RESEARCH REPORT 2015

CELEBRATING 10 YEARS

RETHINK. REINVENT.

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RESEARCH REPORT 2015

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VISION
An international university of choice, anchored in Africa, dynamically shaping the future.

MISSION
Inspiring its community to transform and serve humanity through innovation and the collaborative pursuit of knowledge.

VALUES
Imagination
Shaping the future
Thinking independently
Developing a cosmopolitan identity
Exhibiting ambition and drive
Adopting entrepreneurial approaches

Conversation
Learning together from our diversity
Making wise decisions collectively
Engaging meaningfully with one another
Displaying mutual respect
Leading consultatively

Regeneration
Developing sustainably through creative contribution
Introspecting for renewal
Innovating for the common good
Making positive change
Taking advantage of overlooked opportunities

Ethical Foundation
Treasuring academic freedom
Seeking balance in the pursuit of knowledge
Facing challenges with courage and earning trust
Acting responsibly by being fair, consistent and transparent
Participating in and helping the community (ubuntu)*

**Ubuntu, which means humaneness in the Nguni languages of southern Africa, is the idea that a person achieves excellence insofar as she shares a way of life with others and cares for their quality of life.*

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VICE-CHANCELLOR AND PRINCIPAL'S MESSAGE

Excellence is at the core of the University of Johannesburg's research and postgraduate education initiatives and activities, and achievements in 2015 point to excellence research performance. The University's QS ranking amongst universities in BRICS countries – Brazil, Russia, India, China and South Africa – was 67th amongst BRICS universities and more recently with the release of the latest BRICS' universities rankings, improved its position to 63rd, one of only three South African universities to rise in the rankings in 2016.

In 2015 the National Research Foundation awarded five new South Africa Research Chairs to UJ, the maximum that could be awarded to a single institution, and these new research chairs are all held by UJ's leading women academics. The five new UJ chairs are:

- Laser Applications in Health: Prof Heidi Abrahamse (Faculty of Health Sciences);
- South African Art and Visual Culture: Prof Brenda Schmahmann (Faculty of Art, Design and Architecture);
- Welfare and Social Development: Prof Leila Patel (Faculty of Humanities);
- Integrated Studies of Learning, Mathematics and Science in the Primary School: Prof Elizabeth Henning (Faculty of Education); and,
- Industrial Development: Prof Fiona Tregenna (Faculty of Economic and Financial Sciences).

The Global Excellence and Stature (GES) Initiative is an integrated, structured approach to catalyse system-wide change and firmly establish UJ as a global player, was further implemented in 2015 and the new Strategic Initiatives and Administration unit established to co-ordinate and manage the implementation of the GES programmes.

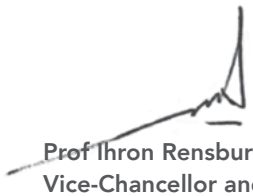
The GES Institutes, Flagship and other programmes have already made significant contributions toward positioning UJ as the Pan-African epicentre of critical intellectual inquiry. Through the GES programme, the University appointed 3 Distinguished Professors and 14 Distinguished Visiting Professors. The addition of world-class scholars to the University research community is already reaping several benefits with increased research outputs, expanded and stronger international links, and most importantly, nurturing the next generation of academics and knowledge workers. The Johannesburg Institute for Advanced Study, a partnership with Nanyang Technological University in Singapore, was launched in May 2015 and the UJ Confucius Institute strengthened the collaboration with Nanjing Tech University in China.

UJ features prominently and boldly promotes accessible excellence in the higher education landscape and has made significant strides in research and postgraduate education, in particular research publications, postgraduate enrolments, post-doctoral fellow growth, and in the provision of an enabling research and postgraduate training environment. The University now administers over R100 million in post-graduate funding support, an impressive growth of 35% between 2014 and 2015. Embedded within the strategic focus of being an international university of choice, anchored in Africa, that dynamically shapes the future, UJ has elevated its postgraduate support through the establishment of the UJ Postgraduate School. The vision for the UJPS is "to establish a Postgraduate School of the highest quality, which supports and develops excellent scholars who have an impact beyond the academic research space which benefits the social, political, cultural and technology spheres, in South Africa, Africa and Internationally".

"The University now administers over R100 million in postgraduate funding support, an impressive growth of 35% between 2014 and 2015"

Provision of an enabling environment is key for research and postgraduate success. The Library's research commons offers a scholarly environment to students and fellows, and the move of the UJPS to its new building, Akanya, at the beginning of 2015 provided the much-needed facilities for workshops and office space for over 50 postdoctoral research fellows.

UJ celebrated its tenth year in 2015 and the achievements highlighted in this report provide a snapshot of the growing vibrant research community and partnerships. I would like to thank our researchers, students and staff for their contributions to enhancing the University's research profile and productivity, as well as our funders of research and postgraduate students.



Prof Ihron Rensburg
Vice-Chancellor and Principal, University of Johannesburg

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INTRODUCTION BY THE DEPUTY VICE-CHANCELLOR OF RESEARCH, POSTGRADUATE STUDIES, THE LIBRARY AND INFORMATION CENTRE

I am extremely pleased to share that UJ continues to raise its research profile, productivity and impact. Research publication outputs increased from 1 074.91 accredited output units in 2014 to a provisional 1 294.44 units in 2015. With regard to research impact which, influences our global status as a world-class research-intensive university, the field-weighted cited impact for publications for the period 2011 to 2015 was 1.2. External research funding doubled, from R109.01 million in 2014 to R229.46 million in 2015, with significant growth of National Research Foundation (NRF) funding - R86.21 million in 2014 to R141.89 million in 2015.

The number of NRF-rated researchers also increased to 156 in 2015, compared to 142 in 2014 and so did the number of prestigious research chairs. UJ is now host to 12 SARChI Chairs following the award of five new Chairs in 2015. In support of the University's objective of being a research-intensive university and to sustain the outstanding performance in research the University has had over recent years, it is important to have a critical mass of suitably qualified academic staff. The academic staff with a doctoral degree improved from 43% to 44.4%.

Postgraduate enrolments have shown an overall 8.8% growth from 2014 to 2015. There were 7358 honours, masters, doctoral and other postgraduate students enrolled in 2015. The growth per group was 7.94 at honours level, 9.24 at master's level and 11.1% at doctoral level. There was a 3.5% growth in postgraduate graduations with 2760 postgraduate students graduating in 2014. At honours level there was a decrease of 7.8% from 2013 to 2015 but the growth over this period was a 2.5% increase at master's level and a 39.9 % growth at doctoral level respectively.

With regard to postgraduate funding, the number of awards increased by 8.4% to 2447 between 2014 and 2015.

The main focus by the Research Capacity Development section of the Postgraduate School in 2015 was on improving the impact and quality of research capacity development initiatives for postgraduates and academic staff. To this end, there was movement towards expanding and deepening support: from *ad hoc* once-off workshops to workshop series and short courses, and from generic workshops to interventions tailored to the content and needs of faculties and departments, on request.

