

# Research and Innovation

The various divisions in Research and Innovation, Internationalisation, and the Library and Information Centre support a range of UJ's strategic key initiatives, including research, postgraduate studies, innovation and technology transfer, and global excellence and stature (GES). This report integrates contributions by the Research Office/Research and Innovation Division, Postgraduate School, and the Strategic Initiatives and Administration Unit.

## OVERVIEW

A year of excellence beyond doubt! This is a fitting way to describe the performance of (UJ's Division of Research and Innovation in 2022. While the country and the rest of the world slowly recovered from the disruption and effects of the COVID-19 pandemic, the Russia-Ukraine war started, creating other forms of disruption particularly on the economy. Yet our scholars, postgraduate students, postdoctoral research fellows, research associates and staff continued to demonstrate resilience in the midst of these challenges. It was in 2022 that UJ submitted the highest number of research output units yet to the Department of Higher Education and Training (DHET) for accreditation, thus increasing the University's chances of ascending to the number one position in terms of DHET-accredited publications in the country. In March 2022, UJ also submitted its highest number of NRF rating applications yet to the National Research Foundation (NRF). Furthermore, the University submitted and was awarded two new SARChI Chairs by the NRF – a SARChI Chair in Green Hydrogen, and a SARChI Chair in Blockchain Technology.

Other big wins of 2022 include two large equipment grants awarded through the NRF's National Equipment Programme (NEP), while the SARChI Chairs that underwent five-year reviews received positive or conditional approval for continuation and support for a further five-year cycle. Both the NEP grants and the new SARChI Chairs provide an excellent start towards our efforts to raise external research income for 2023.

The quality and the impact of the work produced by our staff and students are evident in the outcomes of various global rankings. In 2022, UJ ranked #1 in South Africa, #2 in the continent, and #69 globally, according to the Times Higher Education (THE) Impact Rankings; while the QS World University Rankings ranked UJ #2 in South Africa. Furthermore, in terms of the United Nations Sustainable Development Goals (SDGs), a metric that features strongly in THE Impact Rankings, UJ was ranked #3 in the world for SDG 1: *No Poverty*, and #8 in the world for SDG 8: *Decent Work and Economic Growth*.

## RESEARCH AND INNOVATION

### ***Research productivity, creative outputs and innovations***

UJ has experienced double-digit average annual growth in research publication outputs since its inception, and this remarkable trend continues. In May 2022, UJ submitted a total of 4 555 publications authored in



2021 to DHET for accreditation and subsidy; an increase of over 22% compared to the previous year. The submission comprised 3 530 articles published in accredited peer-reviewed journals, 479 books and chapters, and 546 conference proceedings. The biggest increase in outputs occurred in books and chapters (with a 47% increase compared to the previous year), while journal articles continued to comprise the largest proportion of UJ's publication outputs, constituting 77% of the total publications. Together, the publications submitted in 2022 accounted for 2 818 DHET subsidy units, representing an exceptional 19% increase over the previous year's submission.

To place the 2022 performance in context, UJ's annual submission of publication units has increased by an average of 15% per annum, or 14% when measured in terms of compound annual growth rate (CAGR). CAGR accounts for volatility during the reporting period and indicates the steady mean growth rate over time. Provisional feedback from DHET is that just under 98% of the publications submitted were accredited (this is among UJ's highest annual success rates) with UJ provisionally being awarded 2 753 units: 2 006 for journal articles, 236 for conference proceedings, and 511 for books and book chapters.

Similar trends are also evident in the increase in UJ's publications indexed in the prestigious international Scopus publication and citation database. Scopus-indexed publications increased from 221 in 2005 to 4 783 in 2022, representing a CAGR of 19%; more than double that of the South African higher education sector, which achieved an 8% CAGR over the same period. UJ's above-average increase in research productivity has not come at the expense of quality or the scientific impact of the publications. Scientific impact can be measured using several citation-based metrics, one of the most important being the field-weighted citation impact, or FwCI. FwCI indicates how the number of citations received by an institution's publications compares with the average number of citations received by other institutions' publications with similar profiles (i.e. those publishing in similar fields and output types), over the same time period. In 2005, UJ's publications received 12% fewer citations than the world average for similar publications. Over time, UJ's average FwCI has increased to 29% greater than average, and at the time of reporting, UJ's 2022 publications are currently being cited at a rate of 49% higher than the world average.

