



UNIVERSITY  
OF  
JOHANNESBURG



# RESEARCH & INNOVATION

## 2021 ANNUAL REPORT

The Future  
Reimagined



# RESEARCH & INNOVATION

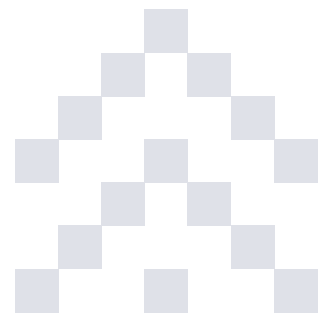
2021 ANNUAL REPORT

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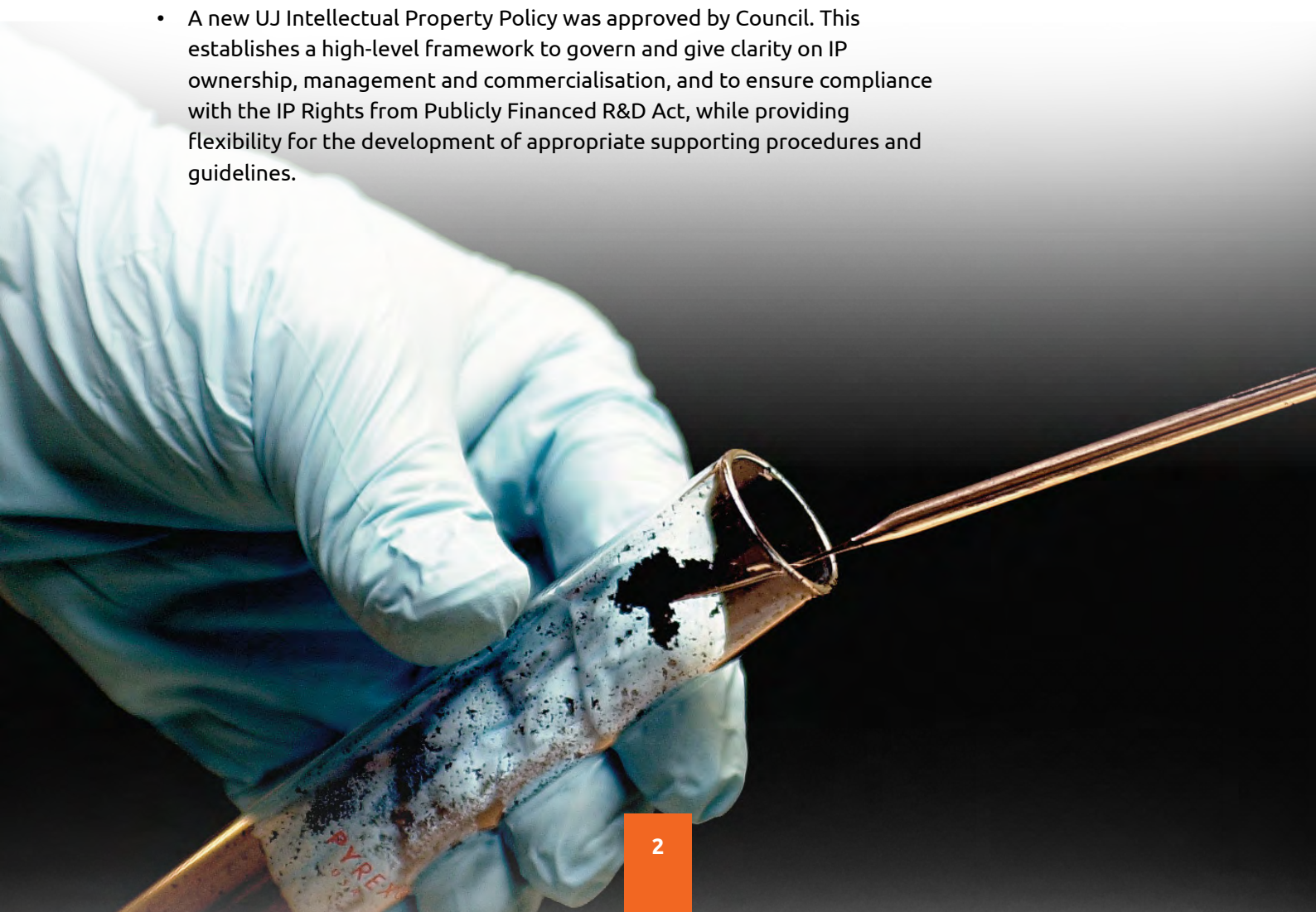
# EXECUTIVE SUMMARY



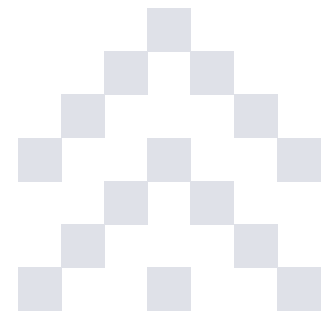
Despite the challenges and changes brought on by COVID-19 restrictions, the University of Johannesburg (UJ) continued to strengthen its position as a research-intensive tertiary institution. This was largely due to the University's position as a South African (and African) leader in the 4th Industrial Revolution (4IR), which assisted greatly in the COVID-precipitated transition from March 2020, and well into 2021.

Significant highlights for the 2021 academic year include:

- Total external research income of R321 million, exceeding the target of R200 million by 60.5%, and exceeding funds received in 2020 by 31%.
- UJ retained second position among the 26 South African public universities, in terms of the number of DHET accredited research outputs produced in 2020 (2021 submission year).
- The overall number of NRF rated researchers at UJ continues to increase year-on-year and currently stands at 270.
- Six (6) patents were granted during the 2021 academic year, further increasing the UJ intellectual property portfolio.
- More than eighty (80) prestigious awards and recognition were bestowed upon UJ scholars and staff during the 2021 academic year.
- A new UJ Intellectual Property Policy was approved by Council. This establishes a high-level framework to govern and give clarity on IP ownership, management and commercialisation, and to ensure compliance with the IP Rights from Publicly Financed R&D Act, while providing flexibility for the development of appropriate supporting procedures and guidelines.



# RESEARCH & INNOVATION TEAM



Four Units/Departments make up the Research and Innovation Division. These Units are responsible for a range of research support related activities including general research and innovation administrative and management support, and facilitating access to external funding. Specific focus areas for each unit are presented below, while the structure of the Division is presented in Figure 1.

## **a) Research Administration**

- Quality assurance and compliance with the Department of Higher Education and Training (DHET) Research Output policy (2015) as well as the DHET Creative Outputs and Innovations policy implemented in 2019;
- Completion of national and international surveys such as the annual national Research and Development (R&D) survey coordinated by the Human Sciences Research Council (HSRC).

## **b) Research Intelligence**

- Research benchmarking
- Bibliometric analyses

## **c) Strategic Research Support**

- External research income
- NRF Rating
- Research collaborations through networks and partnerships
- Support for emerging and mid-career researchers
- Research and Innovation/Ideation Chairs and Research Entities
- Nominations for prestigious awards and recognitions
- Senate committees, including the University Research Committee

## **d) Technology Transfer Office**

- Managing the University's intellectual property portfolio
- Technology transfer
- Guiding opportunities as they progress towards commercialization
- Accessing development and pre-commercialisation funding
- Managing an incubation programme
- Brokering local and international commercial partnerships to move innovations to intended markets

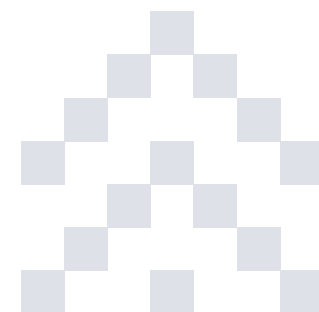
TTO also works closely with the university company, UJInvnt, which will drive the commercialisation of selected internal opportunities.





**Figure 1.** Organogram of the Research & Innovation Division

\*Portfolio vacant for part or most of 2021



# STAFF MOVEMENTS

Changes in staff composition during 2021 comprised mainly of new appointments. The Technology Transfer Office (TTO) appointed a new Director, Ms Rosemary Wolson, who joined the team on 1 March 2021. The Strategic Research Support Unit was joined by two Research Officers – Ms Kgalalelo Motlhabane (from 1 January 2021) and Mr Tshediso Msibi (from 1 July 2021). The Executive Director: Research and Innovation, Dr Carol Nonkwelo resigned end October 2021.

As shown in Figure 1, the total staff complement for 2021 was nineteen (19) staff members (the position of Research Officer in the Research Administration unit was vacant for all of 2021). Of these, twelve (12) are permanent positions, while the remainder (seven) are fixed-term positions funded from external sources. One of the fixed-term appointments was that of a Research Assistant: Grants (Ms Katleho Mokwatsi), to assist with the management of grants received from the National Research Foundation. The research grant management portfolio of the university had only been managed by one staff member so far, and with the growth in number of grants applied for, and received by our academics, it became critical that additional capacity is added.

The Division also received approval (in 2021) to appoint two administrative staff on a 3-year fixed-term contract. The additional staff members will join the Research Administration Unit, and thus assist with Research Outputs as well as Creative Outputs work. The positions will be filled during the course of 2022.

