



ΠΑΜΒΙΑ UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Research Matters

2022

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From the Vice-Chancellor's Desk

Driven by an ambitious vision to be a premier technological university known for knowledge creation, innovation, and entrepreneurship, NUST remains committed to growing the Science, Technology, Engineering and Mathematics (STEM) fields. Additionally, contributing towards the Green, Blue and Bio-Economy.

This is delineated in the institution's Strategic Plan 2020-2025, along with various themes, goals, and initiatives. Key among them is to assume stewardship of science and technology and develop the human capital resources that are in support of national, regional and global priorities as outlined in the Sustainable Development Goals (SDGs) and the African Union's Agenda 2063.

Understanding the needs of local society is critical for impact hence, stakeholder engagement and collaboration are critical success factors for reaching developmental goals in our capacity to meet the rapidly changing needs of society. They help us to stay abreast of local and global challenges, understand external priorities and expectations, and ensure our integrated teaching and research remain relevant.



Dr Eroid Naomab
NUST Vice-Chancellor

The Deputy Vice-Chancellor's Overview

The promotion of a culture of innovation and entrepreneurship, underpinned by a well-established research base, in tandem with other components of our research and teaching landscape. This will assist us in transforming these research and innovation outputs into commercially viable and socially relevant products and services through the pursuance of internationalisation through strategic partnerships.

The University encourages trans-disciplinary research collaborations in the institutional defined areas namely; Water-Energy-Food (WEF) nexus, Climate Change and Natural Resources Stewardship, Green Logistics, Indigenous Knowledge Systems (IKS), and Sustainability and Digital Humanities. All areas have technology, innovation, and entrepreneurship as common denominators.

This report gives a glimpse of what transpired throughout the year in key research thematic areas.

Enjoy the read!



Dr Colin Stanley
Acting Deputy Vice-Chancellor:
Research, Innovation and Partnerships

01

RESEARCH





Creating an innovative technologically inspired research ecosystem

The Directorate of Research, Innovation and Partnerships (DRIP) encourages and stimulates collaboration across faculties, research clusters, institutes, centres, and disciplines. The aim is to harness synergies and stimulate convergence of the diverse knowledge base, thus generating a breeding ground for multi-disciplinary knowledge creation and technology development transfer. The latter results in the promotion of innovation and entrepreneurship across the university, primarily through the strategic consolidation of the Namibia Business Innovation Institute (NBII), Fabrication Laboratory (FabLab), and Innovation Design Lab (IDL).

DRIP Functional Pillars

1 RESEARCH SERVICES



Research Grants Management and Contract Research



Research Support (Ethics and Integrity Services and Research Analytics)

2 RESEARCH AND POSTGRADUATE DEVELOPMENT



Research and Postgraduate Studies (Coordination; Training and Programme Development Facilitation)



Distinct Research Portfolio and Promotion of Science and Technovation Parks

3 TECHNOLOGY, INNOVATION AND ENTREPRENEURSHIP



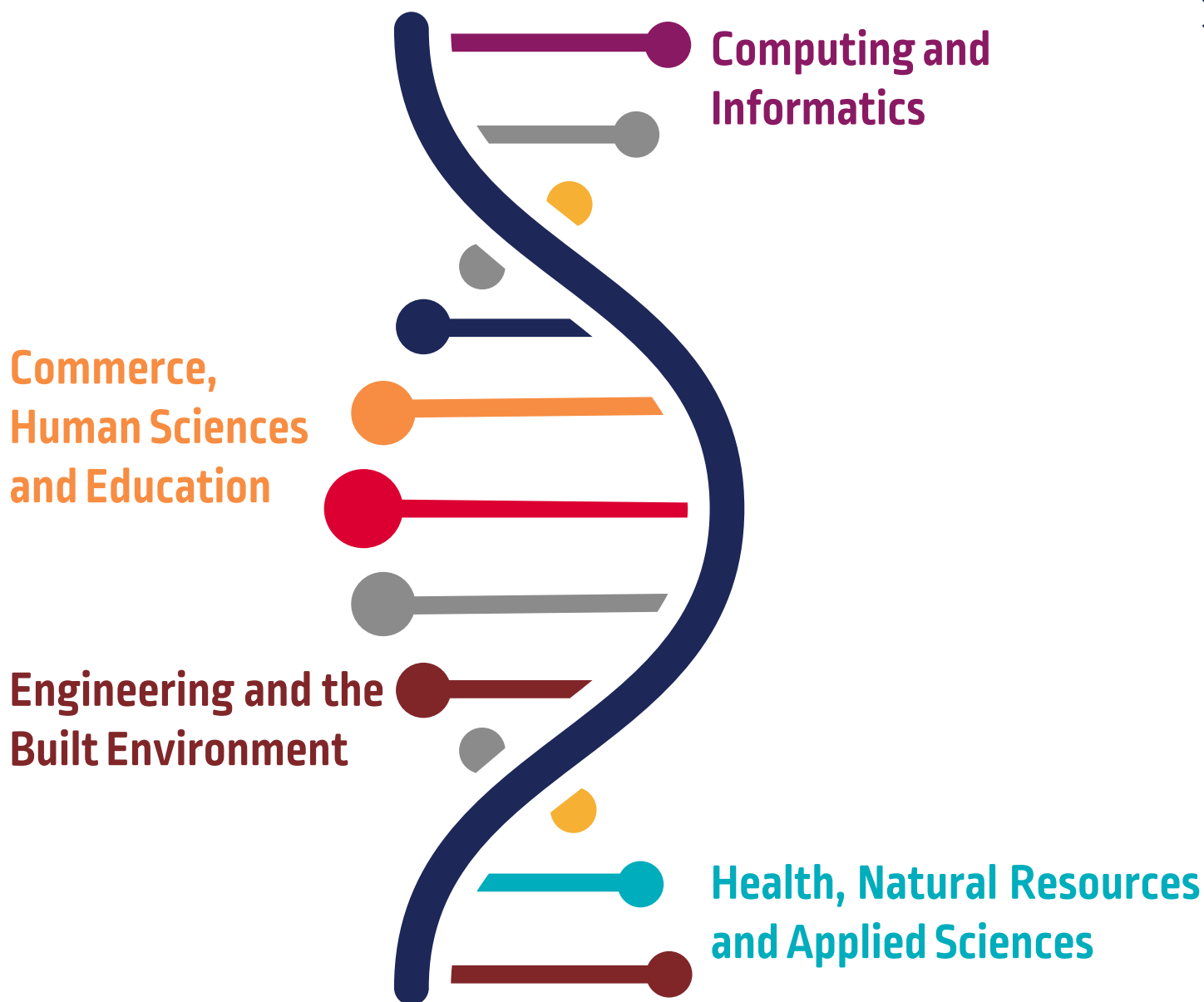
Innovation, Business and Entrepreneurship Development



Technology Transfer and Intellectual Property Protection and Management



High-Tech Transfer Plaza Select (HTTSPS) - (University Industry Partnerships and Flagship Project Management)