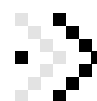
Other important bibliometric indicators reveal that for UJ's publications authored in 2022, 25% appear in the top 10% of the world's highest impact journals (as measured by the CiteScore journal impact factor) and 19% appear in the top 10% most cited publications worldwide. Again, to place UJ's performance in context over the recent five-year period, UJ achieved a CAGR in FwCI of 3,4% compared to the South African higher education sector at 1,7%. UJ's percentage of research output in the top 10% most cited publications worldwide was 14%, against a South African average of 12%. Over the past five years, UJ's outputs have also accrued an average of 9 citations each, and UJ has achieved an impressive institutional h5-index of 96, indicating that UJ's top 96 most cited publications have received at least 96 citations each. This is a remarkable achievement over such a short period given that citations take time to accumulate.

### **External research income**

By 31 December 2022, UJ had received a total of R312 million in external research income, thus 42% above the target of R220 million. The University's largest source of research income remains the NRF and other local funders, including the Technology Innovation Agency (TIA); banks, e.g. Standard Bank and Nedbank; Sector Education and Training Authorities (SETAs) including MerSETA and Wholesale and Retail SETA as well as FoodBev SETA; the National Institute for the Humanities and Social Sciences (NIHSS); the South African Medical Research Council (SAMRC); and the Water Research Commission (WRC), just to name a few. Of the R312 million, only R20 million was received from international sources. Significant effort is therefore required to increase the proportion of funding from international sources going forward.

### **Research and Innovation/Ideation Chairs**

Since its first Chair awarded through the NRF's South African Research Chairs Initiative (SARChI) in 2009, the number of Research and Innovation/Ideation Chairs at UJ has grown to 26 – with 19 SARChI Chairs and seven others, including two UNESCO Chairs. The newest SARChI Chairs at UJ were awarded in December 2022, namely the Sasol/DSI-NRF SARChI Chair in Green Hydrogen, and the SA-Swiss Bilateral Research Chair in Blockchain Technology. Both SARChI Chairs are at Tier 1 – *“Tier 1 Research Chairs will be tenable for five*



years, renewable for two further five-year funding cycles giving a total lifespan of 15 years, subject to satisfactory performance by the Chair following each five-year in-depth review”.

The Sasol/DSI-NRF SARCHI Chair in Green Hydrogen is led by Prof Tien-Chien Jen (Faculty of Engineering and the Built Environment (FEBE)), with Prof Reinout Meijboom (Faculty of Science) as the co-principal investigator. The research focus of this Chair is to advance the green hydrogen economy from production to application.

Prof Nnamdi Nwulu (FEBE) is the Chairholder/Principal Investigator (PI) for the SA-Swiss Bilateral Research Chair in Blockchain Technology, with Dr Luca Mazzola as the co-PI from the Swiss side. The cardinal aim of this Chair is to integrate the essentiality and features of the blockchain technology into supply chain management, using the exportation of goods in South Africa and Switzerland as focus areas of implementation.

In addition to the two SARCHI Chairs awarded, UJ submitted an expression of interest to the NRF to host co-funded SARCHI Chairs in line with the NRF’s core focus of co-funded Chairs, aimed at *“assisting willing universities and other public research entities to accelerate transformation and maintain research excellence consistent with requirements of the SARCHI in research areas aligned to Sustainable Development Goals (SDGs) and National Priorities, such as South Africa’s Medium-Term Strategic Framework (MTSF) priority outcomes and the DSI-driven grand challenges”*. The University is proposing to host several co-funded SARCHI Chairs, which will be located across various faculties, including the Faculty of Science, the Faculty of Health Sciences, and the Faculty of Engineering and the Built Environment. At the time of writing, UJ was still awaiting feedback from the NRF in terms of those prospective SARCHI Chairs that will be invited to submit a full proposal for consideration.