**Table 1.** Research and Innovation Division staff Profile in 2021 (as at the beginning of the year)

Level	Total	Gender		Contract type			Race			
		M	F	Permanent	Fixed term Contract	Temporary	A	I	W	C
P3	1		1		1					1
P5	3	1	2	3			1	1	1	
P6	3	2	1	3			1		2	
P7	4	1	3	3	1				3	1
P8	2	1	1		2		2			
P10	2		2	1	1		2			
P11	4		4	2	1	1	1	1	1	1
<b>Total</b>	<b>19</b>	<b>6</b>	<b>12</b>	<b>12</b>	<b>5</b>	<b>1</b>	<b>7</b>	<b>2</b>	<b>6</b>	<b>3</b>



# GOVERNANCE

The statutory and other governance structures in which the Research and Innovation portfolio is involved include:

- Senate
- Senex
- Senate Committee(s) chaired by the Deputy Vice-Chancellor: Research and Internationalisation
  - University Research Committee (URC)
- Senate Research Ethics Committee
- Management Executive Committee – Commercialisation Committee (MECCC).

Other:

- Resolution Circle Board (invitee)
- UJInvnt Board (invitee)

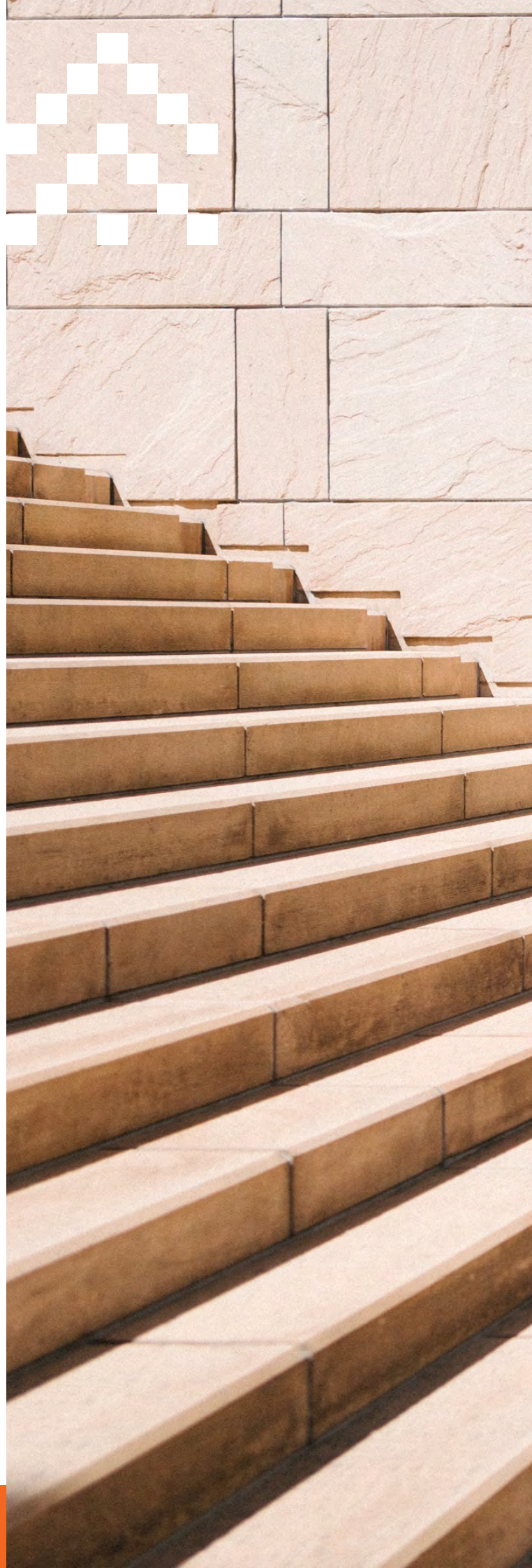
Research and Innovation Policies and strategies that govern and guide the research and innovation activities include:

- UJ Research Strategy
- Policy on UJ Research and Strategic Entities
- Policy on Incentive Scheme for Research, Creative and Innovation Outputs and NRF Rating
- Intellectual Property Policy
- Code for Academic and Research Ethics

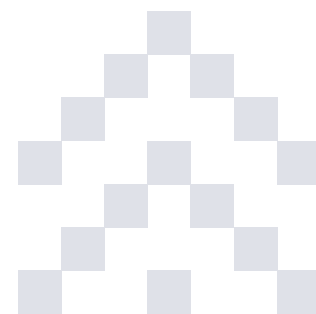
## Risk Management

Working with the Division for Risk and Assurance, the Research and Innovation Division's risk register is reviewed annually. High- to medium-risk areas identified in 2021 included:

- The decrease in growth of research output as a result of the COVID-19 pandemic
- Limited diversification and growth of external research and post graduate funding opportunities
- Inability to attract funders/donors willing to fund large-scale research projects likely to result in commercialization of the outcomes
- Lack of SA funding and companies to develop the development and uptake of UJ technologies
- Legal and compliance risks pertaining to research contracts
- Limited capacity/staff within the Research Office
- Lack of understanding by internal stakeholders, i.e. UJ academics, of the commercialization life cycle



# 2021 ACHIEVEMENTS AND HIGHLIGHTS



## NRF Rated Researchers

The number of NRF-rated researchers at the University of Johannesburg continues its upward trajectory (Table 2) (at the time of writing, two applicants who submitted their applications to the NRF in March 2021 were still awaiting feedback and are not included here). During the reporting period, the number of A-rated researchers at UJ remained at six – these are researchers that their peers recognise as global leaders in their respective fields. UJ's A-rated researchers are in the fields of Geology, Educational Leadership and Management, Zoology, Intelligent Systems, Leadership and Management, and Mathematics. In 2021, the UJ's Management Executive Committee (MEC) approved a strategy to retain A and B-rated researchers on a post-retirement 5-year contract, as well as SARChI Chair holders until the end of their Chair contracts. Resulting from this strategy, the retirement policy was updated and approved by Council (in November 2021).

There was an increase of 10.2% in the number of UJ NRF-rated researchers, from 245 in 2020/21 to 270 by May 2022. Contributing to the increase are the new ratings that became effective on 1 January 2022 based on applications submitted in March 2021. The University submitted fifty-nine (59) NRF Rating applications to the NRF in 2021, comprising of 42 new and 17 re-applications (these are from researchers who held an NRF Rating previously).

**Table 2.** UJ's NRF-Rated Researchers per Category as of May 2022

Year	Rating Category and number per category						Year-on-year % increase
	A	B	C	P	Y	Total	
2014	6	32	77	1	26	142	-
2015	6	33	86	1	30	156	10%
2016	6	38	97	1	34	176	13%
2017/18	9	40	107	1	32	189	7.4%
2018/19	7	39	108	0	39	193	2.1%
2019/20	8	46	128	0	43	225	16.6%
2020/2021	7	50	141	0	47	245	9%
2021/2022	6	53	159	0	52	270	10.2%



## External Research income

The University raised an incredible R321 million in external research income during the 2021 academic year – 60.5% above the target of R200 million. Furthermore, the 2021 income exceeds the income received during the 2020 academic year by 31% (R245.6 million was raised in 2020). Of the total funding, R52.96 million was received from international sources, while R268 million was from local funding agencies and institutions, including the National Research Foundation (NRF); the South African Medical Research Council (SAMRC); the National Institute for the Humanities and Social Sciences (NIHSS); national departments such as the Department of Trade and Industry (DTI); Technology Innovation Agency (TIA); as well as from some Sector Education and Training Authorities (SETAs). External research income also includes funding for postgraduate scholarships.

**Table 3.** External research income per faculty/division

Faculty	Amount (Rm)
CBE	25,880,884.33
EDU	13,122,381.29
FADA	3,769,689.70
FEBE	78,926,155.71
HSC	8,924,294.94
HUM	49,444,595.96
LAW	2,673,597.84
MEC	42,052.00
PGS	64,781,227.70
SCI	73,492,742.16
SIA	10,462.44
<b>Grand Total</b>	<b>321,068,084.07</b>

\*CBE = College for Business and Economics; EDU = Faculty of Education; FADA = Faculty of Art, Design and Architecture; FEBE = Faculty of Engineering and the Built Environment; HSC = Faculty of Health Sciences; HUM = Faculty of Humanities; LAW = Faculty of Law; PGS = Postgraduate School; SCI = Faculty of Science; MEC = Management Executive Committee; SIA = Strategic Initiatives and Administration.

This significant growth in external research income is due to several factors, most important of these is the collaboration between the Research Office and other key divisions within the university – namely the Development and Fundraising Office, the International Office, the Postgraduate School, Strategic Initiatives and Administration, the Finance Division, as well as Procurement Office. Other activities were engagements with academics through workshops and webinars with a focus on writing of grants/funding proposals.

## Research and Innovation/Ideation Chairs

Currently, the University is host to just over twenty Research and Innovation/Ideation Chairs, seventeen (17) of which are the Department of Science and Innovation (DSI)/NRF South African Research Chairs Initiative (SARChI Chairs). During the course of 2021, our Research Chairs received awards in recognition of their work and some were appointed to various bodies.

Prof Heidi Abrahamse, the SARChI Chair in Laser Applications in Health was accepted to the Harvard Medical School Global Clinical Scholars Research Training 2022 Program, following a competitive selection process involving a large pool of international applicants. Prof Abrahamse was also inaugurated as member of the Academy of Science of South Africa (ASSAf).