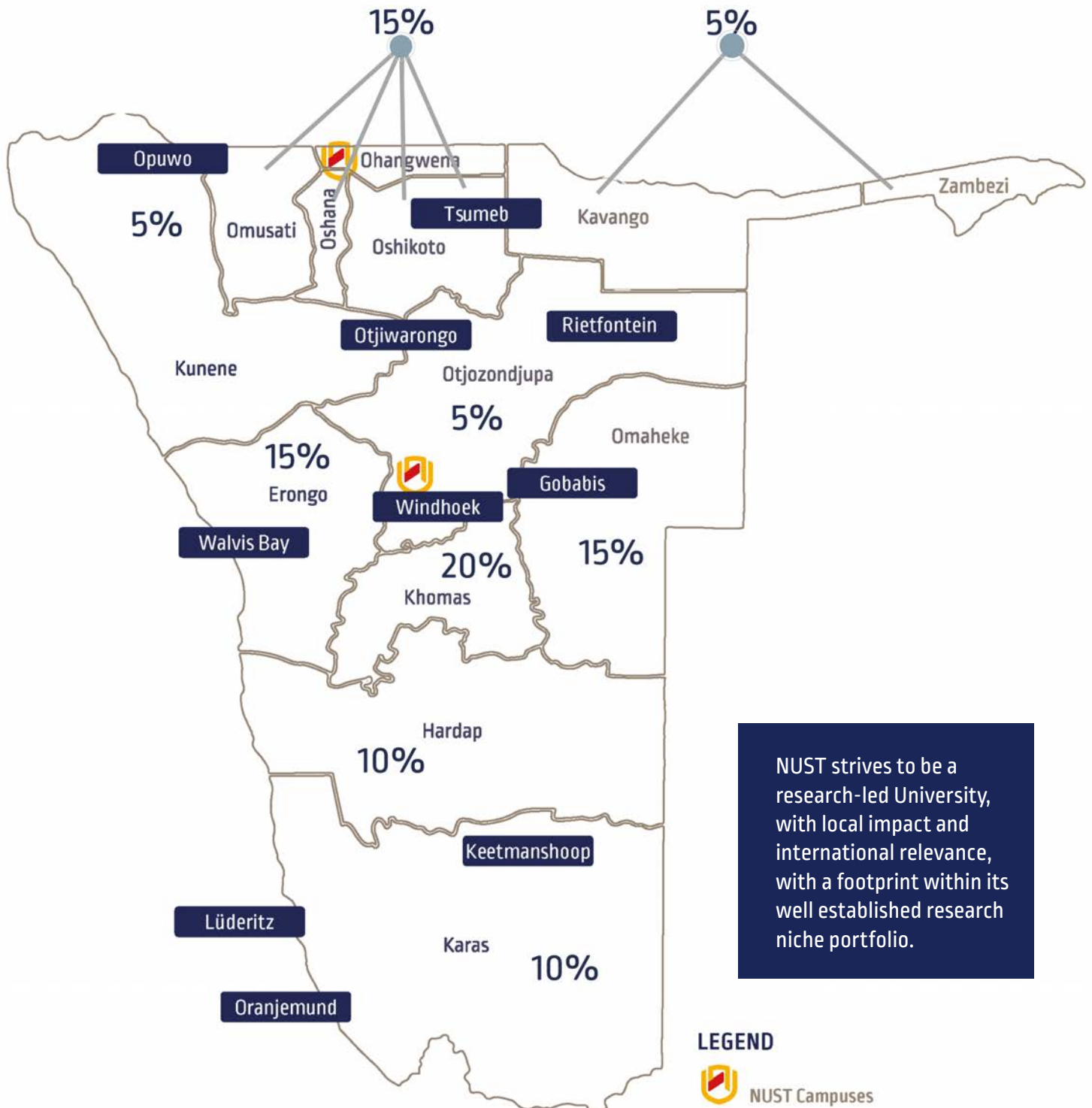
Innovation is in our DNA!

Figure 1: DRIP prides itself with the motto: Innovation is in our DNA, which stands for Dynamism, Novelty and Agility. DRIP takes a specialised service approach to all Faculties within the University.

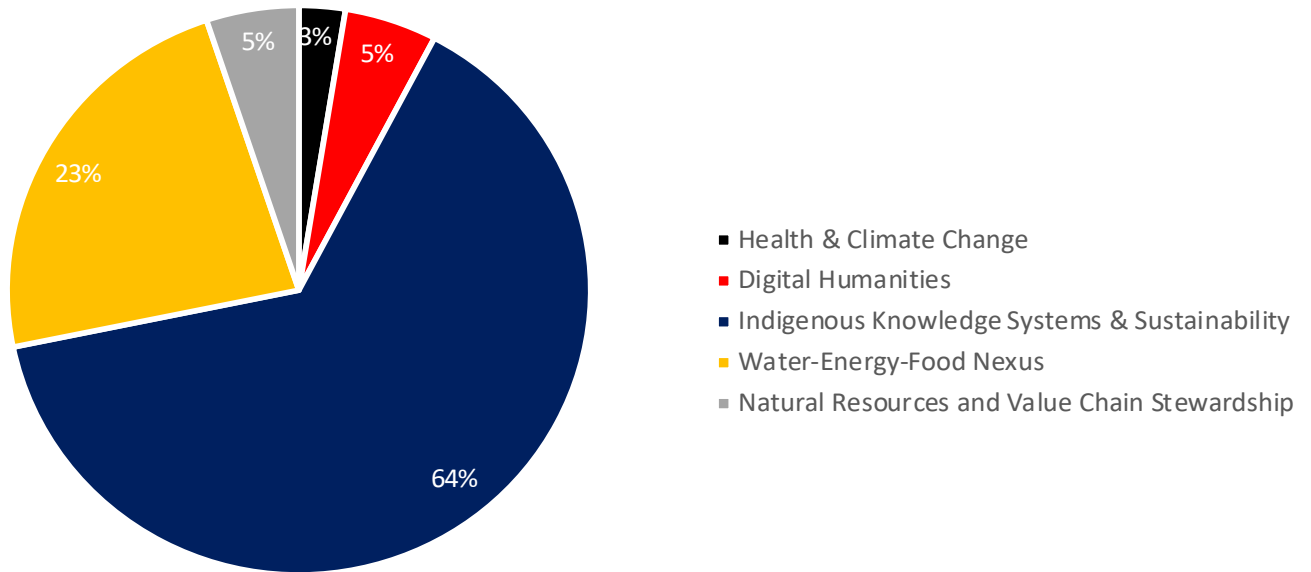


RESEARCH NUMBERS AT A GLANCE

NUST's Research Footprint (per %)