Support to postgraduate students and emerging researchers was provided through 63 capacity building workshops, offered between January and October 2015. The total number of participations in these workshops was 614.214 from staff members and 400 from postgraduate students. Most of the workshops focused either on aspects of research writing, or on the use of SPSS and ATLAS.ti. The success of a funding proposal to the Carnegie African Diaspora Fellowship Programme to host a visiting research fellow allowed for additional writing support to students and staff engaged in Master's or doctoral studies. The research fellow, Professor Cecile Badenhorst from the Faculty of Education at Memorial University, Canada, facilitated dissertation writing workshops in July. Eleven three-day writing retreats for UJ staff with experienced external facilitators were also held in the reporting year. The annual interfaculty Postgraduate Symposium on 13 October 2015 was a well-attended networking opportunity for postgraduates from all faculties. Fifty-one postgraduate students presented papers or posters.

Statkon consultants provided expert research design and data analysis support to students and staff and contributed to the development of staff and postgraduate research skills through facilitation of workshops on Descriptive and Summary Statistics, Statistical Techniques for Comparing Groups, Statistical Techniques for Examining Relationships, Structural Equation Modelling, Sampling, and Questionnaire Design.

The research and postgraduate support portfolio in 2015 was anchored in five well-defined functional units: research administration; research development and support; research intelligence and bibliometrics; postgraduate support; and statistical consulting services. I would like to take this opportunity to thank our dedicated staff members and in particular Mandlenkosi Msibi, the former Executive Director: Research and Postgraduate Studies, for his significant contributions during his time at the UJ, and leadership of the portfolio.

Prof Tshilidzi Marwala
Deputy Vice-Chancellor of Research, Postgraduate Studies, the Library and Information Centre

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Deputy Vice-Chancellor of Research,
Postgraduate Studies, the Library and Information Centre

2015 RESEARCH HIGHLIGHTS

HIGHLIGHTS

67th
out of 6 200 universities in the QS World University Rankings in the BRICS countries

8th
UJ's ranking out of all BRICS universities for its proportion of international faculty

UJ is the only African member of the prestigious Universitas 21 group of research-intensive universities

6th
position in the Thomson Reuters ranking of universities on the African continent

156
NRF-rated researchers compared to 142 in 2014

18
number of knowledge fields in which UJ is ranked in the top 300 globally

12
chairs funded by the DST-NRF South African Research Chairs Initiative

45%
academic staff with Doctoral degrees

24
research centres

204
postdoctoral research fellows

2 095
international students

104
Doctoral graduates in 2015

2 760
total number of postgraduates in 2015

19%
increase in accredited research output units from the previous year

R229m
total external research income

R74m
UJ's internal investment in research

14%
international academic staff

RESEARCH PERFORMANCE

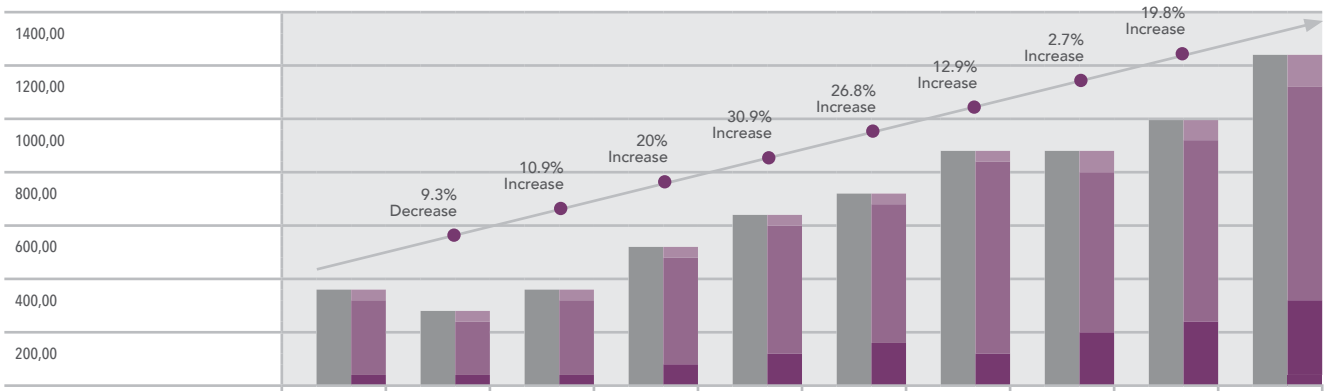
As UJ celebrated its 10th year in 2015. We are proud to have grown our research output exponentially.

Continuing the upward trend for the 8th year in a row, UJ received 1074.91 accredited research output units from the DHET for 2014 publications as indicated in the official DHET report on evaluation of 2014.

The submission comprised 63.90 units for books and chapters (of which 59.52 or 93.1% were accepted), 271.31 units for conference proceedings (of which 253.47 or 93.4% were accepted) and 761.92 for journal articles (of which 100% were accepted).

The represents a 7% contribution to the nationally accredited research output. The overall accreditation rate of 98% is the highest on record for UJ. While UJ has consistently enjoyed excellent success rates for journal articles and conference proceedings, the 2015 submission is notable in that the success rate for books and chapters increased from an annual average of 42% to 93.1%. The DHET submission for 2015 publications is the highest to date and it is envisaged that the upward trend will continue.

TOTAL DHET UNITS AWARDED PER PUBLICATION TYPE



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015 Submitted
Books and chapters	9.80	4.12	6.38	12.13	22.61	18.29	31.36	58.83	59.52	92.27
Journals	360.77	330.64	354.99	412.64	515.75	637.99	738.64	656.09	761.92	898.99
Proceedings	15.99	15.97	27.65	42.06	72.54	118.07	103.91	182.50	253.37	303.18
Total	386.56	350.73	389.02	466.82	610.90	774.35	873.91	897.42	1074.91	1294.44

Global Footprint

UJ has continued to expand its global footprint in terms of international collaborations and partnerships. According to Scopus data for the period 2011-2015, UJ's investigators have co-authored 2 929 publications with 1 438 institutions across the globe.