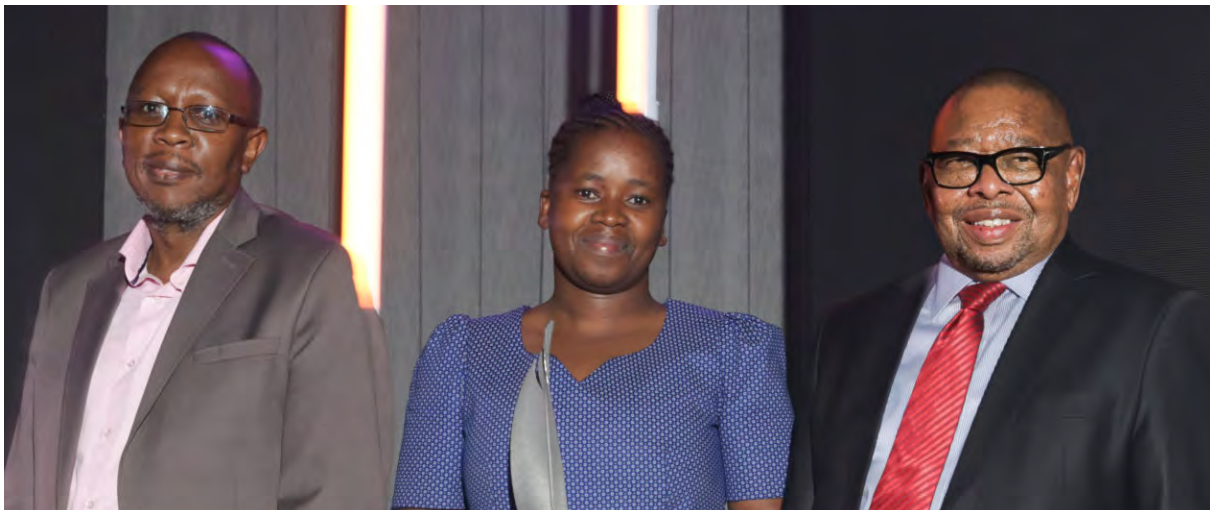
Prof Heidi Abrahamse

Prof Erika Kraemer-Mbula, SARCHI Chair in Transformative Innovation for the 4th Industrial Revolution and Sustainable Development, was appointed new President of the Global Network for the Economics of Learning, Innovation and Competence-Building Systems (Globelics) in November 2021.



Prof Erica Kraemer-Mbula

Professor Philiswa Nomngongo, SARCHI Chair in Nanotechnology for Water, was awarded the 2020/2021 NSTF-South32 Award in the Engineering Research Capacity Development category.



Prof Philiswa Nomngongo (middle) with the Minister of Higher Education, Science and Innovation (right) at the NSTF-South32 Awards event, 30 September 2021

Prof Leila Patel, SARCHI Chair in Welfare and Social Development, received an award in leadership in international social development at the 22nd Biennial International Consortium for Social Development Conference (ICSD) in July 2021.





Prof Leila Patel

Prof Tankiso Moloi was appointed as the Chair of Africa Regional Engagement Group' for the Chartered Institute of Management Accountants (CIMA) and Association of International Certified Professional Accountants (AICPA).



Prof Tankiso Moloi

## Research Centres and Institutes

Through the Policy on UJ Research and Strategic Entities, the university Senate approves Research Centres and Institutes throughout the year. The following entities were approved during the reporting period:

- Atomic Layer Deposition Research Centre (ALDRC), FEBE
- Centre for Applied Data Science, CBE
- Centre for Smart Information and Communications Systems (CSICS), FEBE
- Centre for Sustainable Material and Construction Technologies (SMaCT), FEBE
- Nuclear Research Centre, FEBE
- Joint Research Centre on Climate Change and Smart Mobility (JRC-CCSM), CBE, FEBE & Science
- Centre for Data and Digital Communication, Humanities



Also in line with the Policy on UJ Research and Strategic Entities, the Research & Innovation Division embarked on a process of reviewing research centres and institutes funded through the University Research Committee (URC). The review process will continue into 2022. The policy states that “all entities will be subject to an in-depth, end-of-cycle, peer-review process to assess performance”, and that “the review will include an evaluation of the performance of each entity against goals set out at the time of its establishment, following the review criteria outlined”. The five research centres and institutes reviewed in 2021 are listed below.

- Institute for Pan African Thought and Conversation (IPATC)
- Paleoproterozoic Mineralization Research Centre (PPM)
- Institute for Intelligent Systems (including former Centre for Telecommunications)
- African Centre for DNA Barcoding (ACDB)
- Palaeo-Research Institute

## **Prestigious Awards and Recognition**

Overall, more than eighty (80) prestigious awards and recognition were bestowed upon UJ scholars and staff during the 2021 academic year. These were awarded by both national and international institutions. Furthermore, recipients are based across all UJ faculties and support divisions, as well as within the Management Executive Committee (MEC) – attesting to excellence across all faculties and divisions of the university. The types of awards and recognition include research excellence awards; appointments to national commissions; lifetime achievement awards; and recognition for “top-cited researchers”.

UJ’s strong focus on developing and nurturing talent is also evident from the list of 2021 award recipients. At the 2021 NRF Awards, for example, five UJ academics received the Research Excellence Award for Early Career/Emerging Researchers. These academics are: Dr Tebogo Mashifana; Prof Oluwafemi Adebo; Prof Shanade Barnabas; Prof Nnamdi Nwulu; and Prof Moses Phooko. The sixth UJ recipient of an NRF Award was Dr Nkositile Biata who received the Research Excellence Award for Next Generation Researchers. Professor Philiswa Nomngongo, holder of a SARChI Chair in Nanotechnology for Water, was awarded the 2020/2021 NSTF-South32 Award for Engineering Research Capacity Development “for her training, nurturing and mentoring students through her research focused on analytical environmental chemistry of organic and inorganic pollutants in environmental, biological and other matrices”.

Sumayya Vally, a Lecturer at UJ’s Faculty of Art, Design and Architecture (FADA) was honoured by Times Magazine when she was listed as “The World’s Most Influential Architect Shaping the Future”. Sumayya is the founder of Counterspace, a Johannesburg-based architectural firm, and was praised for her design for the 2020/2021+ Serpentine Pavilion in London. This feat made her the youngest female architect to receive this prestigious accolade.

Dr Nolitha Vukuza, a UJ MEC member, and Prof Mbangiseni Nephumbada, a Professor of Practice at UJ’s Faculty of Engineering and the Built Environment (FEBE), were both appointed by the Minister of Basic Education, Mrs. Angie Motshekga, as members of the seventh South African National Commission for UNESCO until 2024. This Commission was established by Cabinet in 1996 to promote UNESCO’s objectives with regard to education, science, culture, and communication and information, which are the organisation’s targeted fields of competence.

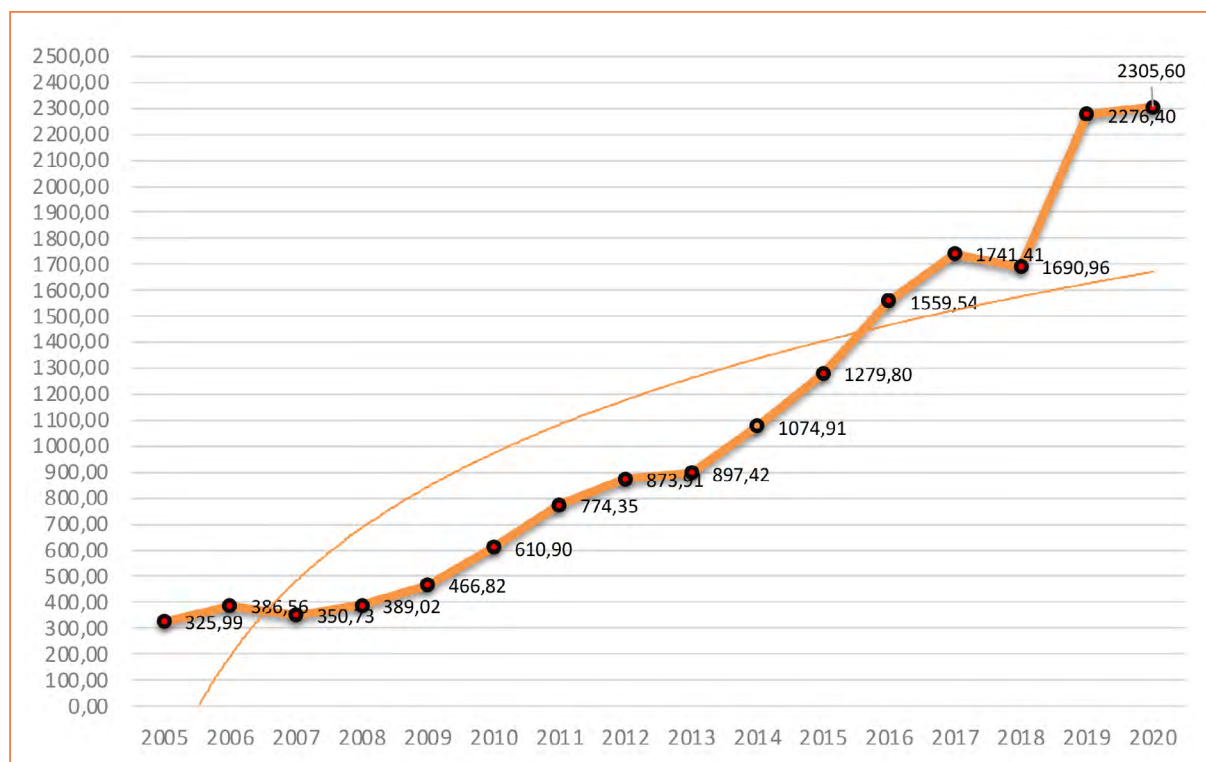


Professors Siphamandla Zondi and Mohammed Jahed were appointed to the National Planning Commission by President Cyril Ramaphosa.

Professor Michael Hamblin, a Distinguished Visiting Professor (DVP) at UJ's Laser Research Centre, was recognized as one of the top 1% cited researchers internationally, while Clarivate Analytics named four of our DVPs among top-cited researchers. These DVPs are Prof Arnold B Bakker (CBE); Prof Mika Sillanpaa (FEBE); Prof Nripendra P Rana (CBE); and Prof Samuel Fosso Wamba (CBE). Several of our academics were inaugurated as members of the Academy of Science of South Africa (ASSAf), they are Prof Heidi Abrahamse (Faculty of Health Sciences); Prof Ruth Stewart (Faculty of Humanities); Prof Shireen Motala (Faculty of Education); Prof Kapil Gupta (FEBE); and Prof Nnamdi Nwulu (FEBE).