### **Prestigious recognition of UJ researchers and NRF ratings**

Over the past few years, UJ has received numerous accolades awarded to the University or to its researchers, with over 110 prestigious awards and recognitions awarded in 2022. As part of these prestigious awards and recognition, the University also tracks appointments to company boards, councils, and task teams. Representation on boards and councils, for example, allows our scholars to play a role in shaping and influencing various national policies. In 2022, a number of our scholars were appointed to these structures, including the following:

- Dr Kirti Menon, Senior Director: Division for Teaching Excellence, was appointed by the Council on Higher Education (CHE) as the chair of the task team on Online and Blended Learning.
- Dr Beate Stiehler-Mulder (College of Business and Economics) was appointed as the Wholesale and Retail (W&R) SETA leadership chair for Gauteng. Dr Stiehler-Mulder is a senior lecturer in the Department of Marketing Management, which is within the School of Consumer Intelligence and Information Systems in the College of Business and Economics.
- Dr Varoshni Nadesan (Faculty of Humanities) was appointed to the Professional Board for Social Work as the Africa representative on the international task force for the implementation of global standards for social work education. The Professional Board is a statutory board mandated by the Social Service Professions Act to regulate social education, training and practice in South Africa. Dr Nadesan has been elected to represent higher education institutions offering education in social work. The task force comprises five other members from Virginia and Minnesota (USA), Parma (Italy), Stockholm (Sweden), and Hong Kong.
- Dr Trevor Ngwane (Faculty of Humanities) was appointed to the board of My Vote Counts, an organisation that conducts research and advocacy to ensure that the electorate and the general public can exercise their political rights and make political choices from an informed position. This is primarily information related to the funding of political parties and independent candidates, the electoral system and its processes, and intra-party democracy.
- Dr Bongani Ngqulunga (Faculty of Humanities) was appointed to chair the Social and Human Sciences Sector of the South African National Commission of UNESCO.
- Prof Brendon Barnes was appointed to chair the steering committee of the DSI-NRF Centre of Excellence in Human Development.
- Prof Tankiso Moloi (College of Business and Economics) was appointed as the chairperson of the Africa Regional Engagement Group (REG) of the Association of International Certified Professional Accountants.



Research awards received include:

- An NRF Research Excellence Award in the Early Career/Emerging Researcher category was awarded to Prof Mpho Raborife (Institute for Intelligent Systems).
- Two NSTF-South32 Awards, one awarded to Prof Bonathile Makhubela (Faculty of Science) in the category: Emerging Researcher, Green Economy. The second recipient was Prof Simon Connell (Faculty of Engineering and the Built Environment) for the MinPET project, awarded in the category: Innovation Award – Corporate Organisations.
- Other UJ scholars who were finalists in the 2022 NSTF-South32 Awards were Prof Omotayo Arotiba (Faculty of Science), and Prof Nonhlangabezo Mabuba (Faculty of Science).

A total of 275 UJ academics had an NRF rating by 31 December 2022, with 7 As; 54 Bs; 161 Cs; and 53 Ys. In March 2022, UJ submitted 92 NRF rating applications to the NRF and if successful, these ratings would become valid on 1 January 2023. At the time of writing (February 2023) UJ had a total of 300 NRF-rated researchers (6 As; 54 Bs; 174 Cs; and 66 Ys), thus adding to the growing number of rated researchers at the University.

### ***Applied technology-driven research and innovation, including commercialisation of research***

The UJ IP portfolio continues to grow, with a total of 64 provisionally or fully registered patents reported by 31 December 2022. Filing decisions are aimed at expanding the portfolio of high-quality UJ IP with potential application in industry and/or society, in a cost-effective manner. In 2022:

- 19 invention disclosures were received by the UJ Technology Transfer Office (TTO).
- 13 patent and design applications were filed, representing 5 families (i.e. unique inventions/designs), covering 8 territories.
- 2 patents were granted.
- 7 industrial designs were registered.
- 1 trade mark was registered.