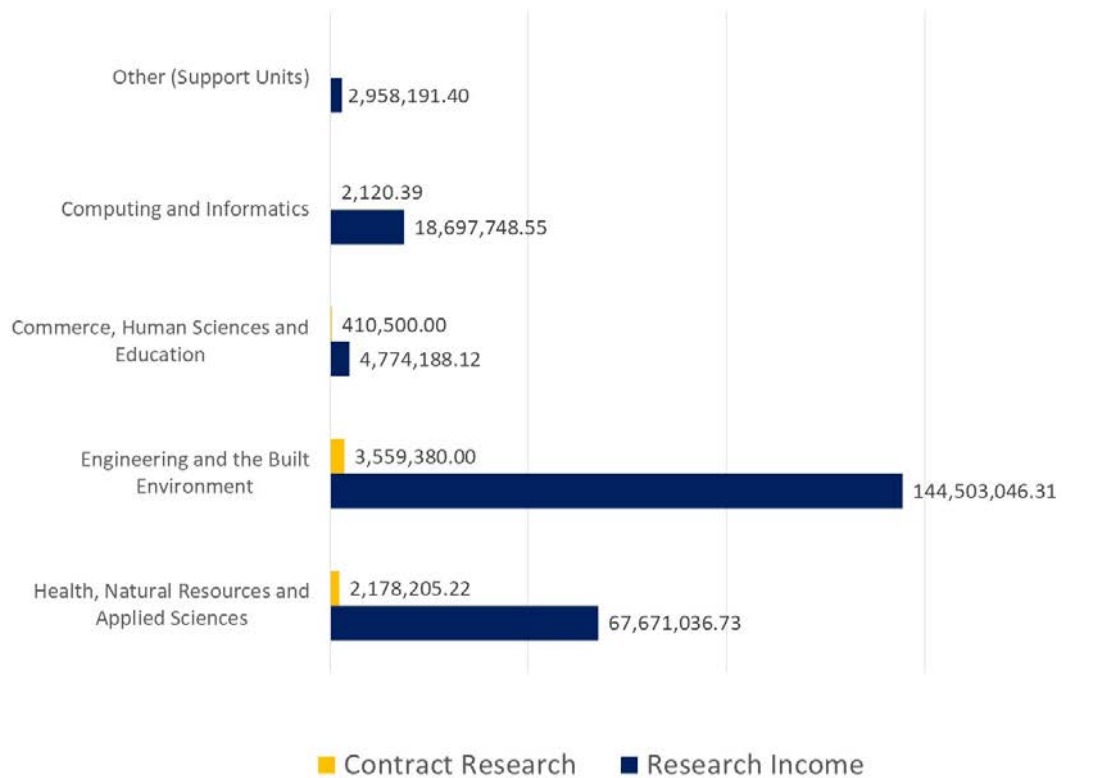


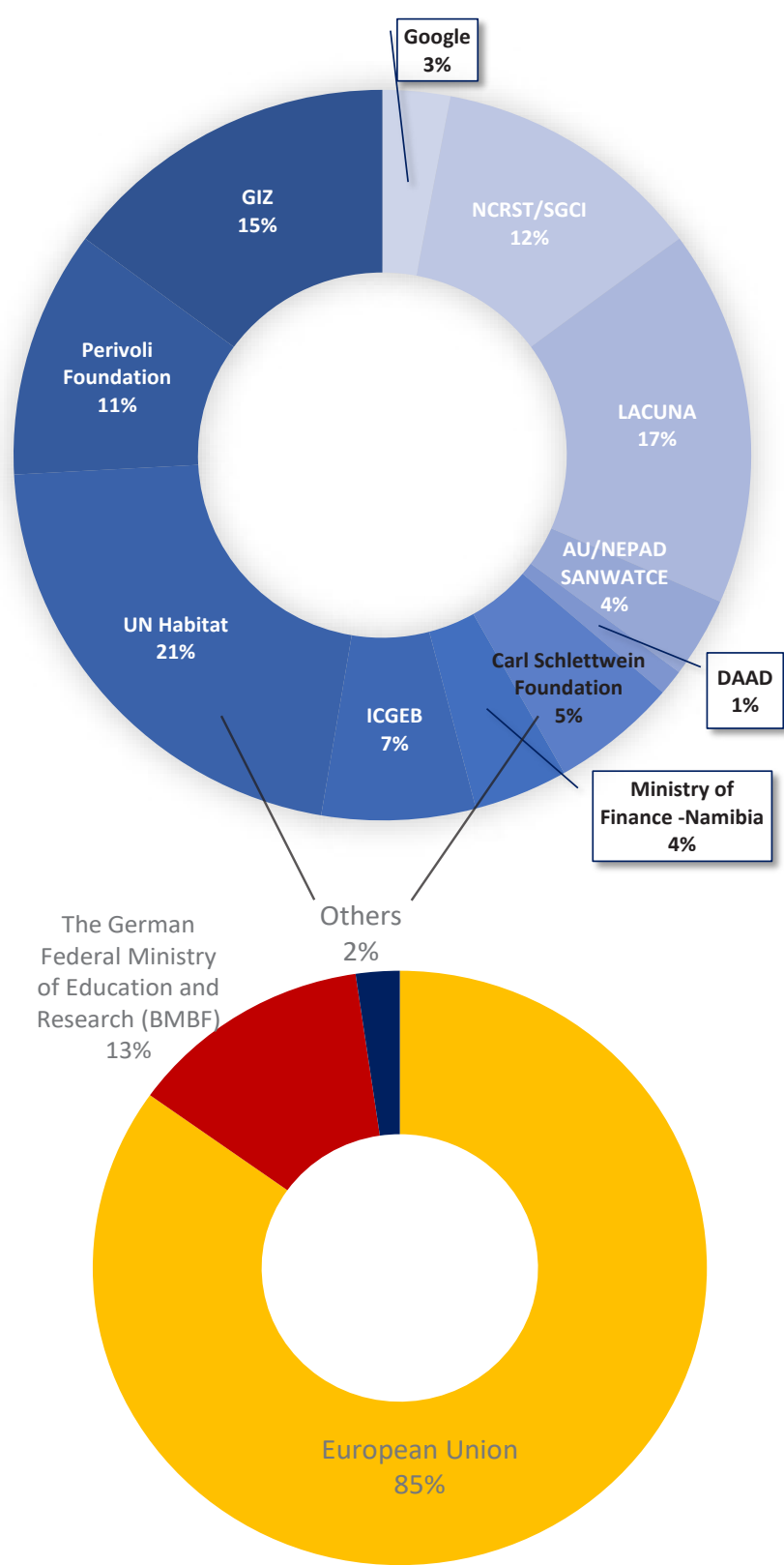
Active Research Projects per Niche Area



Grants Donor Profile

Research Income per Faculty





- *NCRST - National Commission on Research, Science and Technology
- *SGCI - Science Granting Councils Initiative
- *NEPAD - New Partnership for Africa's Development
- * SANWATCE - Southern African Network of Water Centres of Excellence
- *ICGEB - International Centre for Genetic Engineering and Biotechnology



Research Outputs



Faculty	Peer Reviewed Journal Articles	Books	Book Chapters	Oral / Poster Conference Presentations	Technical Reports	Masters Graduates	Doctorate Graduates	Others	Total
Commerce, Human Sciences and Education	46	3	17	18	1	125	-	6	216
Computing and Informatics	14	-	4	37	-	22	2	28	107
Engineering and the Built Environment	31	-	-	18	-	29	1	1	80
Health, Natural Resources and Applied Sciences	36	1	7	28	4	20	-	2	98
Total	127	4	28	101	5	196	3	37	501

Postgraduate Student Enrollment

Faculty	Master's Degree	Doctoral Degree	Total
Commerce, Human Sciences and Education	376	0	376
Computing and Informatics	144	24	169
Engineering and the Built Environment	170	23	193
Health, Natural Resources and Applied Sciences	117	42	159
Total	807	89	897





Research Influence

EduRank.org is an independent metric-based ranking of 14,131 universities from 183 countries. It utilises the world’s largest scholarly papers database with 83,166,817 scientific publications and 1,801,313,576 citations to rank universities across 246 research topics.

Research influence in terms of rankings as follows:

Source [as at July 2023] : <https://edurank.org/>

International Rankings

The Alper-Doger Scientific Index (AD Scientific Index) is a ranking and analysis system based on the scientific performance and the added value of the scientific productivity of individual scientists. Furthermore, it provides rankings of institutions based on the scientific characteristics of affiliated scientists. The Index analyses academic studies from countries, universities/ institutions, and scientists by using numerous criteria to present results to be used for the evaluation of productivity and efficiency by individuals and institutions.

A total of 82 scientists currently and/or previously affiliated to NUST were assessed and the following are in the top 10 category.

Source [as at July 2023] : www.adscientificindex.com



4 148

In the World



119

In Africa



02

In Namibia



2 015

Geography and Cartography (Globally)



1 268

Management Information Systems (Globally)



2 908

Business (Globally)



3 161

Computer Science (Globally)



3 309

Environmental Science (Globally)

University/ Institution Rank	Country Rank	Region Rank	Name	Field	H Index
1	5	1 921	Diptiranjana Sahu	Natural Sciences/Physics	29
2	7	3 299	Heike Winschiers-Theophilus	Computing	24
3	8	3 405	Benjamin Mapani	Engineering and Technology/Earth Sciences	24
4	9	3 504	Edosa Omoregie	Agriculture and Forestry/Fisheries	24
5	10	3 591	Michael Sony	Engineering and Technology/Chemical Engineering	23
6	13	4 747	Uchendu Chigbu	Land and Property	21
8	22	7 386	Michael Mutingi	Healthcare Operations	17
9	23	7 982	Percy Chimwamurombe	Medical and Health Sciences	17
10	24	8 098	Rakesh Kumar	Natural Sciences/Mathematics	17
12	28	9 066	Ben Strohbach	Natural Sciences/Biological Sciences	16





INSTITUTIONAL RESEARCH FOCUS HIGHLIGHTS

Pivotal to the university's research and innovation strategy is building capacity under research themes (or clusters) based upon a demonstrated track record, excellence and discipline expertise, including international standing and collaborations. The Research themes create opportunities for interdisciplinary research activity on global, societal and local needs.

The strategically defined themes, established through a consultative process, are described below, with highlights from related projects and links to the United Nation's Sustainable Development Goals (SDGs).

Water-Energy-Food Nexus

The Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL) Graduate Studies Programme in Integrated Water Resources Management (SGSP-IWRM)

The SGSP-IWRM is a three-year PhD academic programme embedded in SASSCAL's long-term objective of building regional thematic Centres of Excellence within selected academic institutions across all SASSCAL Member States.