Europe
- 576 collaborating institutions
- 1 237 co-authored publications

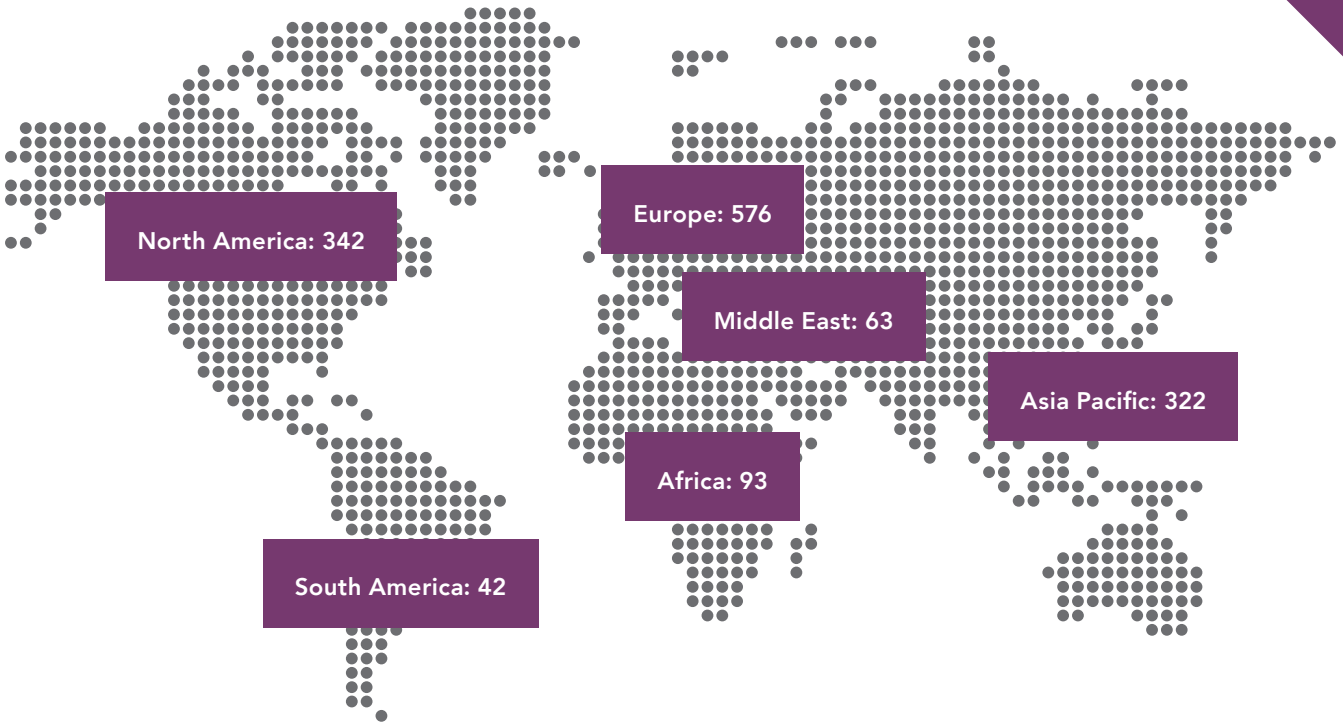
North America
- 342 collaborating institutions
- 840 co-authored publications

Asia Pacific
- 322 collaborating institutions
- 958 co-authored publications

Africa
- 93 collaborating institutions
- 1 736 co-authored publications

Middle East
- 63 collaborating institutions
- 502 co-authored publications

South America
- 42 collaborating institutions
- 449 co-authored publications

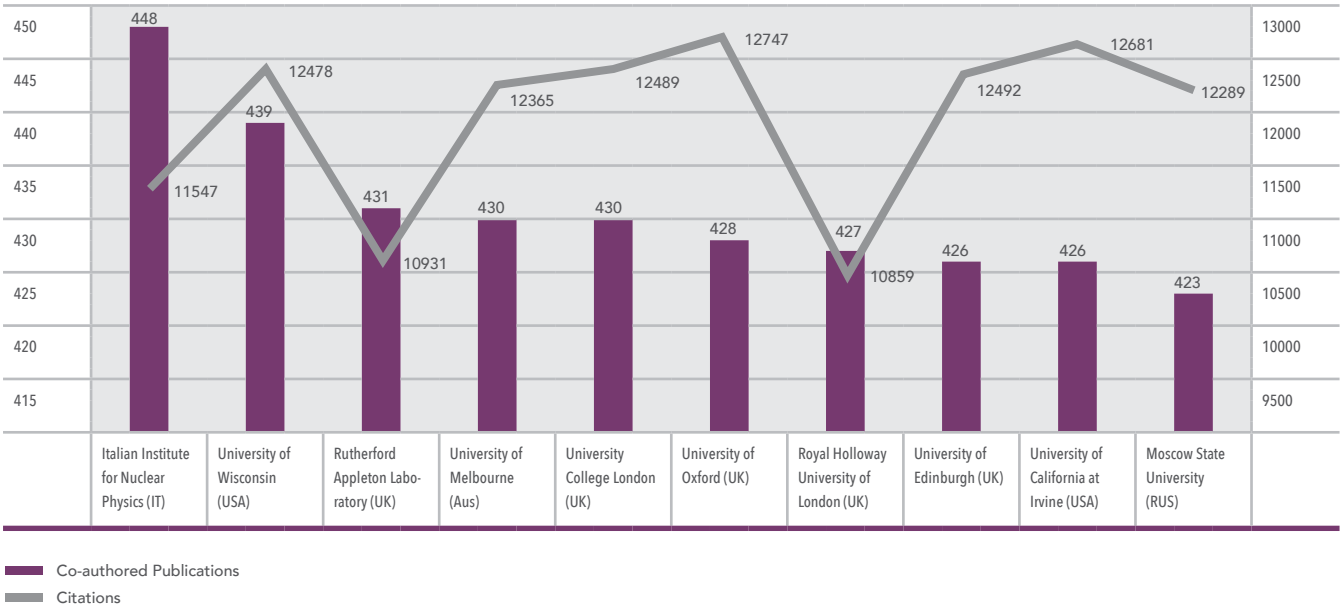

North America: 342
Europe: 576
Middle East: 63
Asia Pacific: 322
Africa: 93
South America: 42

Top 10 International Academic Collaboration Partners by Co-Authored Publications and Citations

Scopus data for the period 2011-2015 indicates that UJ's top three international collaborative partners were the Italian Institute for Nuclear Physics, the University of Wisconsin in the USA, and the Rutherford Appleton Laboratory in the UK.

In terms of cited publications, UJ's top three international partners were the University of Oxford (UK), the University of California at Irvine (USA) and University College London (UK).

TOP 10 INTERNATIONAL ACADEMIC COLLABORATION PARTNERS BY CO-AUTHORED PUBLICATIONS AND CITATIONS



Internationally Co-authored Publications

Thirty-nine percent of UJ's publications were co-authored with one or more international investigators over the 10-year period 2006–2015.