Four new projects were awarded seed funding by the Technology Innovation Agency (TIA), while seven projects received funding from the UJ GES 4.0 Innovation Advancement Fund. These awards were made to projects with activities that will assist in advancing their commercial potential.

During the period under review, the UJ TTO was selected to participate in the Entrepreneurship Development in Higher Education (EDHE)'s Economic Activation Office (EAO) pilot project. As part of the EAO project, the TTO hosted an entrepreneurship stakeholder engagement forum in March 2022 with a view to establishing a UJ entrepreneurship hub. For Student Entrepreneurship Week, a Studentpreneur Expo was organised, affording student entrepreneurs a marketing opportunity to showcase their businesses to the campus community. An 'IP-athon' (IP hackathon) was held in which aspiring student entrepreneurs were tasked with developing a viable business concept for various UJ technologies, with a view to making these technologies available for licensing to the students concerned.

### ***Postgraduate output and support***

#### ***Enrolment and graduate monitoring***

Monitoring postgraduate graduates for the 2022 graduation cycle commenced in April 2022 and will conclude in March 2023. The overall postgraduate graduation target for 2022 was set at 3 887. Reporting as of 6 February 2023 indicated that a total of 3 316 postgraduate students had graduated. A further 706 potential graduates were due to graduate at the ceremonies in March 2023. In terms of the different postgraduate categories, at honours level, 1 891 graduated, 741 at master's level, and 145 at doctoral level. The number of South African black graduates is an important postgraduate target; the number of South African black doctoral graduates increased from 40 in 2018 to 85 in 2020, but dropped to 75 in 2021. The monitoring of 2022 enrolments in comparison to 2021 statistics confirmed that the University's postgraduate headcounts increased by 531 (4,9%), from 10 863 in 2021 to 11 394 in 2022. The total headcount was 374 (3,4%) above the target at the PG level. The PG below master's headcounts decreased by 30 (0,7%), from 4 382 to 4 352. The master's headcount increased by 8%, from 4 781 to 5 125, which is 236 (4,8%) above the target. The doctoral headcount increased by 12,8%, from 1 700 to 1 917, and exceeded the target by 214 (12,6%).



### **Postgraduate funding**

In terms of postgraduate funding, the URC budgeted funds increased from R68 540 079.78 (2021) to R73 601 484.75 (2022). The total URC funds spent as at 31 December 2022 was R71 288 369.51. The unspent amount of R2 313 115.24 was reallocated. The large unspent amount was because several international postdoctoral research fellows (PDRFs) were unable to take up their positions at UJ in 2022. The funds were redistributed to various faculties as additional funding to assist honours, master's, and doctoral students with bursaries. The GES 4.0 budgeted funds increased from R38 150 000 (2021) to R40 740 960 in 2022. The total GES 4.0 funds spent as of 31 December 2022 was R30 485 850.29. The total amount received and spent from external funders was R14 122 443.92. The NRF funds increased from R79 603 686.49 (2021) to R99 564 629 in 2022. The University Research Committee (URC) and GES funding plays a major role in the increase in the number of PDRFs. The Postgraduate School administered 406 postdoctoral research fellows in 2021. This number, however, decreased in 2022 to 276 PDRFs as of 31 December 2022, excluding those who terminated during 2022. The decline in the number of PDRFs is mainly attributable to the delays in the processing of visa applications, as most of our research fellows are international. In total, 141 PDRFs were allocated with URC funds, 16 PDRFs were funded from senior PDRFs budget, 55 PDRFs were funded from GES 4.0, two PDRFs were funded from the rollover budget, and 21 PDRFs were funded from external funds and 41 PDRFs from NRF.

### **Postgraduate student support**

The Postgraduate School affords support to postgraduate students through two units, namely Research Capacity Development (RCD) and Statistical Consultation Service (Statkon).

#### **Research Capacity Development (RCD)**

The Unit has three main activities, which are aligned with its mandate and focused its endeavours within these categories guided by set targets to be achieved for 2022. These were:

- Activity 1 – Research capacity development workshops.
- Activity 2 – Online courses, mini courses, SLPs, presentation opportunities and digital resources for postgraduate students.
- Activity 3 – Writing support for postgraduate students.