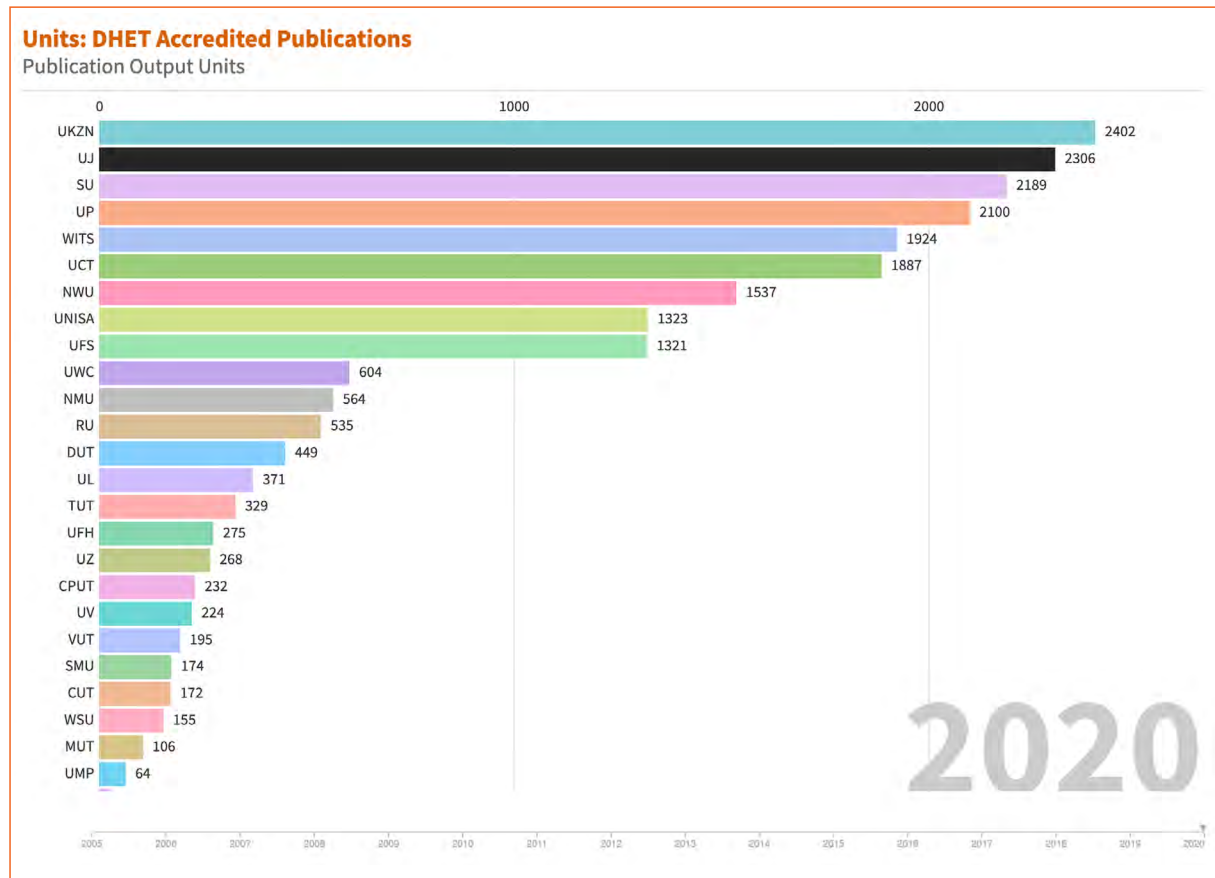
## Research productivity: accredited outputs produced in 2020 and submitted to DHET in 2021

In May 2021, UJ submitted 3818 publications authored in 2020 worth 2372 units to the DHET for accreditation and subsidy, a small increase (1.4%) compared to the previous year. Of these, 97.2% were accredited, which, when including a successful appeal for a 2019 book publication, resulted in UJ being awarded 2306 units for the 2020-year publications. UJ retained its second position nationally for research publications output units, fractionally behind UKZN, but ahead of the other traditional "big five" SA institutions (UCT, SU, Wits and UP). Considering the recent 5 years, UJ's publications output units have increased by an average of 13.3% vs the SA HEI sector's growth of 6.0% and the top ten institution's combined growth of 5.9% over the period. Since UJ's inception, publications unit growth has averaged 14.6% which equates to a compound annual growth rate (CAGR) of 13.9% between 2005 and 2020. The sector achieved average and CAGR rates of 7.7% and 7.6% respectively over the period. Figure 2 demonstrates UJ's sustained and remarkable growth in research publications output units since the institution's inception.



**Figure 2.** Total DHET publications output units awarded to UJ since 2005

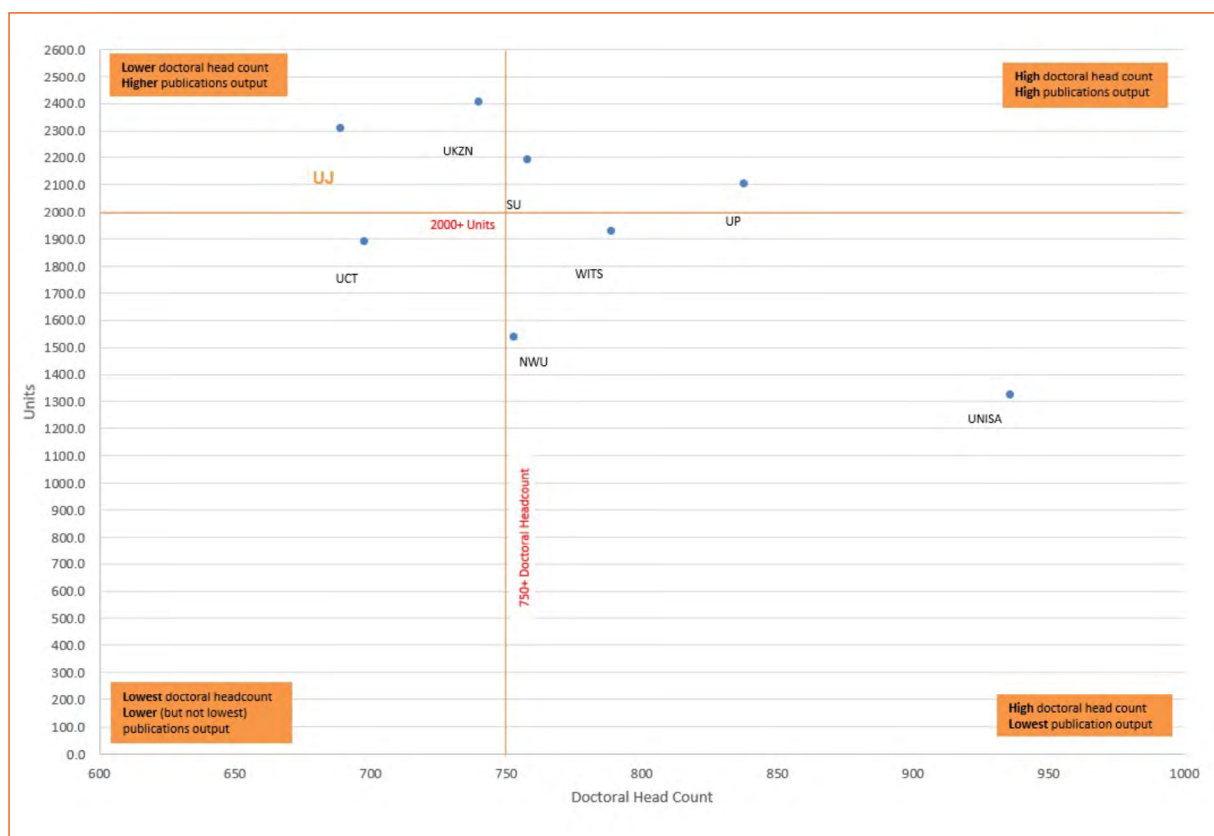
UJ's position relative to the other SA HEIs in terms of research publications output as of 2020 is shown in Figure 3. To visualise UJ's research publications progress since inception, click [here](https://tinyurl.com/UJDHETUNITS), or copy/paste the following URL into a browser: <https://tinyurl.com/UJDHETUNITS>.



**Figure 3:** UJ's research publications output progress visualised

As shown below, UJ achieved the second highest research publications output units despite having the lowest doctoral headcount. Increasing UJ's doctoral cohort may present the opportunity for UJ to significantly increase its research publications output units.