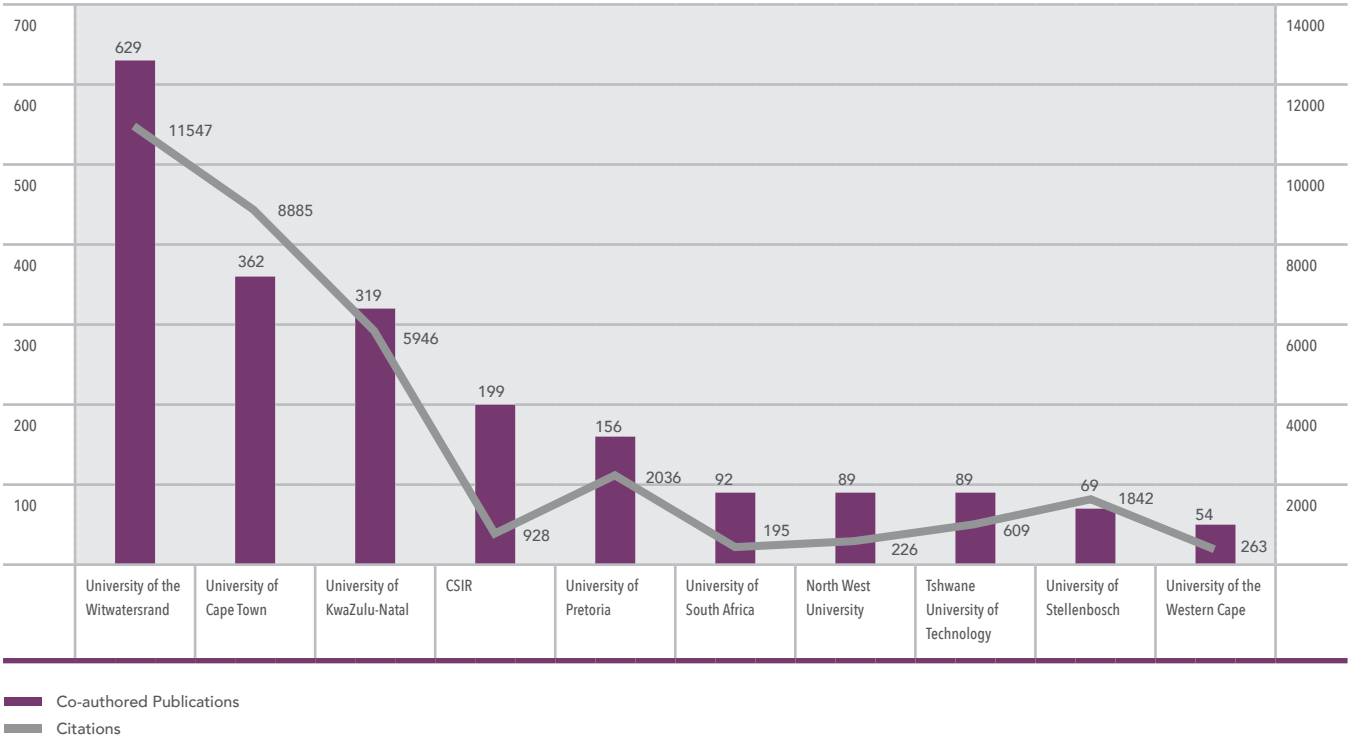
The percentage of internal collaboration has risen consistently over the past five years, peaking at just over 47% for publications in 2015.

Top South African Collaboration Partners by Number of Co-Authored Publications and Citations

Scopus data for the period 2011-2015 indicates that nationally, UJ collaborated with 28 South African institutions and co-authored 1 556 publications.

UJ's top three national collaboration partners in terms of co-authored publications and citations are the Universities of the Witwatersrand, Cape Town and KwaZulu-Natal respectively.

TOP SOUTH AFRICAN COLLABORATION PARTNERS BY NUMBER OF CO-AUTHORED PUBLICATIONS AND CITATIONS



UJ's Top Research Fields (According to the Scopus All Science Journal Classification (ASJC) System for the Period 2011–2015)

The Field-weighted Citation Impact is the ratio of citations in the Scopus database relative to the expected world average for the subject fields, publication types and publication years.

The ratio indicates the degree to which UJ's research is cited relative to the world average for similar publications, which is 1.0. Values greater than 1.0 indicate an above-average global citation impact.

The ASJC field in which UJ's research achieved the greatest impact over the period was Physics and Astronomy with a field-weighted citation impact of 2.29. This indicates that over the period UJ received 2.29x or 129% more citations than the world average for the publication types in the subject field.

UJ'S TOP RESEARCH FIELDS ACCORDING TO THE SCOPUS ASJC SYSTEM FOR THE PERIOD 2011–2015

The Field-Weighted Citation Impact

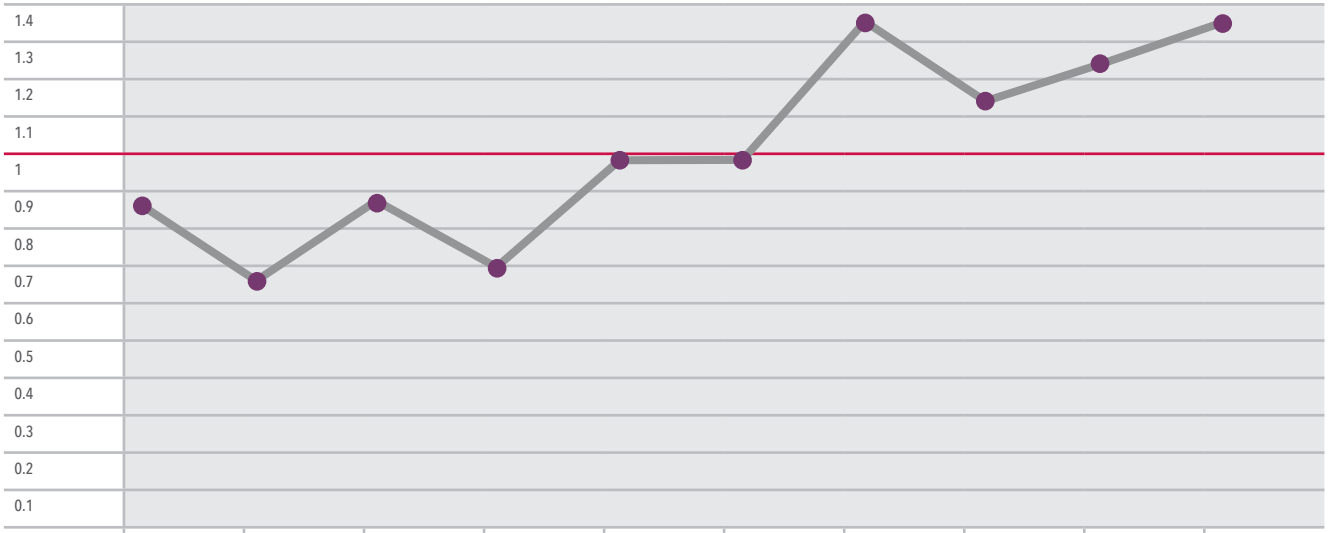
The Field-weighted Citation Impact is the ratio of citations in the Scopus database relative to the expected world average for the subject fields, publication types and publication years.

The ratio indicates the degree to which UJ's research is cited relative to the world average for similar publications, which is 1.0 (values greater than 1.0 indicate an above-average global citation impact).

In 2012 the citation impact of UJ's publications exceeded that of the world average impact expected for institutions with similar publication profiles.

For the 10-year period UJ's citation impact has been 13% greater than expected, with the figure rising to 32% greater for 2015 publications.