#### **Activity 1 – Research capacity development workshops**

The Unit ran workshops on various aspects of the research process using an online, face-to-face and concurrent face-to-face and real-time streaming mode. Forty workshops and two my postgraduate journey workshops were targeted for 2022. This target was achieved and exceeded in their offering of 57 workshops and four my postgraduate journey workshops. The number of attendees participating in the workshops varied depending on the month of the year and the topic on offer. The highest number of attendees was observed in May (1 076) and the lowest in November (56).

#### **Activity 2 – Online courses, mini courses, SLPs, presentation opportunities and digital resources for postgraduate students**

The Unit planned to develop and run online mini courses and provide one-on-one online support and digital resources for postgraduate students. Through an instructional designer, the Unit endeavoured to convert written material to pedagogically sound online learning material. This material was posted and completed on the LMS. The Unit also facilitated the annual Visualise Your Thesis (VYT) and the Three Minute Thesis (3MT) competitions and an interfaculty postgraduate student and postdoctoral research fellow conference. In addition, RCD facilitated one self-access, asynchronous STEM writing mini course and one self-access writing for publication course in 2022.

#### **Activity 3 – Writing support for postgraduate students**

During 2022, RCD provided direct writing support for postgraduate students in the form of 386 one-on-one consultations with feedback on written work, online support in synchronous writing mini courses, support in 20 'sit tight and write' sessions, and guidance in three residential writing retreats. The Unit also designed and ran tailored workshops for the various departments and faculties as well as two 'establishing a writing practice' courses. A science communication training workshop was also successfully hosted by the Unit in collaboration with The Conversation Africa.



### **Statistical Consultation Service (Statkon)**

This Unit endeavours to provide a research-orientated service to UJ postgraduate students and staff conducting quantitative, statistically based research. During 2022, Statkon consultants contributed to excellence in research, increase in research output and throughput of students by providing support for 326 projects. Over 50% of projects supported master's students. The second highest percentage of projects supported was for doctoral students. Staff research projects constituted the third highest, while 10% of the supported projects catered for honours students. In addition to new analysis projects, Statkon consultants also provided research design and statistical analysis support for projects carried over from 2021. Consultants continued to facilitate a significant proportion of meetings online, which were the preference of most researchers, and this mode of delivery was executed successfully with minimal disruptions to business continuity. Statkon also prepared 56 online questionnaires for UJ researchers, and their statistical consultants provided post-analysis support for approximately 20 projects.

## **Strategic initiatives and administration**

### **University Capacity Development Grant**

The overarching aim of the DHET University Capacity Development Grant (UCDG) is to support the academic research activities and capacity development of staff, directed mainly towards staff completing higher degrees. In addition, the mobility grant provides opportunities for international travel to establish and support new and existing research collaborations and partnerships. Overall, seven projects listed below were supported in 2022, with a total annual budget of R7.037 million allocated. The seven UCDG projects are:

- Project 1: Improvement of staff qualifications.
- Project 2: Research career development of emerging and mid-career researchers.
- Project 3: Professionalisation of academic and research staff.
- Project 4: Supervision development.
- Project 5: International collaboration and networking.
- Project 6: Women leadership development programme.
- \* ■ Project 7: Providing integrated student support and development to postgraduate students.

### **The GES 4.0 Initiative**

The GES Initiative was launched in 2014 as an integrated and structured approach to catalyse institution-wide change for enhanced effectiveness and efficiency across the University's missions and administrative support functions. The initiative's ultimate goal is to support UJ in sustaining academic excellence for global competitiveness and prominence, while remaining relevant and responsive to the Pan-African agenda.

The GES initiative has several interlinked catalytic interventions whose particular objectives are aligned with and support the KPIs of the University Strategic Plan 2025. In particular, these interventions aim to strengthen academic and research capacity and leadership within the University, with the ultimate goal of increasing research outputs and impact. Of particular relevance are postgraduate and postdoctoral support (covered earlier in this report), the visiting academic programme and the flagship institutes.