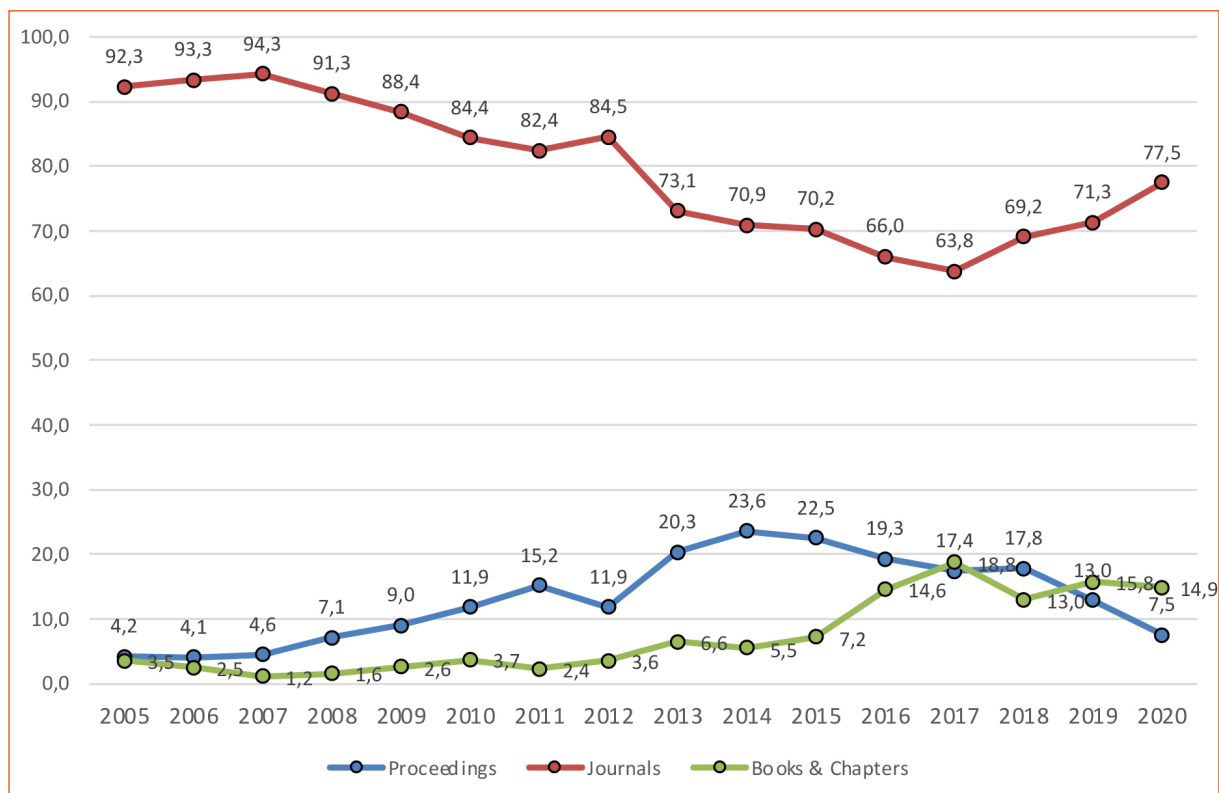




**Figure 4.** Research publications output units of the top ten institutions vs doctoral headcount

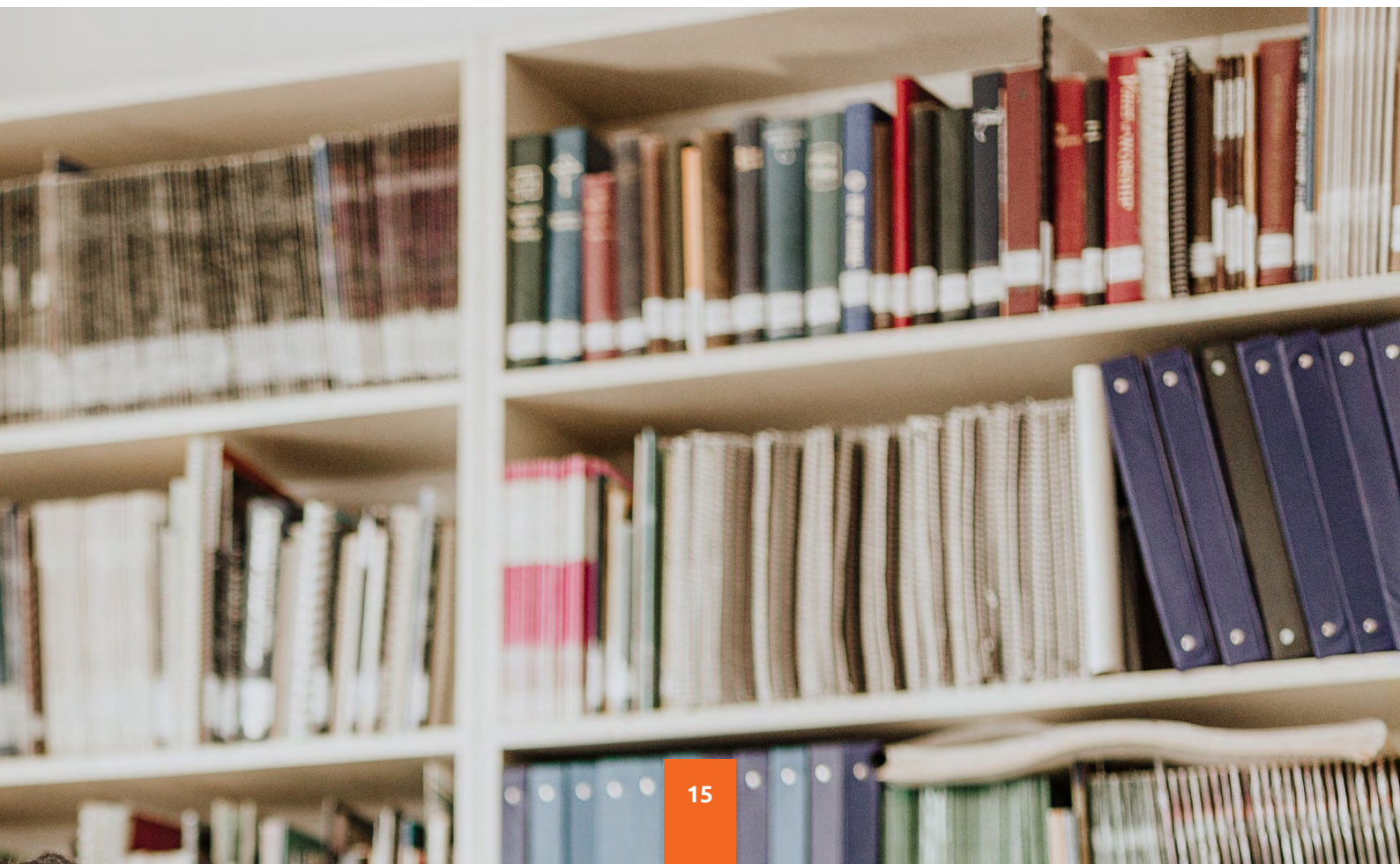
It is encouraging to note that journal articles comprise an increasing volume of UJ's research publications output units. In recent years the volume of journal article units has steadily increased. In 2017, journal article units comprised 64% of the total publications output units, rising to 78% by 2020. Over the period the proportion of conference proceedings has decreased, while books and chapters remain stable. The figure below indicates the percentage composition of UJ's publications output units since inception.

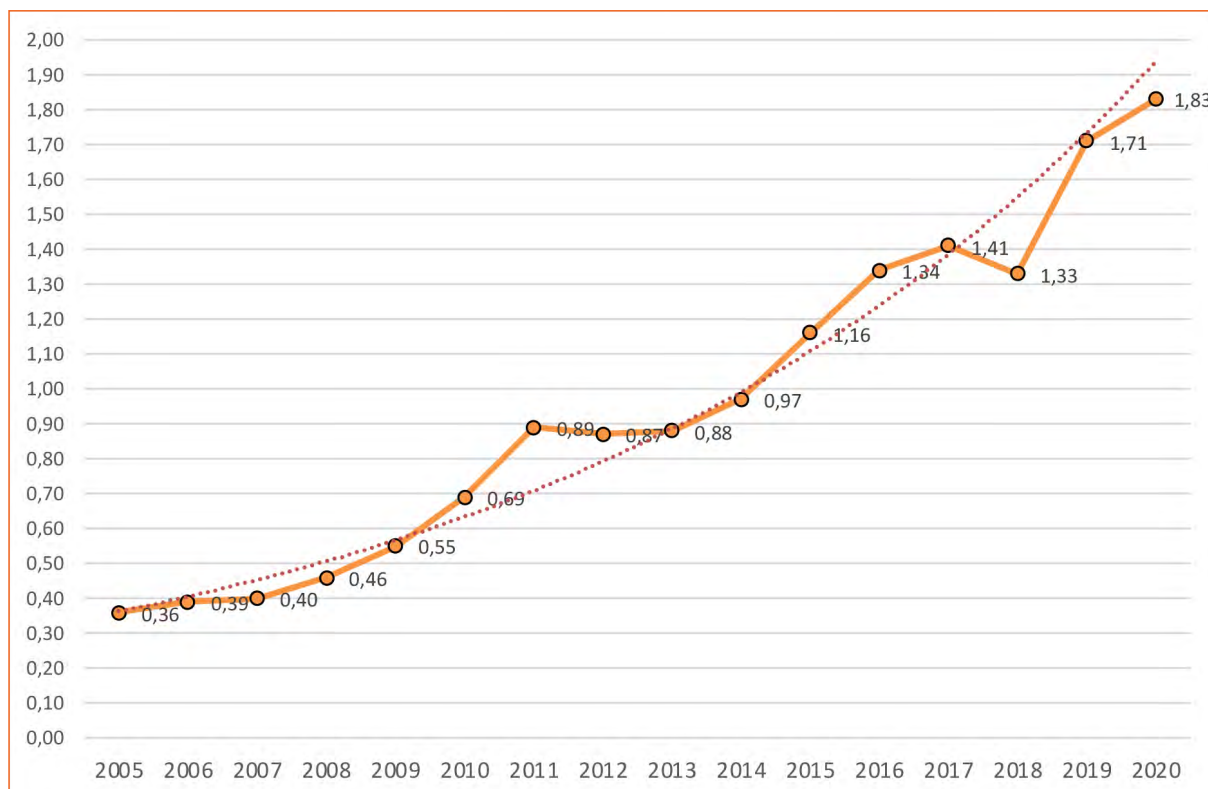




**Figure 5.** Percentage composition of UJ's publications output units since 2005.

The total number of research publications output units awarded to institutions is partly a function of their size; those with large staff and student cohort are more likely to produce high volumes of research outputs. Figure 6 indicates the increasing trend in UJ's per capita research output which refers to the average publications output units per permanent academic staff member.