The objective of the programme is the development and deployment of an innovative and excellent regional collaborative education and research programme in different specialisations under the theme of Integrated Water Resources Management. The research component is complemented by selected tailor-made short courses to strengthen the students in new techniques such as geospatial analytical skills, programming and the use of models in data integration and analysis.

A SASSCAL Research Chair on Water Resource Quantity and Availability was awarded to Prof Ditiro Benson Moalafhi, during a Special SGSP Session at the 23rd WaterNet Symposium in South Africa, held under the theme: Advancing the Regional Water Security Scientific Agenda through Inter/Multi/Transdisciplinary Research. Prof Moalafhi is based at the Botswana University of Agriculture and Natural Resources (BUAN).

During the Symposium, eight SGSP-IWRM students presented papers.

The platform enabled the doctoral candidates to engage established academics and practitioners in the water sector.



From Left: Prof Jean-Marie Kileshye Onema, WaterNet; and Dr Anna Matros-Goreses, Executive Director: Directorate of Research, Innovation and Partnerships, NUST; handing over a Certificate of Recognition to Prof Ditiro Benson Moalafhi, the SGSP Chair.





Name of Student Presenter	Title of Abstract
Muumbe Lweendo	Changing Hydro-Climatic Regimes and Planning Tools for Climate Resilient Development Pathways
Otlaadisa Tafila	Geological Influences on Groundwater Flow in the Okavango Delta Area
Catherine Tlotlo Kerapetse	A Conceptual Review on Modelling Surface-groundwater Interactions in Semi-arid Areas
Chiamba Chiteculo Canivete	Strategy for the Implementation of Building Information Modeling in the Integrated Water Resources Management in Angola
Jimmy Katambo	Applications of Artificial Intelligence for Water Resources Management
Sydney Sichilima	Application of Water Quality Index and Geo-Spatial Assessment Within Vulnerable Shallow Aquifer System in Peri-Urban Area of Zambia – A Case of Mulenga Compound
Ofentse Moseki	Assessment of Rice Water Use Efficiency and Productivity in Semi-arid Conditions of Namibia
Maurício Honorato Clemente	Modelling of Phosphorus and Nitrogen Concentrations in the Cubango River, Okavango Zambezi Basin

Moreover, following a consultative process, in order to determine the need and demand for the proposed PhD programme in IWRM, to be hosted by the Faculty of Engineering and the Built Environment, an online needs assessment survey questionnaire was developed. It was distributed to various stakeholders in Namibia and other SADC countries. It is evident that the needs analysis survey and consultative workshops regarding the proposed programme yielded positive responses and tremendous support from different stakeholders in Namibia and beyond.



Dr Jane Olwoch, SASSCAL Executive Director (seated centre), and Ms Rennie Munyayi, Acting Director of the SGSP-IWRM, NUST (seated, second from left), flanked by students and staff from the two institutions.



Smart Energy Solutions for Africa (SESA)

SESA is a European Union-funded Horizon 2020 project that aims to provide energy access technologies and business models that are easily replicable and generate local opportunities for economic development and social cohesion in Africa. The project has been designed to combine innovative energy access solutions for a range of applications in both urbanised and rural contexts in Africa and will focus on testing, validating, and replicating those energy innovations through co-developed demonstration actions.

The trips to Donkerbos and Otjisa, and the activities thereof, focused on understanding the local context from a market and technical perspective, identifying energy infrastructure and exploring novel and innovative green energy possibilities that expand green energy use beyond the established use cases.

During the above endeavours, a range of approaches, methods, and techniques such as Community-based Co-design, Futuring and Design fiction were pursued to appropriately and creatively engage and design with community members. This involved exploring rural game possibilities, cultural robots, virtual reality and evaluation of emerging technology within a current and future cultural and traditional premise.

This resulted in the development of a community hub design for Donkerbos as part of a collaboration with NUST's Architecture Department and a locally renowned architect, in addition to the alignment and realignment of emerging technology in rural indigenous contexts. Overall, these outcomes have enhanced and will expand technology innovation in rural areas, with additional innovation and technology design possibilities and approaches envisioned.

7 AFFORDABLE AND
CLEAN ENERGY



Mr Uariake Mbinge: Community Elder and Researcher, using VR technology in Otjisa.



Livestock Digitalisation Research - InfoRange

NUST, together with five research institutions, received a project grant valued at approximately N\$52 million from the German Federal Ministry for Education and Research (BMBF). The funding is for a project known as InfoRange, which aims to increase efficiency in rangeland-based livestock value chains through machine learning and digital technologies.

Rangeland-based livestock production is a major land use system that contributes between 15 and 60 percent of the agricultural GDP in eastern and southern African countries. However, site-specific information on the condition and intensity of use of rangeland resources is rarely available or accessible to herders in real time.

The project thus cuts across the agriculture and digital technologies sectors, taking a multidisciplinary approach, which is reflected in the diverse expertise among the researchers, which includes staff and PhD students.



Building partnerships on a sustainable raw materials value chain (AfricaMaVal)

The primary objective of the project is to develop EU-Africa partnerships and ensuring a responsible sourcing of minerals for the European industry. This is achieved while providing for a sustainable local co-development in the best Environmental, Social and Governance (ESG) conditions and creating a long-term business environment for European and African companies. AfricaMaVal focuses on the minerals and metals presented in the Fourth list of Critical Raw Materials for the EU, as well as on Copper (Cu), Nickel (Ni), Tin (Sn) and Manganese (Mn) that are particularly pertinent considering Africa's geological potential and their critical status in the digital and energy twin transitions. In this proposal, an "Extended Critical Raw Materials" list (ECRM) will be used.

Partners: Bureau de Recherches Geologiques et Minières, [France], EIT Raw Materials GmbH, [Germany], Bundesanstalt fuer Geowissenschaften und Rohstoffe [Germany], Association of Women In Mining in Africa (AWIMA) [Ghana], LGI Sustainable Innovation [France], International Raw Materials Observatory AISBL [Belgium], Southern African-German Chamber of Commerce and Industry [South Africa], Eurogeosurveys - EGS, [Belgium], Minerals Africa Development Institution [Uganda], Laboratorio Nacional de Energia e Geologia i.p. [Spain]



Transforming bush encroachment from a problem into a secure and sustainable energy source (STEAMBIO AFRICA)

SteamBioAfrica demonstrates superheated steam processing of invasive woody biomass into clean burning biofuel and water in rural Namibia. Operating at an industry relevant scale (250kg/hour throughput) for over one year, SteamBioAfrica validated this biofuel with domestic and industrial customers in Namibia, Botswana, and South Africa. The project prepared sustainable and inclusive business plans to justify post project investment in large scale replication that will result in economic impact, and jobs across the region. The objective was to validate the superheated steam biomass processing as viable and sustainable source of large scale, clean burning, secure and affordable energy across Southern Africa.

Partners: Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB (Germany), Heckmann Metallund Maschinenbau GmbH (Germany), Network New Europe Limited (United Kingdom), Comercial e Industrial Aries (Spain), Sveriges Lantbruksuniversitet (Sweden), Fundacion CIRCE (Spain), University of Strathclyde (United Kingdom), Normag Labor- und Prozesstechnik GmbH (Germany), Urbion (Spain), Manrochem (United Kingdom).



Fostering Research and Intra-Africa Knowledge Transfer through Mobility and Education

NUST is coordinating the implementation of the FRAME Project in partnership with University of Buea (Cameroon), University of the Free State (South Africa), University of Hawassa (Ethiopia), Kwame Nkrumah University Science and Technology (Ghana) and University of Twente (The Netherlands). FRAME stands for Fostering Research and Intra-Africa Knowledge Transfer through Mobility and Education.



The project is part of the Intra-Africa Academic Mobility Scheme Initiative funded by the European Commission through the Education, Audiovisual and Culture Executive Agency (EACEA). The scheme supports higher education cooperation between countries in Africa and aims at contributing towards national capacity development for food, water and energy security.