THE FIELD-WEIGHTED CITATION IMPACT



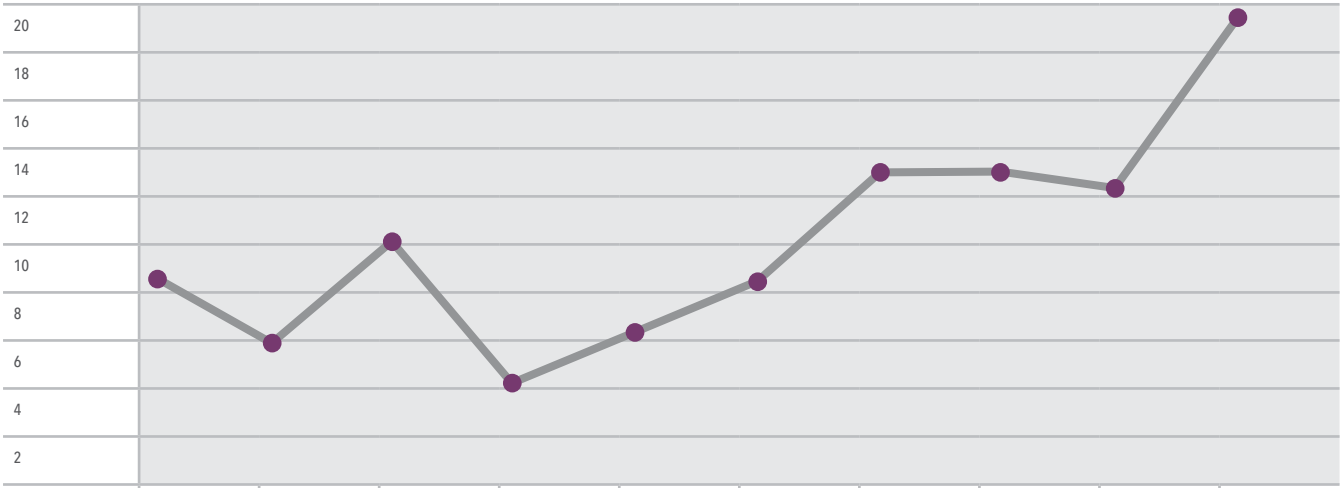
Publication Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2014
Field-Weighted Citation Impact	0.86	0.66	0.87	0.70	0.97	0.97	1.35	1.15	1.25	1.35

Percentage of Publications in the Top 10% Citation Percentiles

The percentage of UJ's publications that appear in the top 10% of the world's most cited publications.

UJ has shown a strong upward trend. Which represents a compound annual growth rate of 9.8%, with slightly under 20% of UJ's 2015 publications making it into the top 10% most cited.

PERCENTAGE OF PUBLICATIONS IN THE TOP 10% CITATION PERCENTILES



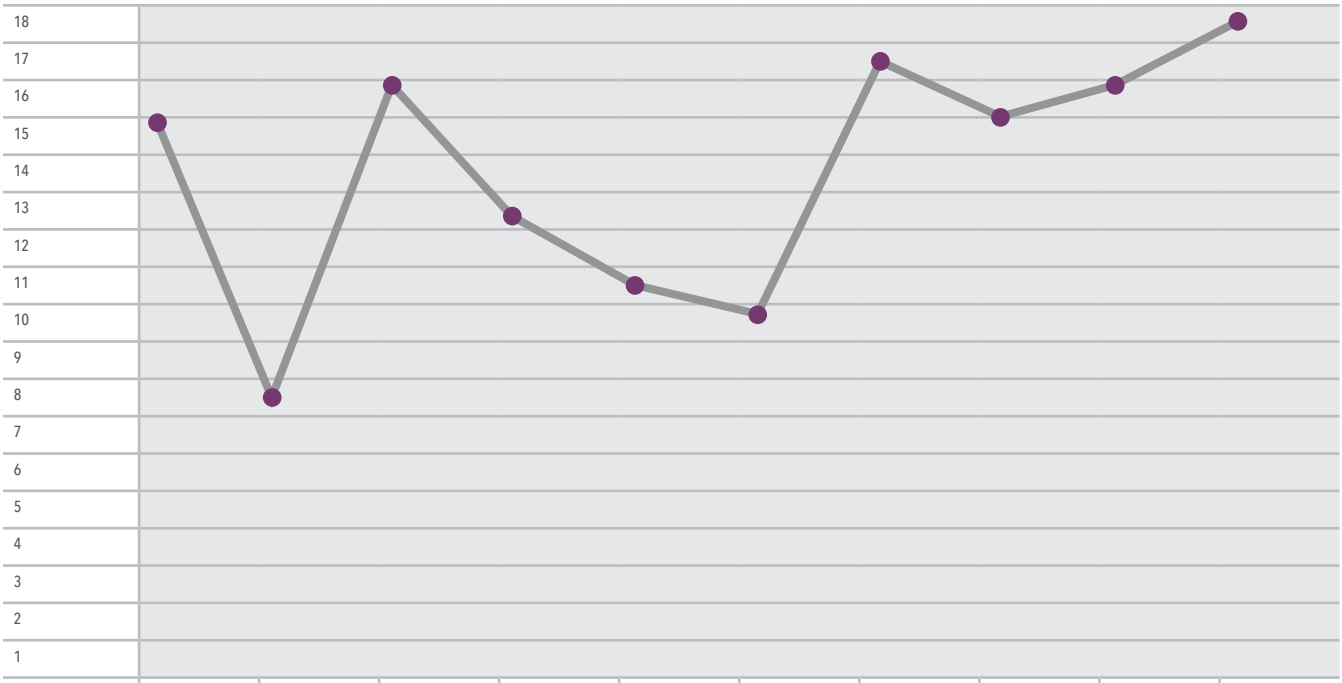
Publication Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Outputs in Top 10% of the World (%)	8.5	5.9	10.6	4.9	6.2	8.4	13.4	13.1	12.4	19.7

Percentage of Publications in the Top 10% Most Cited Journals

The percentage of publications in the top journal percentiles indicates the percentage of UJ's publications that have been published in the world's top 10% most cited journals (based on the Scopus Source-Normalised Impact per Paper (SNIP).

UJ has again shown a strong upward trend over the period with an average of almost 14% of UJ's publications featuring in the top 10% most-cited per annum. Almost 20% of UJ's publications in 2015 feature in the top 10% most-cited journals.

PERCENTAGE OF PUBLICATIONS IN THE TOP 10% MOST CITED JOURNALS



Publication Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Publications in Top 10 Journal Percentiles (%)	14.9	7.5	15.9	12.3	10.5	9.8	16.5	15.0	15.9	17.6

RESEARCH AT UJ

Vice-Chancellor and Principal, Prof Ihron Rensburg (UJ) and Prof Bertil Andersson, President of Nanyang Technological University (NTU) Unveiling the Johannesburg Institute for Advanced Study (JIAS) plaque.

DRIVING GLOBAL EXCELLENCE AND STATURE

In the first decade of existence following the merger of the three legacy institutions, UJ has had remarkable achievements which contributed towards the established identity of a well-performing institution nationally and internationally. Building on this excellent performance, UJ, through an intensive process, developed a strategic plan identifying new objectives and performance targets to be attained by 2025. These are articulated in the Strategic Plan 2025, anchored in a single strategic goal of attaining Global Excellence and Stature (GES). To support the GES strategy, the University established a number of catalytic interventions to bolster research and innovation in specific areas.

GES STRATEGIC RESEARCH AREAS/THEMES

The University recognises that its identity, competitiveness and relevance depends, to a great extent, on the nature and quality of its research and research performance. To this end the University has identified and invested in developing strategic research areas through which it seeks to drive research and scholarly excellence and distinctiveness.

These areas are nurtured through GES Flagship Institutes and Programmes that are ideally long-term and multidisciplinary research. The University has committed seed funding for a period of five years towards the establishment of these programmes, with the expectation that they will eventually become financially self-sustainable.

