and design thinking.

Specific focus areas include spectrum access and management innovation, cloud network architectures and services and digital audio-visual technologies.

Objectives

- Researching and developing demonstrable solutions around the emerging and transformative technologies in connectivity and voice computing ecosystem and transferring tools, technology products and processes to support existing, and formation of new, private and public enterprises that will create new and competitive products and services;
- Developing solutions to localise key parts of the connectivity and voice computing ecosystem as import replacements; and
- Supporting the development of the regulatory capacity of the state to effectively develop enabling policies and regulations that are aimed at removing the barriers for adoption of emerging and transformative technologies in the South African market.

TRACK RECORD

TELEVISION WHITE SPACES

Radio frequency spectrum is an important component of the national information and communications technology infrastructure. Intelligent and flexible spectrum management is required to accommodate demands from new and existing wireless services.

Television whitespace (TVWS) provides an exciting opportunity to re-use television bands for broadband access in sparsely populated areas. The technology provides an opportunity for wireless Internet service providers to provide 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 (4IR). A TVWS radio can offer a broadband speed of approximately 24 Mbps over a coverage distance of more than 10 kilometres.

The CSIR Secondary Geo-location Spectrum Database (S-GLSD) technology has been qualified by the Independent Communications Authority of South Africa to provide commercial S-GLSD services in the country. The role of the S-GLSD service provider is to enable telecommunication network operators to roll-out affordable broadband networks and provide services using TVWS spectrum without causing harmful interference to the incumbent users of the spectrum band. This is in compliance with Regulation 5 of the South African TVWS Regulations of 2018. The CSIR GLSD technologies also received a similar qualification by the United Kingdom (UK) regulator, the Office of Communications (Ofcom) in 2016 to provide commercial TVWS services in the UK market. The technology has won various accolades, including the NSTF-2020 Innovations award.

MICRO-ENTERPRISE MEDIA ENGINE

Micro-Enterprise Media (MEME) is an internationally patented solution that delivers unbroken video streams over mobile networks from 2.5G (rural) – 4G (Wi-Fi) at data costs ranging from as low as R2 up to R50 per viewing hour. The solution has a low barrier to entry and is packaged into an offering as 'broadcasting in a box', suitable to enable media small, medium and micro enterprises to become global broadcasters.

TRACK RECORD

AWEZAMED

AwezaMed is a unique mobile application that bridges communication barriers between healthcare providers and patients in the maternal healthcare domain. The app is a product of a partnership between the CSIR and Aweza, a tech-based initiative that strives to inspire and empower South Africans to overcome language barriers across all sectors of society.

The mobile application enables healthcare providers to access a phrase or question in English and translate it into isiZulu, isiXhosa or Afrikaans. The translated phrase can then be played to patients using Qfrency TTS.

Another version of the app was developed and is called AwezaMed Covid-19. This version contains phrases and questions relating to Covid-19 and offers translations for ten of South Africa's official languages, with English as source language. This version is available for download from the Google Play Store and there is no cost for users.

QFRENCY

Qfrency is a text-to-speech technology that creates human-like voices from written text for the South African market. These synthetic voices can say and read anything in South African languages, on a wide range of devices and platforms. They can be used for impact in real-world applications, such as disseminating information, providing dynamic content, enhancing digital literacy and enabling communication.

CONTACT DETAILS:

Lucas Gumbi

T: +27 12 841 4234 | **E:** lucasgumbi@csir.co.za

www.csir.co.za