**Figure 6.** UJ's per capita research publications output units since 2005

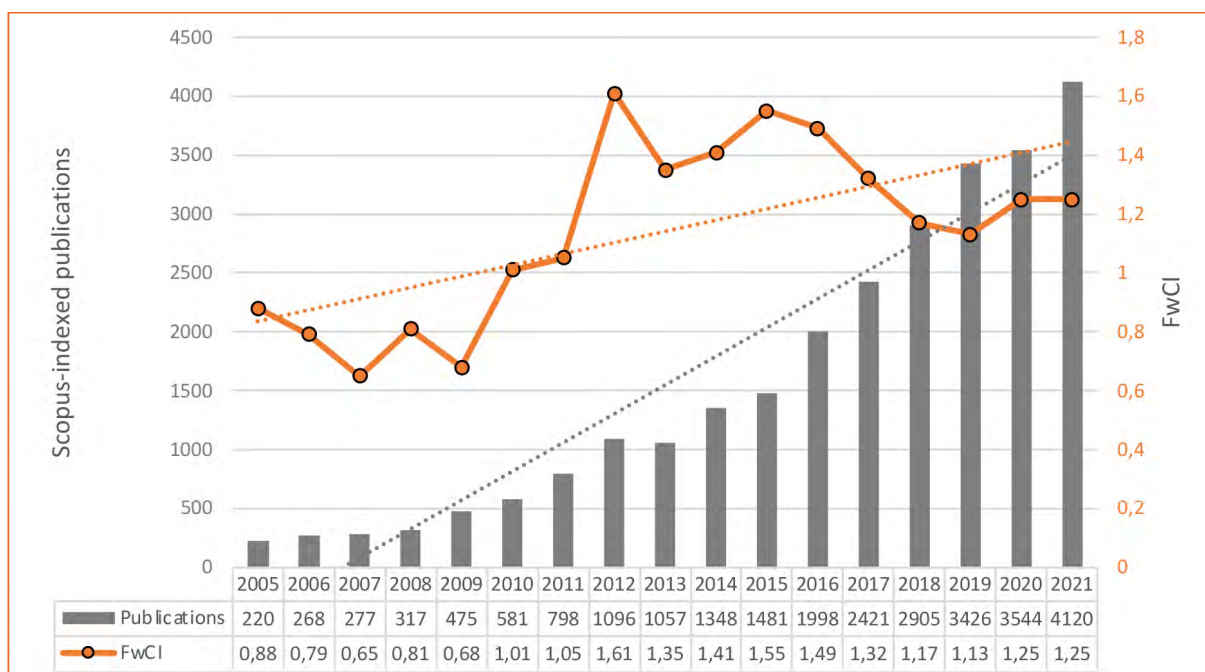
On average UJ's per capita research output has increased by 12% per annum since 2006, and 10.1% per annum over the past 5 years. This equates to a compound annual growth rate (CAGR) of 11.4% since 2006. For context, between 2006 and 2020, the CAGR in per capita outputs of UKZN was 7.7%, UP: 6.4%, Wits: 4.8%, SU: 4% and UCT: 2.8%.

At the time of writing, in May 2022 UJ will submit over 4600 publications authored in 2021, worth approximately 2800 units to the DHET for accreditation. This represents an increase of 19% over the previous year and exceeds the target of 2509 units for 2021 publications by 12%.

## Scholarly output and impact

UJ's scholarly output in the international Scopus publication and citation database, and the scientific impact thereof, continues to trend upwards. In 2005 UJ recorded just 220 publications indexed by Scopus with a Field-weighted citation impact (FwCI) of 0.88 or 12% less than the global average. The FwCI is a widely used indicator of academic or scientific impact where a value of 1.00 indicates the expected world-average citation rate for publications. By 2010 the impact of UJ's publications exceeded that of the world average; an achievement the university has sustained ever since. By 2021 UJ's publication volume had increased almost nineteen times with the publications in that year receiving 25% more citations globally when compared to other institutions with similar academic and publication profiles. The decline in the FwCI over more recent years is typical of this metric and is to be expected. Citations take time to accumulate, with older publications receiving more cumulative citations than recently published outputs. This phenomenon applies to all institutions globally. Figure 7 indicates the upwards trajectory in UJ's productivity and scientific impact between 2005 and 2021 in terms of Scopus indexed publications and FwCI.

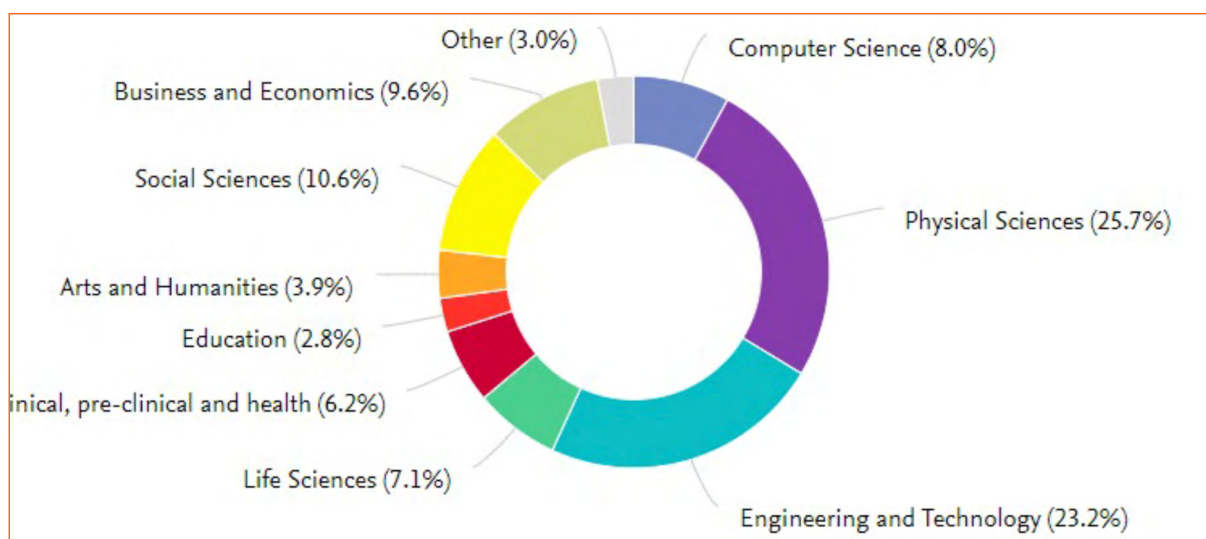




**Figure 7.** Upwards trajectory in UJ's productivity and scientific impact between 2005 and 2021

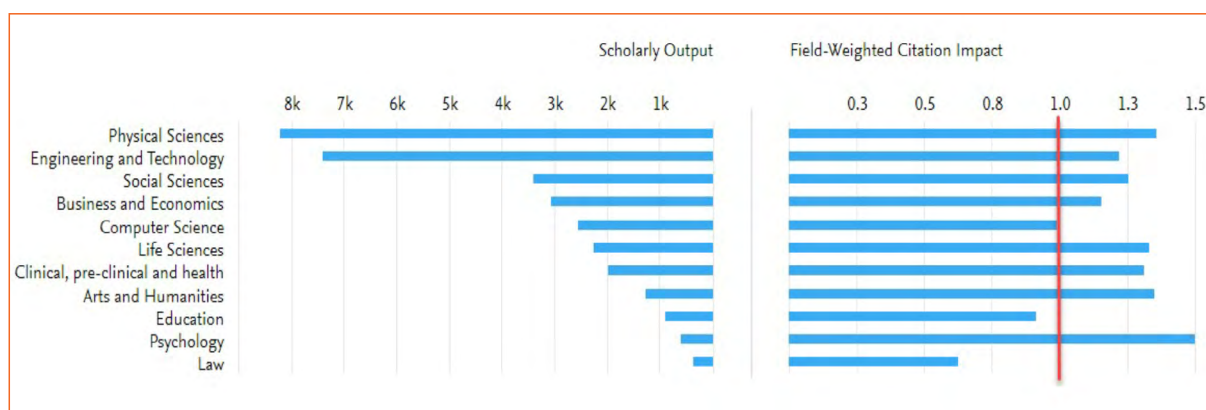
The increase in citation rates has been complimented by a similar increase in the general academic visibility of UJ's publications. According to Scopus, UJ's publications were viewed over 4000 times in 2005, increasing by a factor of more than twenty times to over 81000 views in 2021.

Figure 8 indicates the research areas in which UJ is the most prolific over the last 5 years in terms of the Times Higher Education (THE) University Subject areas.



**Figure 8.** THE subject areas in which UJ is most prolific, 2016-2021

According to Scopus data, UJ is most productive in the THE subject areas of Physical Sciences (8207 publications) and Engineering Technology (7394 publications) between 2016 and 2021. In terms scientific impact, UJ achieved greater-than-average citation rates in 8 out of the 11 (73%) subject areas. The top three subject areas with the greatest scientific impact were Psychology (FwCI of 1.50 or 50% more than the world average for similar publications), Physical Sciences (1.36 or 36% more than average for the field) and Arts and Humanities (35% greater-than-average scientific impact). Figure 9 indicate the THE fields UJ is most productive in and the corresponding scientific impact in terms of FwCI.