Some of the planned GES research programmes were successful in sourcing external funding, and include the Soil Sciences flagship programme which is now a part of the DST-NRF Centre of Excellence in Integrated Minerals and Energy Resource Analysis (CIMERA); the Childhood Education and Nanotechnology and Water programmes which were incorporated into NRF SARChI Chairs in Integrated Learning of Language, Mathematics and Science in the Primary School, and Nanotechnology for Water, respectively.

GES FLAGSHIP INSTITUTES

Institute for Intelligent Systems

The Institute for Intelligent Systems is the first of its kind in Africa. It aims to develop critical thinkers in intelligent systems, continuous engineering and cognitive computing through global collaboration across disciplines. This will help to advance economic transformation and sustainable economic growth in Africa, BRICS countries and beyond.

Institute for Pan-African Thought and Conversation

This Institute aims to create a platform for strong African voices to change thinking by putting new topics on the agenda – and approaching old topics in new ways. Among other things, academics from across Africa will:

- explore politics, ethics and worldviews;
- advance African values and perspectives in politics and debate justifiable beliefs;
- present African values; and
- investigate how Africa should relate to the South, East and West in the next major stage of the continent's independence against the backdrop of a globalised world.

UJ Confucius Institute

The UJ Confucius Institute (UJCI) was established in July 2014 as a joint venture between UJ, Nanjing Tech University, and the Confucius Institute Headquarters or Hanban, with the aim of facilitating language training, cultural exchanges, and public diplomacy that deepen Sino-South African relations.

Johannesburg Institute for Advanced Study (JIAS)

JIAS is a partnership between UJ and Nanyang Technological University (NTU). Its aim is to create a space for deep thinking and the pursuit of knowledge for its own sake, especially, but not exclusively, in its interdisciplinary format. Breakthrough thinking is often stimulated by unexpected conversations that challenge worldviews. JIAS is a space where carefully curated high-end thinkers from a diverse range of backgrounds spend time together, and seek to find new ways to approach seemingly intractable problems.

Prof Huang Wei, President of Nanjing Tech University and Prof Ihron Rensburg cut the ribbon at the University of Johannesburg Confucius Institute launch.

GES FLAGSHIP PROGRAMMES

International Commercial Law

Commercial law supports business. As business evolves, so too must the law. More and more business is being done across national borders, especially across the African continent. There is a need for a common understanding of the law, even a set of common laws to help to smooth trade and commerce. The Institute aims not only to research these laws but also to help draft them – creating common regulations, conventions and model laws. The Institute will support lawyers in private practice through acting as an information centre for Hague Principles on Choice of Law in International Commercial Contracts, and other research.

Childhood Education

This flagship programme explores how primary school children develop and learn, and what this means for educators. The research spreads beyond the boundaries of teaching and incorporates developmental cognitive psychology and psychometry. The programme incorporates the innovative/unique teacher education model that is implemented through the Funda UJabule School. Furthermore, it has successfully integrated research, community engagement and teaching/teacher education.

Earth Sciences

Earth Sciences programme combines three research areas into a single pursuit of exploring ways to help South Africa and the rest of the African continent to create wealth and develop human potential through using mineral and fossil fuel resources effectively. The programme involves the work of the SARChI Chair in Geometallurgy, the Palaeoproterozoic Mineralization Research Group (PPM) and the DST-NRF Centre of Excellence for Integrated Minerals and Energy Resource Analysis (DST-NRF CIMERA).

Nanotechnology and Water

The Nanotechnology and Water programme comprises of the SARChI Chair in Nanotechnology and Water Research, which hopes to find new ways to purify water using nanotechnology.

Graduate School for Architecture (GSA)

Africa has much work to do to create socially inclusive, authentically African and sustainable urban environments and it needs architects who are sensitive to our unique challenges to do so. The architectural curriculum across the continent is predominantly Eurocentric and the GSA aims to change that. The new approach, successfully implemented in 2015, is a radically revised curriculum and a new teaching method.

UJ hosts a national DST-NRF Centre of Excellence, the Centre of Excellence for Integrated Minerals and Energy Resource Analysis **(CIMERA)** with Prof Nic Beukes as Director.

The research focus is the study of the origin, distribution and character of Earth mineral and fossil energy resource systems with the aim of ensuring their sustainable utilization not only in South Africa but Africa as a whole.

Focus Areas

1. Metallogenesis of Early Earth Mineral Resource Systems
2. South Africa's Three Superlative Mineral Resources
3. Fossil Energy Resources of Sedimentary Basins
4. Small Scale Mining Opportunities in South Africa
5. Critical Metals of the Future
6. New Bulk Mineral Resource Developments in Africa
7. Environmental and Medical Geology
8. Public Awareness and Education

In addition, the university has more than twenty Research Centres in a wide range of disciplines.

- Visual Identities in Art and Design
- Hypervision Research Group
- Centre for Telecommunications
- Mineral Processing and Technology Research Centre
- Composite Materials Research Group
- Photonics Research Group
- Sustainable Energy Technology and Research Centre
- South African Accounting History Centre
- Centre for Education Rights and Transformation
- Centre for Education Practice Research
- Centre for the Study of Democracy
- Centre for Social Development in Africa
- Centre for Anthropological Research
- Laser Research Centre
- Water and Health Research Centre
- South African Institute for Advanced Constitutional, Public, Human Rights and International Law
- Institute of Transport and Logistics Studies (AFRICA)
- Centre for Information and Knowledge Management
- Centre for Work Performance
- African Centre for DNA Barcoding
- Research Centre in Synthesis and Catalysis
- Paleoproterozoic Mineralization Research Centre
- Centre for Nanomaterials Science in Research
- Centre for Competition, Regulation and Economic Development

TECHNOLOGY STATIONS

The Technology Innovation Agency (TIA) funds Technology Stations to support industry and provide world class engineering services and support based small and medium technology enterprises. These Stations also provide technical expertise and high-tech equipment or infrastructure. UJ hosts two Technology Stations linked to the Faculty of Engineering, and the Built Environment.

Metal Casting Technology Station

The Metal Casting Technology Station (MCTS) is a technology transfer partner for the metal casting industry, pioneering development through training, research and technology support. A non-profit initiative funded by the DST through TIA, the MCTS operates from UJ in partnership with the Department of Metallurgy in FEBE. Focusing on casting design and simulation; education and training; physical metallurgy; rural and emerging foundries; and sand technology, the MCTS supports and assists the metal casting industry – foundries, suppliers and related industries – to improve the sector's innovation ability for increased competitiveness and sustainability.

Process, Energy and Environment Technology Station

Process, Energy and Environment Technology Station (PEETS) was established in 2010 and is positioned at UJ under the Faculty of Engineering and Built Environment, and funded by the DST via TIA. The primary mandate for the PEETS is to contribute towards improving the competitiveness of industry through the application of specialised knowledge and technology and facilitating the interaction between industry (especially SMMEs) and the academia in order to enable innovation. PEETS is the only organisation that serves as a catalyst to shorten the gap between Academia and Industry in the Energy and Environment space.