Digital Humanities

Virtual Reality (VR) applications have gained in popularity, meanwhile expanding their use contexts to many different fields. Recent developments in VR headsets, with optical-based tracking, such as the Oculus Quest 2, support hand gesture-based interactions. However, currently a very limited repository of implemented gestures exists.

With the aim of designing VR applications for diverse user groups, an inclusive and participatory approach to the development of early stage technologies are used, such as VR gesture interactions. In collaboration with members of the Ju/'Hoansi community in Donkerbos, a gesture-controlled VR application of a hunting story, as told by the elders in the village was created. It was demonstrated in the field by an elder and youth, as well as 3D models and scenes described and designed by community members and interpreted by the researchers.

The story has been implemented in VR using the Unity game engine. The application consists of a number of scenes, where the user progress in the story, either through object interactions, or through gesticular interactions with the non-player characters (NPCs), using their hands only. The VR application is being validated by community members in Donkerbos. An analysis of user immersion, expectation satisfaction and observed gesture use will guide further research and developments of such systems.





Primary learners from Namibia, Finland and Malaysia co-designed a new online learning space for children

Futuristic Education is here!

During a one-week workshop at People's Primary School, Windhoek, Prof Heike Winschiers-Theophilus and Ms Itenge from the Academic Development and Support Unit, facilitated a co-designing session where participants explored 3D livestreaming technology to explore the new 3D live streaming technology using the Microsoft Holo Lense and Lidar technology (laser cameras).

The workshop was part of a four-year Academy of Finland funded project, under the leadership of Prof Erkki Sutinen (Future Tech Lab, Windhoek Campus, University of Turku) in partnership with an international and interdisciplinary research team. "This immersive technology will connect people across continents, with a feeling of being present and together, while being in remote places", stated Prof Sutinen enthusiastically.

Dr Naska Goagoses, (Carl Von Ossietzky University of Oldenburg), the educational psychologist on the team, ensured that pedagogical frameworks and constructs, such as academic engagement, are embraced in the design of the technology to facilitate remote presence education. "Although the technology is in its infancy, it is of outmost importance to include Namibian students and teachers, in this early stage technology development to ensure local needs and ideas influence future development and global edutech trends," emphasised Prof Winschiers-Theophilus. The teachers and students who participated in the workshop, provided valuable suggestions of which some will be implemented by the software development team, led by Dr Nicolas Pope (University of Turku). Visit <https://sites.utu.fi/bittip/> or <https://youtu.be/9eVA52loncg>

In a time where primary education has experienced its greatest uncertainty due to a global pandemic, 62 learners from three local primary schools in Namibia, Finland and Malaysia respectively, jointly designed a new on-line learning space for children throughout a number of teleconferencing sessions. The project is a result of a transdisciplinary international long-term partnership between computer science and educational psychology researchers from NUST, University of Turku Finland, University of Technology Sarawak (UTS), Malaysia and Carl von Ossietzky Universität Oldenburg (COUO), Germany.

The research team recognised the absence of suitable on-line platforms for primary learners as well as a lack of involvement of children from different continents in collaborations of new educational technology developments. Children co-designing on-line platforms for children across the world provides solutions for the exchange of local perspectives in global learning ecologies, setting new trends during and after COVID-19, for inclusive and diverse education systems. Over a period of 6 months, learners from each school, namely Woodlands International School Sibul, Malaysia, People's Primary School, Windhoek Namibia and Pääskylvuori School, Turku Finland, respectively, met bi-weekly to create design suggestions for an on-line learning space. Two representative learners from each school met bi-weekly on-line with the learners from the other continents to explore, exchange and synthesis design concepts, which were then prototyped by computer science students from NUST and UTS. The created system was successfully used to facilitate a final session with all learners from the three continents, facilitated by the educational psychologist from Germany.



Natural Resources and Stewardship



Providing scientific input into conservation challenges

NUST's Biodiversity Research Centre (BRC) was established to enhance multi-disciplinary faculty and student research to provide scientific input for the conservation challenges faced by the country. As a partner of the Ministry of Environment Forestry and Tourism and member of the Namibian Chamber of Environment, the Centre is fast establishing itself as indispensable to support biodiversity conservation and associated rural livelihoods. By including aspirant scientists through NUST's Master's and PhD programmes there is an added benefit of mentoring, together with the biodiversity industry, the next generation to support sound decision making around biodiversity (such as wildlife) and community prosperity. This would not be possible without support from a global network of academic, conservation and donor organisations.

The centre secured PhD and Master's bursaries for Namibian students during the year under review. Some noteworthy international partners which either co-supervise students or participate in our research are St. Andrews University and London School of Economics in the UK, the Smithsonian Institution in the US, and the United Nations University. In collaboration with the Giraffe Conservation Foundation (GCF), the BRC formed a partnership with Etosha Heights Private Reserve to develop a long-term holistic conservation and education science programme. Etosha Heights has rewilded over 60,000 hectares of degraded farmland to a haven for wildlife adjacent to the iconic Etosha National Park in Namibia. The site has also been a base for the ORYCS project where together with Potsdam University and the University of Namibia (UNAM), it continues to track the movements of wildlife between the national park and neighbouring areas, and the effect of these movements on communities and the ecosystem as a whole. In 2022, lions and elephants were species added to the suite of animals being tracked. This work resulted in four peer-reviewed scientific journal articles in 2022.

The BRC has, through a Ministry of Environment, Forestry and Tourism-GIZ funded project, conducted research and training regarding Namibia's biodiversity economy. The research considers the value of biodiversity for livelihoods of communities, as well as the costs and benefits of conflict causing animals such as elephants and predators. This has also provided an opportunity to engage communities affected by conflict with elephants and to co-design and early-warning systems using satellite telemetry and the Earth ranger platform.



Research Funding for Impact 20 Year Commemoration between NUST and EU

The longstanding partnership between the Institution and the European Union, began in 2002 with the development of the NUST Hotel School. It is the epitome of joint and collective effort towards mutually beneficial developmental objectives. Over the past two decades, NUST and the EU have collaborated on no less than 48 projects with a total value of over N\$926 million (approx. €52m). The projects range from research, cultural spheres and staff/student exchanges.

Developmental Focal Areas	Number of Projects	Total Value
Institutional and Individual (mobilities) - excludes Hotel School Investment	13	€ 12,707,766.67
Research *	31	€ 34,271,045.60
Cultural	04	€ 4,793,880.99
Total	48	€ 51,772,693.26

**many of the projects are cross-cutting in nature, especially research projects contributing to both to institutional, individual and cultural development aspects.*



Internationalisation is at the core of the collaboration and as such, the various partnerships established over the period within the EU Member States, both at University and Industry levels, provide evidence of mutually beneficial engagements.

The two decades of partnership was cemented with the unveiling of the “Synergy” Statue by Whuda Marble Art Namibia. The sculpture is a representation of the fruitful collaboration between the EU and NUST and is designed to incorporate both institutions and their synergy. This is accomplished with a white marble centre piece displaying unity by displaying the EU stars engraved on the one side and the technicality of the University on the other.

The sculpture is mounted on an indigenous rock called “Socialite”. The original drill markings have been left on to display the active industry, whilst the “U” Shape securing the circular marble structure is designed to incorporate the NUST logo, deliberately untreated to oxidise overtime and turn red, incorporating the colours of the University.





From Left: H.E. Alberto de la Calle (Spanish Ambassador to Namibia); Henry Coetzee (Sculptor); H.E. Sinikka Antila (EU Ambassador to Namibia); Winfried Holze (Sculptor); Hon Maureen Hinda-Mbuende (Deputy Finance Minister) and Dr Eroid Naomab (NUST Vice-Chancellor).

STATUE NAME: Synergy



From Left: His Excellency, Prashant Agrawal, High Commissioner of India to Namibia; Honourable Dr Itah Kandjii-Murangji, Minister of Higher Education, Technology and Innovation; Dr Eroid Naomab, NUST Vice-Chancellor; Prof Dharm Singh Jat, UNESCO Chair on Secure High-Performance Computing for Higher Education and Research; Dr Hilma Amwele, UNESCO Chair on Sustainable Water Research for Climate Adaptation and Saline Agriculture in Arid Environments; and Father Rod April, Secretary-General for the Namibia National Commission for UNESCO.



unesco

Chair

Enhancing International Networks

The University Twinning and Networking Programme (UNITWIN)/UNESCO Chairs Programme supports the establishment of UNESCO Chairs and UNITWIN Cooperation Programmes in higher education institutions. UNITWIN Programme, provides a platform for integrated research, training, information, and documentation activities related to diverse fields.