**Figure 9.** THE fields in which UJ is most productive and achieved the highest FwCI

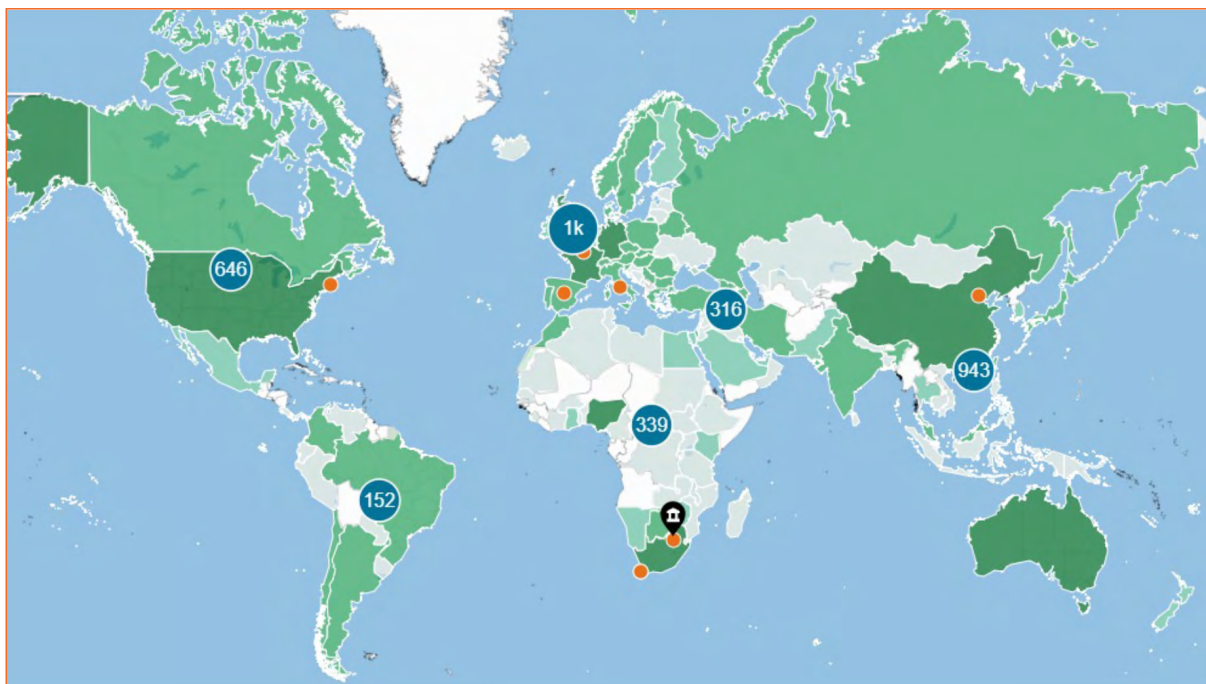
UJ's top local collaboration partners in terms of co-authored publications indexed in Scopus for the period 2017-2021 were Wits, UCT and the CSIR, while internationally UJ collaborated primarily with the French National Centre for Scientific Research (CNRS), the University of Oxford and the Italian National Institute for Nuclear Physics. Figure 10 indicates UJ's top collaboration partners in terms of number of publications, citations, co-authors and FwCI.

	Institution	Publications	Citations	Co-Authors	FwCI
1.	University of the Witwatersrand	1,403	31,615	857	2.48
2.	CNRS	882	31,082	1,427	3.76
3.	University of Cape Town	835	26,951	312	3.30
4.	Council for Scientific and Industrial Research	805	19,809	266	2.26
5.	University of Oxford	714	28,514	344	4.02
6.	National Institute for Nuclear Physics	688	28,648	1,741	4.03
7.	Chinese Academy of Sciences	687	27,313	500	4.05
8.	Harvard University	682	29,467	171	4.31
9.	CSIC	680	28,684	340	4.15
10.	Science and Technology Facilities Council	679	24,048	149	3.60

**Figure 10.** UJ's top local and international collaboration partners in terms of co-authored papers

Not surprisingly, UJ's collaboration with leading global institutions such as Harvard University, the Spanish National Research Council (CSIC), the Chinese Academy of Sciences and the University of Oxford yielded papers with particularly high scientific impact as measured by the FwCI. These collaborations produced co-authored papers that were cited more than four times the global average for similar papers. Globally, UJ co-authored over 12000 publications with 3830 collaborating institutions. These institutions comprised:

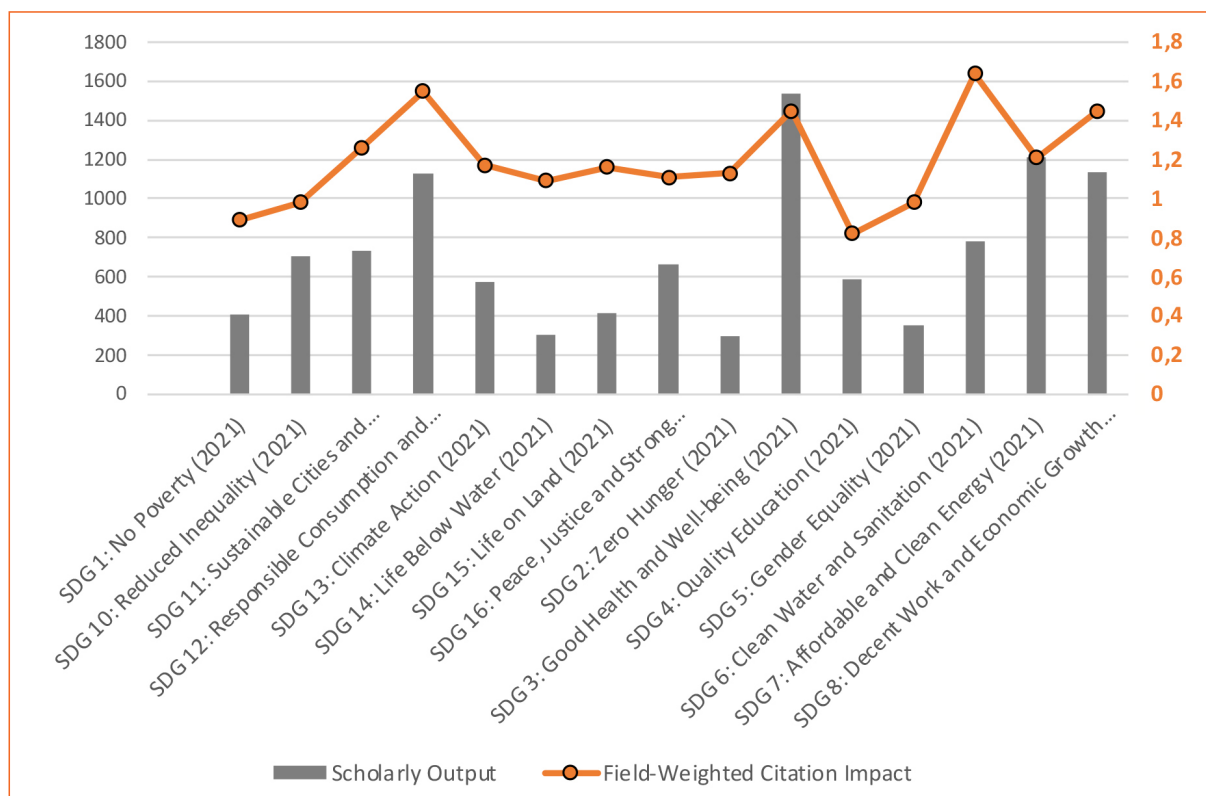
- Academic institutes (11633 co-authored publications with 3013 institutions)
- Government organisations (2919 co-authored publications with 539 institutions)
- Corporate entities (214 co-authored publications with 119 institutions)
- Medical institutes (110 co-authored publications with 75 institutions)
- Other organisations (222 co-authored publications with 84 institutions)



**Figure 11.** UJ's global authorship with international collaboration partners

Europe remained UJ's largest geographical area for collaboration, followed by the Asia-Pacific region, North America, Africa, and the Middle East.

Turning to UJ's contribution to the United Nation's (UN) Sustainable Development Goals (SDGs), Figure 12 indicates UJ's contribution in terms of volume of scholarly output and scientific impact in terms of the FwCI per SDG. UJ's publications in twelve out of the seventeen, or 71% of the SDGs was more highly cited than the global average for publications by other institutions in the same SDGs.



**Figure 12.** Figure 12: UJ's contribution to the UN SDGs and the scientific impact thereof





UJ was most productive in terms of volume of scholarly output (as indexed in Scopus) in these top 5 SDGs:

- SDG 9: Industry, Innovation and Infrastructure – 1568 publications
- SDG 3: Good Health and Well-being – 1538 publications
- SDG 7: Affordable and Clean Energy – 1212 publications
- SDG 8: Decent Work and Economic Growth – 1133 publications
- SDG 12: Responsible Consumption and Production – 1125 publications

UJ's most cited work over the period was in these top 5 SDGs:

- SDG 3: Good Health and Well-being – 12639 citations
- SDG 6: Clean Water and Sanitation – 11909 citations
- SDG 12: Responsible Consumption and Production – 10547 citations
- SDG 9: Industry, Innovation and Infrastructure – 10034 citations
- SDG 7: Affordable and Clean Energy – 8304 citations

UJ's work with the highest scientific impact (as measured by the field-weighted citation impact) was in these top 5 SDGs:

- SDG 6: Clean Water and Sanitation – 64% more cited than the global average
- SDG 12: Responsible Consumption and Production – 55% more cited than the global average
- SDG 3: Good Health and Well-being – 45% more cited than global average
- SDG 8: Decent Work and Economic Growth – 45% more cited than the global average
- SDG 11: Sustainable Cities and Communities – 26% more cited than the global average

According to Scopus data, UJ is placed among the most active institutions in the world in several SDGs, falling within the top 100 institutions in:

- SDG 8: Decent Work and Economic Growth, 16th in the world
- SDG12: Responsible Consumption and Production, 17th in the world
- SDG 1: No Poverty, 34th in the world
- SDG 9: Industry, Innovation and Infrastructure, 44th in the world
- SDG 4: Quality Education, 87th in the world
- SDG16: Peace, Justice and Strong Institutions. 93rd in the world



## Creative Outputs and Innovations

DHET implemented a new Policy on Creative Outputs and Innovations (2017), effective from January 2019. The policy recognises and rewards creative outputs produced by public higher education institutions in South Africa in the fields of Design, Film, Fine Arts, Literary Arts, Music, Television and Theatre, Performance and Dance. The Policy also rewards Innovative outputs. Outputs produced in the three preceding years from the submission year are considered.