### **Virtual Academic Programme**

Although initially viewed as a Visiting Academic Programme, due to the COVID-19 period, this catalytic initiative evolved into a largely *Virtual* Academic Programme. As a result, this aspect of the GES 4.0 catalytic initiative gained further momentum, with more than 95% of the lifespan budget committed. The overall GES 4.0 allocation to the Visiting Academic Programme is more than R120 million; in total (including GES 4.0, GES 1.0, and centrally funded positions), we have close to 150 visiting academics who are supported with these funds. The ROI for the Visiting Academic Programme continues to grow, with a notable contribution towards research output, stature, and student/PDRF/staff mentoring. The majority of our distinguished visiting professors (~60%) are included by Elsevier as among the top 2% of scholars in their respective fields, while ten are included in the Clarivate Highly Cited Researchers list (five list UJ as their secondary affiliation). If one considers only outputs where a monetary value can easily be assigned, 38 (combining GES 1.0 and GES 4.0) visiting/virtual distinguished professors submitted research/scholarly outputs amounting to 102.25 units (up



from 70.31 units for 2021 publications) for accreditation (these are outputs that carry a 2022 date), amounting to R12.98 million in publication subsidy to UJ. The honoraria paid to visiting academics is supported by an ROI analysis (keeping in mind the Council's condition of a 1:1 return on investment (ROI)). It should be noted, however, that the value added (ROI) by this programme extends beyond a monetary value, through the stature added, international collaborative networks, staff/PDRF/student mentoring, and/or workshops.

### **Flagship institutes**

UJ continues to grow its national, Pan-African, and international stature through several flagship institutes and programmes, with contributions to research and scholarly outputs, student training, industry linkages, and third-stream income generation. In 2022, 2021 and 2020, the flagship institutes collectively contributed 139.83 units for DHET accreditation. As horizontals across the vertical faculties, the institutes contribute to the UJ academic programme through teaching and learning and postgraduate student supervision. Of note is that the Master's degree in AI (through the Institute for Intelligent Systems, IIS) was accredited in 2021 and commenced with intake in 2022; and that the Master's degree in Development Studies, specialising in Africa and the Caribbean, a joint endeavour between the Institute for Global African Affairs (IGAA), and the University of the West Indies, similarly started in 2022.

Two of the institutes saw some change in leadership. For the Institute for Pan-African Thought and Conversation (IPATC) and the IGAA, Prof Siphamandla Zondi was appointed as the Director following Prof Adekeye Adebajo's departure; Prof Mpho Raborife was appointed as the Deputy Director of the IIS.

The IIS remains hugely successful in establishing longer-term collaborations, linked to external fund leveraging. Examples include Accenture (R50 million over five years) and Growing Up Africa (over R40 millions of in-kind infrastructure commitment). A significant contract was signed with eGov in 2022 (to the value of R68.4 million over three years) to advance training in AI broadly. IPATC promotes innovative global African thought leadership through community-engaged research, teaching, and dialogue. IPATC furthered collaborations that intersect the African Union Agenda 2063, Sustainable Development Goals (SDGs) and 4IR. This is in the context of the priority areas, for internationalisation, as established through the National Planning Commission (NPC).

A number of writing fellows joined the Johannesburg Institute for Advanced Studies (JIAS) Fellowship Programme. The Institute for the Future of Knowledge (IFK) shifted its focus towards utilising 4IR technologies to promote sustainable development. To achieve this goal, the Institute incorporated new research areas, including blockchain and the Cryptoverse (a 3D virtual world), decentralised artificial intelligence and control systems, and work of the future. The IFK also published several opinion pieces in local and international media outlets, including live broadcasts. The UJ Confucius Institute (UJCI), in collaboration with the Culture Office, Embassy of China in South Africa, ushered in the Chinese New Year on 1 February 2022, and the event was well attended by various official guests.

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**Ndivhuwo Luruli (Dr)**

Executive Director:  
Research and Innovation