NUST promotes national competitiveness by providing multiple opportunities for excellent education, applied research, innovation and service. In this regard, the University is committed to supporting efforts to achieve the Sustainable Development Goals (SDGs), focusing on the United Nations (UN) 2030 Sustainable Development Agenda, in particular the Global Education 2030 Agenda. Hence, NUST is driving the agenda for the UNESCO Chairs to not only promote international inter-university cooperation and networking to enhance institutional capacities through knowledge sharing and collaborative work but also to ensure that industry presence is elevated to ensure relevance and socio-economic impact. The opportunity to establish a UNESCO Chair is a rare and prestigious honour. Only four UNESCO Chairs have been established in Namibia, with three at NUST. The research, education, and outreach activities under the UNESCO Chairs programmes focus on three key interrelated areas:



Dr Hilma Amwele, UNESCO Chair on Sustainable Water Research for Climate Adaptation and Saline Agriculture in Arid Environments

Projects include:

- Work on spring water quality in Namibia and South Africa, in partnership with North-West University (NWU).
- Spring water quality in Namibia and South Africa Spring water was sampled from South Africa in Alemanni eye in October 2022 and in Namibia water will be sampled from a hot spring in Gross Barmen, Windhoek, Rehoboth, Opuwo and Epukiro (cold spring).

Dr Gloria Iyawa, UNESCO Chair on Gender and Digital Technologies

- Development of Machine Learning Datasets for Crop Pest and Disease Diagnosis Based on Crop Imagery and Spectrometry Data – The project aimed at developing a quality labelled imagery dataset for food security crop disease diagnostics that automates and support disease diagnostics in situ; study and monitor crop disease spread patterns; and also support multiple other research activities.
- Machine Learning for Identifying Teenage Patients at Risk of Gestational Hypertension.

Prof Dharm Singh Jat, UNESCO Chair on Secure High-Performance Computing for Higher Education and Research

Research includes:

- Design and implementation of block chain-based secure edge computing paradigm for time constraint applications.
- Design and Develop a Prediction Model for Improving Start-Up Success Using Machine Learning.

NUST's Green Vision

The growing demand for low- or even zero-emission sources of energy coupled with world energy consumption, has brought increasing awareness of the need for efficient, clean, and renewable energy sources. In particular, the generation of electricity from renewable sources, such as wind, solar and green hydrogen, offers enormous potential for meeting future energy demands and achieving carbon neutrality.

Green energy technologies require innovative research and development in “cross-dimensional/multifunctional disciplines”. Research on these technologies often needs to integrate with variety of research methods/processes at different scales. The proposed research work is thus to develop novel cross-dimensional green energy materials for hydrogen mostly focusing on materials research and development of future devices. As a University of Science and Technology, NUST is strategically placed to drive this agenda, through the Namibia Energy Institute.

It has identified a number of key research areas in this field: Green hydrogen production, storage, and applications development; renewable energy as source to produce hydrogen with focus on wind power; desalination and agricultural production to include Water-Food-Nexus; development and application of digital technologies for H2-Nexus System; business models, roll-out strategies, and framework conditions and education, awareness, and training (both blue and white collar industries).

The first International Conference on Hydrogen-Based Energy Systems (ICHES-2022) was co-hosted by NUST and UNAM in October 2022. The conference drew a diverse range of international participants from various fields. Additionally, researchers from NUST shared their findings in this area.



CELEBRATING RESEARCH EXCELLENCE

NUST hosted its annual Institutional Research Week, an event that serves as a platform for academics to present their research findings, exchange ideas, and share experiences across disciplines. The theme mirrored the Institution's theme for the year titled: Revitalise Social Contract in STEM Education and STI Stewardship. This is the highest achievement in the career of an academic and is a mark of personal distinction to a member receiving the title. In accordance with the NUST Professorship Policy, an inaugural ceremony was held to mark this milestone achievement and to celebrate the Professors' invaluable contribution to the University, and the education sector at large.

The candidates were inaugurated and subsequently delivered their inaugural public lectures. Below are their names and titles of their presentations:

- **Prof Godfrey Dzinomwa**
A contribution to Mineral Beneficiation and Further Value Addition in the 21st Century
- **Prof James Katende**
Renewable Energy-based Electricity: Challenges of Adequate, Secure, and Reliable Power Supply
- **Prof Hannes van der Walt**
Engineering Simulation: The Future and its Impact on Education.
- **Prof Samuel John**
Hybrid Controller Schemes for Antilock Braking Systems in Road Vehicles
- **Prof Victor Kamara**
Structural Engineering
Uniqueness and Challenges in an Ever-changing Environment
- **Prof Benjamin Mapani**
Zircon – A Mineral that has Revolutionised the Concept of Time and Opened Vistas of Economic Import: The Story of my Research Journey
- **Prof Habauka Kwaambwa**
Moringa-Based Green Circular Economy: A Contribution of Curiosity-Driven and Applied Research of the Miracle Tree
- **Prof Rakesh Kumar**
Recent Advances in Queuing Theory





2022 Research Awards

To promote competitiveness and research output amongst the academic staff, recognition is given to emerging and established researchers who perform exceptionally and make tangible impacts through innovation and community engagement.

Congratulations again to the following staff members:

Best Established Researcher of the Year per Faculty

Faculty of Computing and Informatics
Professor Heike Winschiers-Theophilus

Faculty of Commerce, Human Sciences and Education
Professor Teresia Kaulihowa

Faculty of Engineering and the Built Environment
Professor Benjamin Mapani

Faculty of Health, Natural Resources and Applied Sciences
Dr Maurice Nyambuya

Best Established Institutional Researcher of the Year

Faculty of Engineering and the Built Environment
Professor Benjamin Mapani

Best Emerging Researcher of the Year per Faculty/Unit

Teaching and Learning Unit: Academic Services
Ms Helvi Wheeler

Best Institutional Emerging Researcher of the Year

Teaching and Learning Unit: Academic Services
Ms Helvi Wheeler

Research Management Recognition

Represented by the University's Directorate of Research, Innovation and Partnerships (DRIP), NUST received an accolade for Organisational Growth in Research Management at the Southern African Research and Innovation Management Association (SARIMA) 2022 Awards Ceremony that was held in Johannesburg, South Africa, an event that attracted emerging and seasoned research managers from approximately 28 countries and 50 institutions.

The president of SARIMA, Dr Andrew Bailey congratulated the team and highlighted that this is the first time this accolade is awarded. Dr Colin Stanley, the Acting Deputy Vice-Chancellor of Research, Innovation and Partnerships said that "receiving such recognition amongst institutions that have been in the education

sector for several decades is indeed remarkable and speaks volumes."

Dr Anna Matros-Goreses, the Executive Director of DRIP, who is also Vice-President for Research Management of SARIMA, emphasised that "this award speaks to the promotion of a culture of innovation and entrepreneurship, underpinned by a well-established research base which is aligned to leading the next generation of impactful researchers."

The SARIMA Excellence Awards were initiated in 2014 to celebrate excellence in Research and Innovation Management in Southern Africa, and aim to encourage *growth and achievement in the field.*





02 INNOVATION



On 15 July, the HTTPS marked its one-year anniversary. The initiative aims to transform the facility into a space that drives competitiveness through transdisciplinary research co-creation, co-development, application and the transfer of specialised knowledge and technology aligned with NUST signature programmes.

MTC is the platinum partner within the NUST-HTTPS initiative and focuses on advancing its digital transformation agenda.

Melvin Angula,
Chief Commercial
Officer at MTC
(left), and Dr Eroid
Naomab, NUST
Vice-Chancellor,
celebrating the
first HTTPS
anniversary.