12 DST/NRF RESEARCH CHAIRS

Research Chairs are also instrumental in driving research programmes that lead to knowledge production, solutions to problems and training of research fellows and postgraduate students

The South African Research Chair Initiative (SARChI) aims to strengthen scientific leadership and research capacity in South African universities and supports established scholars to focus on advancing research and training of the next generation of research leaders in their respective fields. UJ now hosts twelve (12) SARChI chairs:

- Education and Care in Childhood (Faculty of Education)
- African Diplomacy and Foreign Policy (Faculty of Humanities);
- Social Change (Faculty of Humanities);
- International Law (Faculty of Law);
- Geometallurgy (Faculty of Science);
- Indigenous Plant Use (Faculty of Science);
- Nanotechnology for Water (Faculty of Science).

New SARChI Chairs

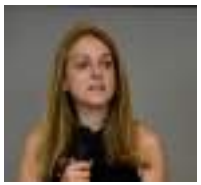
- Integrated Studies of Learning Language, Mathematics and Science in the Primary School (Faculty of Education)
- Industrial Development (Faculty of Economics and Financial Sciences)
- South African Art and Visual Culture (Faculty of Art, Design and Architecture)
- Laser Applications in Health (Faculty of Health)
- Welfare and Social Development (Faculty of Humanities)

FIVE NEW SOUTH AFRICAN RESEARCH CHAIRS INITIATIVE

The DST and the NRF awarded five new SARChI Chairs at UJ.

Prof Heidi Abrahamse
Faculty of Health Sciences

Prof Abrahamse has been associated with cancer therapy, stem cell differentiation and wound healing. South Africa is faced with ailment, with the non-communicable diseases coming to the fore as challenges to morbidity and mortality. In this grouping South Africans are especially vulnerable to diabetes and cancers. As the SARChI Chair in Laser Applications in Health, Prof Abrahamse aligns the areas of importance identified by government and will contribute by introducing both preventative modalities and treatment modalities associated with two of the main non-communicable diseases.



Prof Brenda Schmahmann
Faculty of Art Design and Architecture

Through the Chair in South African Art and Visual Culture, Prof Schmahmann is set to create a forum for producing research and enabling capacities which have enormous importance to the heritage and museum sectors, to arts management, to the gallery sector, to the education sector, and which complements and provide invaluable support to the work of art and design practitioners.

Prof Leila Patel
Faculty of Humanities

Prof Patel has a wealth of research experience in social welfare, social policy and social work. With her appointment as Chair in Welfare and Social Development, she aims to build on research strengths of the University's Centre for Social Development in Africa which are, inter alia: poverty and vulnerability with the focus on women, children, youth, and people with physical and mental disabilities.

RESEARCH CHAIRS

Prof Elizabeth Henning
Faculty of Education

Prof Henning has long been advocating mathematics and science interventions in primary schools. She has also emphasised that language and literacy are key to learning across the curriculum. Under SARChI, the Chair in Integrated Studies of Learning Language, Mathematics and Science in the Primary School, aims to shed light on children's development of mathematics and science concepts, using English as language of the discourse of texts in the later grades of the primary school.

Prof Fiona Tregenna
Faculty of Economic and Financial Sciences

The Chair in Industrial Development will drive a national research programme on industrial development, contributing to policy-relevant knowledge creation. As the Chair, Prof Tregenna is likely to drive research makes a valuable contribution to the importance of different sectors. These could include: industrial policy, deindustrialisation, industrial development and income distribution, employment creation through industrial development, the services sector, and industrialisation in the Southern African region.

Externally Funded Research Chairs

COJ Chair in Green Innovation
This Chair focuses on sustainable development, as well as the City of Johannesburg's aim of a resilient, liveable, sustainable urban environment underpinned by infrastructure support for a low carbon economy.

UNESCO Chair in Value Education
The purpose of the Chair shall be to promote an integrated system of research, training, information and documentation in the fields of education, particularly helping young people to live together in an atmosphere of peace, respecting themselves and others and contributing to sustainable development.

Youth Development Institute of South Africa (YDISA)
The Youth Development Institute of South Africa (YDISA) is established through a collaborative partnership between UJ and the National Youth Development Agency.

Internally Funded Research Chair

Teaching and Learning Research Chair
Prof Leibowitz's key role at the University is to support the scholarship of teaching and learning amongst academics. She has given many talks and conducted workshops at universities in South Africa on the scholarship of teaching and learning and related topics.

NRF RATED RESEARCHERS

The NRF rating system is a valuable tool for benchmarking the quality of our researchers against the best in the world. NRF ratings are allocated based on a researcher's recent research outputs and impact as perceived by international peer reviewers. The rating system encourages researchers to publish high quality outputs in high impact journals/outlets.

The ratings that are awarded fall within the following categories:
A – Leading international researchers
B – Internationally acclaimed researchers
C – Established researchers
P – Prestigious awards
Y – Promising young researchers

UJ is proud to have six NRF A rated researchers who are recognised by their peers and as international leaders in their fields.

NRF A-Rated Researchers

- Prof Nic Beukes
- Prof Hendrik Ferreira
- Prof Bill Harris
- Prof Mike Henning
- Prof John Maina
- Prof Thadeus Metz

The strategy to identify new potential applicants for NRF rating and assist rated researchers to improve their ratings has yielded good results. By the end of 2015, the University had 156 NRF rated researchers, up from 142 at the end of the previous year. The increase in the number of rated researchers is mainly attributed to newly rated researchers rather than new UJ staff appointees.

	NRF Rating Category						
Year	A	B	C	P	Y	L	**Total**
2010	5	20	52	1	10	2	90
2011	5	21	57	1	14	1	99
2012	5	24	66	1	19	0	115
2013	6	28	72	1	26	0	133
2014	6	32	77	1	26	0	142
2015	6	33	86	1	30	0	156

AWARDS

In 2015, several UJ researchers were recognised for their contributions and achievements in their respective research areas.

EXTERNAL AWARDS

2015 South African Association of Botanists' Gold Medal Award

Prof Ben-Erik van Wyk
SARChI Chair in Indigenous Plant Use, Department of Botany and Plant Biotechnology, Faculty of Science

Prof van Wyk was awarded the prestigious South African Association of Botanists (SAAB) Gold Medal Award in 2015. This SAAB award acknowledges outstanding botanical research and contributions to the advancement of botany in South Africa and is awarded only in exceptional circumstances to outstanding candidates. Prof van Wyk has contributed to ethnobotany through his work on medicinal, poisonous and food plants. He is also the Chair of Indigenous Plant Use Forum and has also contributed significantly to training and mentorship of botanists in South Africa.

NRF Champion of Research Capacity Development and Transformation at South African Higher Education Institutions

Prof Tshilidzi Marwala
Deputy Vice-Chancellor of Research, Postgraduate Studies the Library and Information Centre

Prof Tshilidzi Marwala was presented with the NRF Champion of Research Capacity Development at South African Higher Education Institutions Award in 2015 for unearthing, nurturing and supporting research talent in people from designated groups to achieve world-class research excellence.

Prof Marwala has an extensive track record in human capacity development having supervised 45 Master's and 18 PhD students to completion. Of the 31 black South African students he supervised, 10 completed their dissertations with distinction. Some of these students have proceeded with their doctoral and postdoctoral studies at leading universities such as Harvard, Oxford, Cambridge, British Columbia, Rutgers, Purdue and Concordia.