The UJ's first submission for creative output and innovations was in November 2019. There were six creative outputs and one innovative output submitted. From the six creative outputs, two were for the Fine Arts subfield while four being for the Literary Arts subfield. There was a 100% approval rate in the Fine Arts, earning the university three units. In the Literary Arts subfield, only approved one of the four creative outputs was approved (25% success rate), garnering two units. The innovative output received a 100% approval rate, acquiring two units.

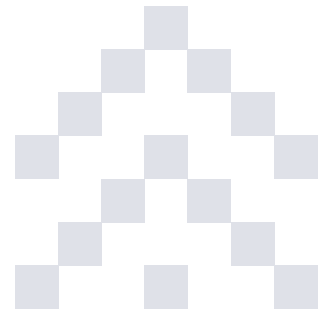
For the second submission in November 2020, there were twenty creative outputs (233% increase from 2019) and two innovative outputs (100% increase from 2019). The university was awarded 19.33 units (of the 20 submitted in November 2020), while the two innovations submitted were rejected. In November 2021, seventeen creative outputs were submitted to the DHET (a 15% decrease from 2020), whereas there were no innovations submitted for this period (2021).

**Table 4.** Creative outputs submitted by UJ to the DHET, November 2021

Creative output type	Number submitted
Film	1
Fine Arts	8
Literary Arts	3
Music	1
Theatre, Performance and Dance	3
Television	1
<b>Total</b>	<b>17</b>



# PROMOTING INNOVATION AND ENTREPRENEURSHIP



The UJ TTO provides an interface between research, industry and other stakeholders to facilitate the uptake and impact in society of UJ inventions, technologies, services and products. The TTO promotes a culture of innovation and entrepreneurship across the University, aligned to the University's strategic objectives. The TTO is responsible for managing and commercialising the University's intellectual property (typically through licensing to existing companies or creating new start-ups), and for supporting entrepreneurship at the University. The TTO:

- Evaluates new inventions, products and services,
- Obtains intellectual property protection (where applicable),
- Assists in ensuring the progression of technologies to higher technology and commercial readiness levels,
- Connects researchers and opportunities to funders, collaborators, investors and other partners,
- Provides information, advice and awareness-raising on associated matters to the University community,
- Supports and co-ordinates entrepreneurial initiatives at the University.

The TTO works in close collaboration with UJInvnt to build the pipeline of commercialisation opportunities based on University intellectual property.

## Intellectual Property Portfolio

The University intellectual property portfolio continues to grow. Filing decisions are aimed at expanding the portfolio of high-quality intellectual property with potential application in industry and society, in a cost-effective manner. In 2021:

- 12 invention disclosures were made to the TTO
- 48 patent and design applications were filed, representing 15 families (i.e. unique inventions/designs), covering 11 territories
- 6 patents were granted.

## Invention disclosures

The following invention disclosures were submitted:

- Kerzner@uj App
- A long period grating sensor for water level sensing in a nuclear power reactor
- Procuero - IFM3A year project
- Diamond polishing plan from 3D reconstruction by X-ray Bragg/Laue reflection map of internal extended defects and lattice orientation
- Fiber optic sensors with sword and naked fibre
- Smart solar-powered LED for lighting and heart health
- A mobile application where individuals will be able to purchase petrol using their airtime





- Self-assembled bed frame with multi-functional storage and seating
- A newly discovered indigenous plant for cosmetics
- 3D printed snacks from malted quinoa and fermented cowpea
- Cationic and anionic dyes coated on 3-aminopropyltrimethoxysilane functionalized on alkali-treated coal fly ash as novel fingerprint powders
- Website/application

## Policy Development

After several attempts to put in place a new University Intellectual Property Policy since 2017, in 2021 a new Policy was drafted, consultations were carried out through the relevant university committees and structures, and it was approved by Council and deemed compliant by NIPMO (early in 2022). The new Policy establishes a high-level framework to govern intellectual property ownership, management and commercialisation, and achieves compliance with the Intellectual Property Rights from Publicly Financed R&D Act, while providing flexibility for the development of appropriate supporting procedures and guidelines.

## Technology Development Support

The TTO is responsible for managing a Seed Fund awarded by the Technology Innovation Agency (TIA), which provides funding to translate the outputs of University research into fundable commercialisation projects. Two new projects were awarded seed funding, and further support was provided for several ongoing projects. Three other projects received TTO funding for activities which advance them towards commercial readiness.

## Entrepreneurship Support

### Economic Activation Office programme

Through the TTO, the University was selected as one of the pilot universities for the Entrepreneurship Development in Higher Education (EDHE)' Economic Activation Office (EAO) programme. The objective of this programme is to establish a central function to

facilitate and coordinate support, networking, collaboration and information sharing between the various diverse entrepreneurship and innovation support initiatives carried out in different parts of the University. This programme is currently being rolled out, bolstering efforts that were already underway in the University.

### **Incubation support**

The TTO continued to offer support to student entrepreneurs through the Mashauri FastForward incubation programme. The programme is aimed at supporting incubatees to develop, refine and scale their ventures through an experiential, customised curriculum based on learning-by-doing. Twelve incubatees completed the programme and received certification, eight awarded Cum Laude. Twenty incubatees had the opportunity to pitch their businesses to a panel of esteemed judges during the Demo Day event. The winner, Liso Mdiya from Lisson Edibles (which offers experiential catering aimed at giving a food design experience merged with storytelling to introduce nutritional wellness) walked away with an additional Design Thinking course towards enhancing her entrepreneurial skills. Follow-on support was also provided to 11 of the graduating incubatees through the Uzima programme, which offered:

- A mentor to provide one-on-one inputs and guidance,
- Program customisation to fit the venture requirements,
- Monitoring of individual ventures,
- Advanced course material specifically focused on finances, cash runways, marketing, managing partnerships, SLAs, etc.

The Uzima programme ended with 4 students qualifying as “Investor Ready” and in a position to pitch their businesses. From this group, Nomfundo Cele from QualTrans Africa (an AI application to evaluate/measure service quality in public transportation) was selected as a Sub-Saharan Africa finalist to participate in the 2022 Mandela Washington fellowship assigned to the Leadership in Business track at the University of Texas in Austin, Texas. Rufus Ranzhlagwe from M’Riri (novel cosmetic product based on an African plant and traditional knowledge) has been granted TIA Seed Funding to further the development of his product. A new cohort call was opened for the Starting Up programme in November 2021, with forty student entrepreneurs afforded the opportunity to refine their skills in ideation and problem testing.

### **EDHE Entrepreneurship Intervarsity Competition**

The TTO once again coordinated the University’s participation in the EDHE Entrepreneurship Intervarsity Competition. UJ fielded 821 entrants in 2021, the highest number of all universities (up from 45 in 2019 and 235 in 2020). All applications were screened by the TTO and 208 students were invited to submit a pre-recorded video pitch. Eight students were selected to represent the University at the Gauteng regional competition and received pitching preparation support from the TTO. Keamogetswe Sema from Thealit (a collection of luxurious self-care and wellness products) proceeded to the national finals.

### **Student Entrepreneurship Week**

A webinar series was held during Student Entrepreneurship Week in October 2021:

- Webinar 1: The basics of starting your entrepreneurial journey,
- Webinar 2: Being a student entrepreneur – Cultural Hour Fireside Chat,
- Webinar 3: IP 101 – An introduction to the basics of Intellectual Property.

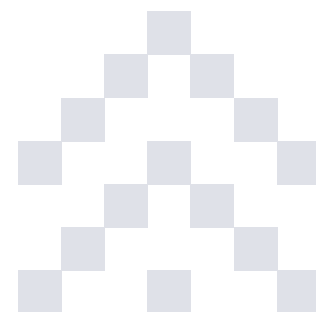




## Training, Awareness and Engagement

An online workshop was held for World IP Day 2021 in partnership with the UJ Centre for Entrepreneurship on IP and SMEs: Taking your ideas to market. Various awareness engagements by members of the TTO team took place at different University departments. Several members of the team were invited to make presentations at various webinars and conferences. TTO team members also acted as facilitators, developing and presenting material for a range of external training providers, including WIPO Summer School, WIPO-NIPMO IP Innovation Policy workshop and SARIMA. This is an endorsement of their expertise by the broader professional community.





# CONCLUSION

2021 was undoubtedly a highly productive year for the Research and Innovation Division – targets were exceeded across the board, with the highest number of research outputs units submitted to the DHET for subsidy claim, and the highest amount of external research grants received. Despite many funders cutting back and unable to award large grants, our academics continued to attract external grants, ensuring that research projects continue. The UJ intellectual property portfolio, although still a “young portfolio” compared to other institutions, continues to grow.

The main threat to the work of the Division remains the incredibly small team of staff versus the growing portfolios across the Division’s four Units. The few appointments made in 2021 provided much needed capacity. The two positions approved by MEC in 2021, to be filled in 2022, will also provide much needed human resources. Going forward, the Division will continue to focus on staff retention strategies, including targeted staff development programmes.





**The Future**  
Reimagined