Since its inception, the HTTPS created an ecosystem to engage stakeholders from the public and private sectors to concretise partnerships that:

- unlock specialised expertise and investment opportunities
- create enabling environments for digitisation and Innovation
- deliver long-term digital transformation to enhance strategic planning and investment in a digital economy
- design long-term strategic initiatives to enable future innovations that can be taken to market by start-ups, entrepreneurs and industry.
- sustainably address the challenges of transitioning to an advanced, technological and knowledge-based economy nationally and globally, and,
- allow internships and Work-Integrated Learning (WIL) opportunities to pre- and postgraduates to develop new skills and filling the experience-gap for the next-generation workforce

Ideation in Motion

The MTC Innovation Centre is now officially housed at the HTTPS, together with a mobile home. The centre is a hub for testing, building and showcasing new business and consumer ICT applications as well as exploring gaming technology and applications.

It is a physical space for the digital and physical tools that will result in innovation focused on incubating enterprise-based services on everything from comprehensive fibre internet and digital Cloud computing services, to spearhead digital transformation in the smartphone and smart city (connected society) initiatives. Furthermore, it encourages rapid innovation by facilitating the flow of specialised knowledge and fostering functional ecosystems inspired by cutting-edge technology.



From left: Dr Licky Erastus, MTC MD; Theo Mberirua, MTC Board Chairperson; Dr Eroid Naomab, NUST Vice-Chancellor; and Hon Modestus Amutse, Member of Parliament, at the MTC Innovation Centre Grand Opening at the HTTPS.



Virtual Mining Experience

Imagine simply putting on some glasses, walking through the entire diamond mining journey, from extraction to processing, and experiencing these precious gems like never before - in just a few minutes? Well, this is what a team of NUST students have made possible, after 30-hours of an intensive hackathon.

The Virtual Reality (VR)/Augmented Reality (AR) hackathon was an initiative of the NamDeb Diamond Corporation, in partnership with the HTTPS. The event was aimed at developing an interactive design and development platform that virtually showcases the complete diamond mining process.

The students from the Faculty of Computing and Informatics demonstrated their knowledge of innovative software solutions that unlock technology's potential in combining of Virtual Reality/ Augmented Reality, the mining industry and mobile applications.



Meet Alex the Bot.

Unleashing the 4IR Potential

NUST exhibited Virtual Reality technology; 3-Dimensional printing; and Robotics projects at the Namibia 4IR Conference and Expo. The events were initiated by the 4IR Task Force that was appointed by the Head of State, Dr Hage Geingob, amongst which the NUST Vice-Chancellor Dr Eroid Naomab, formed part of, with the mandate to amongst others, conduct a country assessment to determine the readiness of Namibia for the 4IR and make recommendations towards a coherent policy and legislative framework, to harness the full potential presented by technologies.

One of the NUST exhibitions was about Alex the Robot, used by the Faculty of Computing and Informatics. Alex has semi-autonomous driving and expandable capabilities, and it mimics a toy car in its appearance.

Its expansion plate allows it to speak or produce sound, listen through mics, and use ultrasonic sensors for distance measurements plus with the camera, it can analyse its vision and even recognise objects. The robot is powered by a Raspberry PI 4, giving it reasonable processing power and access to extensive libraries of the Python Programming language.

The University's Fabrication Laboratory (FabLab) was also amongst the exhibitors at the 4IR Expo. FabLab creates an enabling environment to provide access to specialised soft and technical skills in advanced manufacturing technology, enabling anyone anywhere to make [almost] anything! This includes amongst others, 3D printing, laser-cutting, engraving, embroidery, and vacuum forming.

Social Innovation through Entrepreneurship Promotion

Through its innovative Entrepreneurial Hub, which comprise of Namibia Business Innovation Institute (NBII), Fabrication Laboratory (FABlab) and Innovation Design Lab (IDL), the University was selected to capacitate the potential start-ups and Small and Medium Enterprises with innovative tools to sustainably establish and grow their businesses.

Innovative start-ups and SMEs in developing and transition countries often have good ideas but may not have these ideas developed to the stage where they can be implemented sustainably. As such, NUST was contracted to identify innovative distribution agents for the Namibia Fish Consumption Promotion Trust (NFCPT) through the selection of enterprises with the potential aligned to the framework of this initiative that will result into start-ups. T

The training intervention aims to capacitate the potential startups, SMEs and existing retailers with innovative tools to sustainably establish and grow their businesses in the fishing sector.

Student Start-Up Support

The NBII student-based Acceleration Programme aims to equip students with the necessary entrepreneurial skills to enhance and fulfill their business aspirations. The criteria includes all businesses/ ideas in line with National Development Plans and/or Sustainable Development Goals (SDGs), but mostly with a focus on tech-based businesses/ideas.

Two tech-based businesses, one which created a WIFI network currently being piloted in Keetmanshoop Municipality, and the other one is an online teaching platform for learners.

1. *Leo Canopus* responds to the need to deliver new smart services to citizens. Additionally, enable a greener, more efficient infrastructure management to help maximise budgets and assets, while delivering better, structured investment plans that create value for cities and citizens. Community Wi-Fi serves as the foundation to help address challenges and deliver new innovative services.
2. *Yyeni* is an online platform that provides teachers with digital classrooms equipped with features that improve the speed and quality of teaching. .

NFCPT Workshop facilitated by NUST staff.





03 PARTNERSHIPS



Smart Campus Drive

MTC, NUST, and Huawei entered into a tripartite cooperation agreement - a vehicle to promote research, innovation, technological and entrepreneurial excellence and internationalisation within the context of the Smart Campus Initiative.

Additionally, the cooperation will focus on professional development; curriculum co-development; student placement for research and in-service training; technology research and development; co-creation; e-learning enabled by 4IR technologies; service delivery and commercialisation; cybersecurity, cloud computing and data warehousing.



From left:

Tim Ekandjo, MTC's Chief Human Capital, Corporate and Marketing Officer; Dr Eroid Naomab, NUST Vice-Chancellor, and David Yu, Huawei's Managing Director, sealing the deal.

Providing Global Solutions to Future Challenges

Finland's Demola Global and NUST signed an agreement that will connect Namibian students and staff to global innovation activities, with the intention of contributing and utilising the global knowledge base of insights about the "challenges of future". It will have a significant impact on the vitality of the Namibian innovation ecosystem.

Through the engagement, Demola and NUST aim to increase industry-academia collaboration and international connectedness on the innovation and entrepreneurship ecosystem in the country.

Centre of Excellence for Civil Association for Africa

A Bilateral Memorandum of Understanding (MoU) was signed between the Finnish and the Namibian governments, anchored on conducting a feasibility study for Finland-Namibia collaboration to establish the Airrhow Centre of Excellence (CoE) for Civil Association for Africa. The MoU is between the government of the Republic of Namibia, acting through its Ministry of Works and Transport, and Finland, through the Tampere Region AiRRhow-Alliance. Tampere Region in Finland has become a CoE for virtually all the disciplines related to civil aviation. The Council of Tampere Region and Tampere University have coordinated this excellence with the aviation industry to form the AiRRhow Alliance

which aims to innovate, promote and implement education and training for all aviation sectors, including training simulations, infrastructure development, digitalisation of aviation, and aviation operations – on the ground and in the airspace.

Honourable John Mutorwa, Member of Parliament and Namibia's Minister of Works and Transport (MWT), appointed NUST as the coordinating agency in collaboration with the Tampere University for the feasibility study on the potential implementation of the CoE for African civil aviation in Namibia.



From left: Dr Mika Kautonen, Tampere University; Dr Eroid Naomab, NUST Vice-Chancellor; Hon John Mutorwa, Minister of Works and Transport (Namibia); Ville Skinnari, Minister for Development Cooperation and Foreign Trade (Finland); and Ville Kairamo, Demola Global CEO.



Creating Priority Sector Solutions through an IoT Challenge

HTTFS, in partnership with Co-Creation Hub (CcHub), launched an Innovation Challenge aimed at supporting the development of innovative IoT solutions for sector-specific challenges in Namibia. The Innovation Challenge gave students the opportunity to take part in engaging sessions, aimed at creating innovative solutions in three key sectors: Water, Energy and Agriculture. The Challenge was facilitated by Co-Creation Hub. The intention is to contribute to the Vision of Namibia to be a prosperous and industrialised nation, developed by Namibian human resources by 2030.

From a thorough 2-weeks ideation and prototyping boot camp to receiving in depth business support, the selected students created new or improved products, processes, services, and customer experiences.

Industry partners had multiple engagements with the selected participants to ensure the solutions meet their needs.

Four teams were selected to proceed to the pre-incubation stage. The pre-incubation programme commenced with two learning sessions delivered to date.

TEAM 1:
Waste to light tech -
Using IoT to
support the production
of biomass energy in
Namibia



TEAM 2:
 Aquatech Possible -
 Using IoT to for
 sustainable water
 management in
 Namibia



TEAM 3:
 NG Tech - Using IoT
 for effective
 livestock
 management in
 Namibia



TEAM 4:
 H2O TECHS - How
 might we use IoT
 technology to help
 improve access
 to clean water by
 monitoring water
 quality?

Innovation Readiness Week (IIR Week) Deemed a Success



The Innovation Investment Readiness (IIR) week, co-organised by the Namibia Investment Promotion Development Board (NIPDB), NUST and MTC, provided a platform for government and private stakeholders to identify prototype projects that can increase their competitiveness and potential to attract investment. The event was attended by several high profile delegates inclusive of ministers and diplomats. By the end of the week, more than 50 investment-worthy projects were identified.

Creating Innovative Solutions

Telecom Namibia (TN), in partnership with the University held an Innovation Week on campus that saw students and staff from both institutions taking part in a hackathon to create innovative solutions that enhance the TN customer experience.

The solutions were centred on, but not limited to; payments, service activation and ordering, fault reporting, theft prevention, and detection and customer engagement.

Regulatory Sandbox Potential

Together with the Bank of Namibia and CChub, an African co-creation company, a financial technology summit was held for key players in the banking and education sectors and to broaden to share best practices in the evolution of digital financial services across the continent.

A few recommendations from the summit included:

- The need for the establishment of an HTTPS Digital financial services: Research Network Membership.
- According to the Namibian Financial Literacy Index, financial literacy levels are low at 51.2% for knowledge of financial concepts and at 32.4% for financial behaviour in Namibia. Thus for Fintech to be introduced to the market, user awareness training would have to lead in Namibia.



Johannes !Gawaxab, Bank of Namibia Governor



James Mnyupe, Economic Presidential Adviser



Innovators pictured during a break-away session.

Strategic innovative research agenda - roadmap ahead

There is a need for deliberate and concerted effort to focus on the institution's collective product delivery in a predetermined manner to positively impact the economy. Consequently, NUST, is aiming at consolidating the management and coordination of innovation related activities. In this regard, the following strategies are considered:

- **Enhance** internal collaborations among centres, institutes and faculty in order to promote self-sufficiency, self-efficiency and achieve closed innovations by NUST.
- **Strengthen** existing collaborations-Create a forum of idea sharing for possible research topics and interest
- **Implement** cross-institutional short-term staff secondment/ exchange to identify synergy potential
- **Develop** joint proposals and engage in inter-disciplinary research and innovation projects, and,
- **Identify** roles of institutes to faculties in order to establish clear areas of collaboration.

This approach creates a strong, interlinked and sustainable innovation system, involving all the actors from academia to industry and civil society. Therefore, a coherent strategic approach of managing the development, application and commercialisation of scientific, technological and innovative knowledge needs to be created. This is important to stimulate a vibrant and coherent innovation system with clear benchmarking indicators. Market competition is an important driving force behind technological innovation while technological innovation is the ultimate route to enhanced enterprise competitiveness. To this end, the Institution will promote private-public research/innovation partnerships following the integrated steps of the Technology Transfer Cycle, with the ultimate aim of forging long term alliances.

Finally, there will be a drive to promote IP protection in order to facilitate the transfer of knowledge and create instruments for knowledge transfer, through the formalisation and approval of the NUST IP policy. Emphasis will be placed on support services and resources for nurturing start-up science and technology enterprises with the goal of developing them into financially viable businesses equipped with the tools for long-term survival and growth.



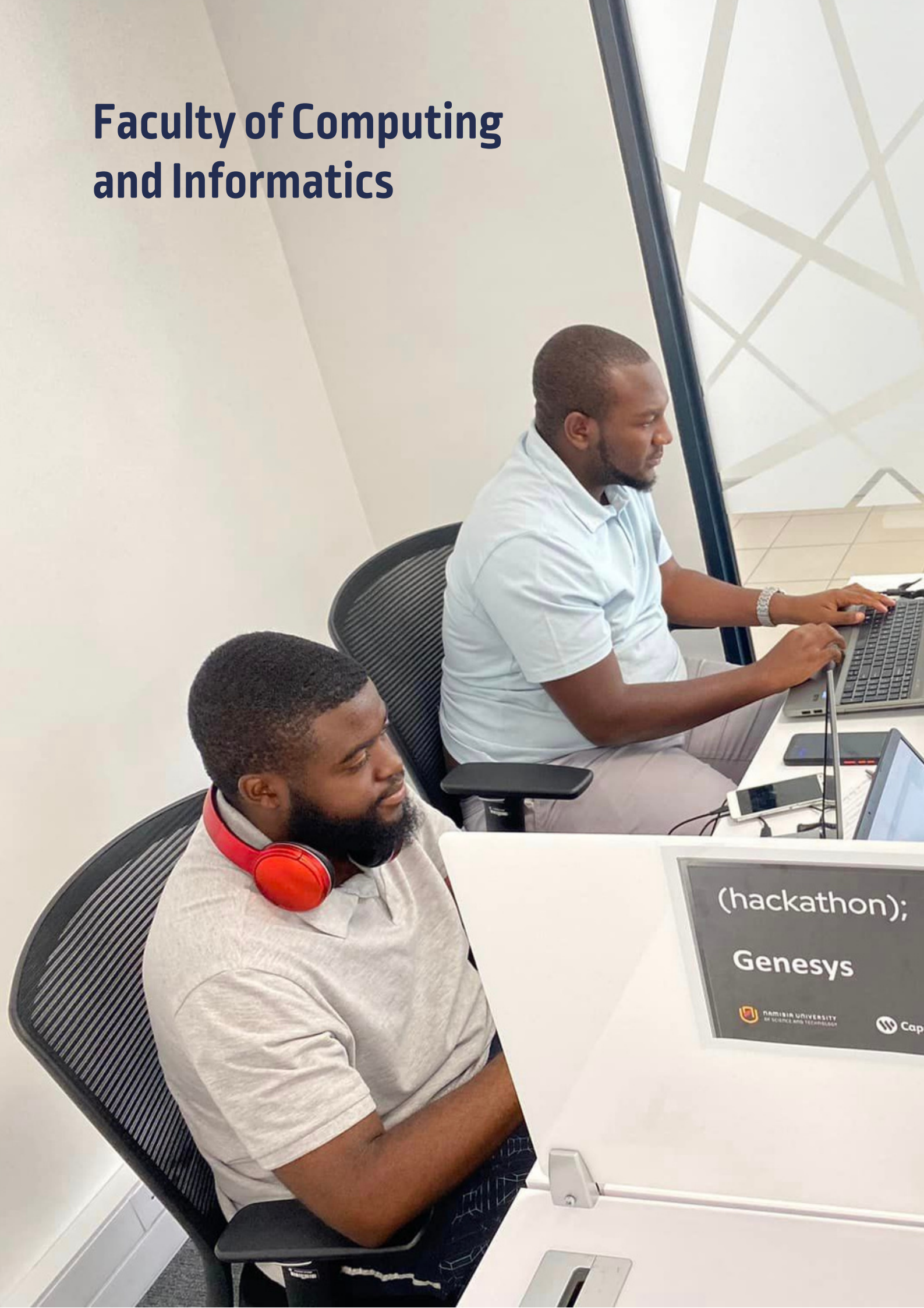
Dr Anna Matros-Goreses
Executive Director:
Directorate of Research, Innovation and
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2022



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