2015/2016 TW Kambule-NSTF Award for Research and Outputs Over a Period of Up to 15 Years

Prof Bheki Twala
Director: Institute for Intelligent Systems, Professor of Artificial Intelligence and Statistical Sciences at the Faculty of Engineering and the Built Environment

Prof Twala is the Director of the GES Institute for Intelligent Systems and Professor of Artificial Intelligence and Statistical Sciences in FEBE. He received the TW Kambule-NSTF Award for his work building on diverse expertise in making decisions given incomplete information, and utilising Artificial Intelligence techniques for predicting and for the classification of tasks in several fields such as banking and finance, insurance, biomedical, robotics, psychology, software engineering, and most recently in electrical and electronic engineering science. Prof Twala is an NRF-rated researcher and his research.

INTERNAL AWARDS

The Vice Chancellor's Distinguished Awards for research and innovation recognise significant research contributions and achievements, and innovative research performed while in the employ of the University. In 2015, two academic staff members were acknowledged for their research in the categories:

- **Outstanding Researcher of the Year**
- **Most Promising Young Researcher of the Year**

Outstanding Researcher of the Year Award

Prof Nic Beukes
Department of Geology,
Faculty of Science

Prof Beukes is an established researcher, whose career has been outstanding in relation to scholarship and global collaboration. Not only does he have international standing, but his local work and scholarship in South Africa have led to his status as one of the global leaders in Earth Science and thereby projects UJ, his academic home, in the same way. An NRF A-rated scholar, he has maintained a consistently high field-weighted citation index, internationally recognised research output in scholarly journals, and has an outstanding H index. Prof Beukes has successfully supervised and/or co-supervised 52 MSc students; successfully supervised and/or co-supervised 18 PhD students; supervised 8 postdoctoral researchers; authored/co-authored 175 peer-reviewed research articles; co-authored 3 books and authored/co-authored 269 conference abstracts/proceedings.

Prof Nic Beukes continues to represent UJ in prestigious and influential earth science collaborations in the USA, Europe and the southern hemisphere. He is also the Director of CIMERA.

Most Promising Researcher of the Year Award

Dr Clinton Aigbavboa
Department of Construction Management and Quantity Surveying, FEBE

Dr Aigbavboa won the Most Promising Researcher of the Year Award (for academic staff members who have obtained their doctoral degrees within the most recent five years) for his contribution as an active researcher with an interest in the field of sustainable human development, with research focus on the following areas: sustainable housing regeneration (urban renewal and informal housing), lifecycle assessment in the construction industry, leadership in low-income housing, post occupancy evaluation and green job creation. His research draws on current developments and is applicable to construction industry development via the development of emerging contractors, the economics of infrastructure development, and the adaptation of building information modelling as a solution to the eradication/minimisation of urban and rural housing shortages.

Dr Aigbavboa has established significant research collaboration and relationships with some national and international institutions and with the industry. The most recent includes the signing of an MoA with the Scientific Society for the Promotion and Advancement of the Social Sciences (Akraoasis) in Serbia. He is also an academic quality controller for South African-based construction industry training outfits offering training materials.

RESEARCH STORIES

UJPS AT THE FOREFRONT OF PAN-AFRICAN CONNECTEDNESS, LOCAL RELEVANCE AND CONTRIBUTION

UJ is an important feature of the higher education landscape, and boldly promotes accessible excellence. A largely undergraduate institution, it has made great leaps in research and postgraduate studies, in particular if we review the key indicators of research publications, postgraduate enrolments, postdoctoral fellow growth, and in the provision of an enabling environment. One indicator of this is that it administers over R100 million in postgraduate funding support, growing by 35% between 2014 and 2015. Embedded within the strategic focus of being an international university of choice, anchored in Africa, that dynamically shapes the future, UJ has taken another leap to establish the UJ Postgraduate School.

The postgraduate portfolio at the University is an integral pillar of the University's Global Excellence and Stature drive. The establishment of the UJ Postgraduate School (UJPS) in 2015 is a significant step towards providing effectively and efficiently managed resources in improving UJ's postgraduate performance and to serve and support postgraduates holistically through a single, highly accessible point of contact, thus serving to advance their progress and success. The UJPS will function across faculties and will enhance the support offered to all the postgraduate students and postdoctoral fellows at the University. It will complement Faculty efforts to provide an enabling environment for study and life for postgraduate students. An important role of the postgraduate school will be to provide a welcoming and caring single point of contact to all prospective and current postgraduate students that will provide access to services and resources required. It will act as a "hub" and "home" to postgraduate students.

"over R100 million in postgraduate funding support, growing by 35% between 2014 and 2015"

In 2015, UJ had around 7 358 postgraduate students with the ambition to grow this number significantly over the next few years, thereby increasing the postgraduate to undergraduate student ratio from 85:15 in 2015 to 83:17 in 2020. The postgraduate numbers included 3 859 honours students, 2 792 master's students and 849 doctoral students. There was a 12% growth in doctoral students from 2014 to 2015. International students form 12% of the total postgraduate student body and 32% of all doctoral students are international students. The graduation for postgraduate students has also shown an increase of 3.5% in total and 2 357 postgraduate students graduated in 2015. Of these, 1 752 were honours graduates, 501 were master's graduates and 104 students succeeded in graduating with a doctoral qualification.

41% of doctoral students and 50% master's students at UJ are part-time students who require additional support, especially a dedicated space to interact with other posgraduate students as well as a single point of contact. 62.7% of doctoral students are in paid employment and 68.3% of these students work 40 hours or more per week in paid employment (2015 Postgraduate Student Experience Survey).

The Postdoctoral Research fellows at UJ are often early career academics who have recently obtained their doctorates and are focusing on their research areas. They form an important part of UJ's strategy regarding global excellence and the number of the PDRFs has grown from 173 in 2014 to 204 in 2015. The University funded 124 of these PDRFs, the NRF funded 37 and there were 43 externally funded PDRFs.

The vision for the UJPS is "to establish a Postgraduate School of the highest quality, which supports and develops excellent scholars who have an impact beyond the academic research space which benefits the social, political, cultural and technology spheres, in South Africa, Africa and Internationally".

UJ has in its mission global stature and recognition, pan-African connectedness and local relevance and contribution, and within each of these there is a carefully crafted strategy for postgraduate studies. Some of these include innovative multi and interdisciplinary programmes, joint degrees with our U21 partners and the recruitment of the best African scholars and students who can lead UJ's ambition to be the pan-African pi-centre for critical enquiry and advanced study. Within our research institutes and centres on issues of social relevance and national development such as energy renewal, sustainable cities, laser research, nano technology, artificial intelligence etc., the role of postgraduate students and post-doctoral fellows is also clear.

7 358
postgraduate students in 2015

35%
growth in postgraduate funding support between 2014 and 2015

204
Postdoctoral Fellows in 2015

Prof Ihron Rensburg, Prof Shireen Motala and Prof Tshilidzi Marwala at the unveiling of the Postgraduate School building, Akanya.

GSA FIRST TO OFFER THE UNIT SYSTEM IN AFRICA

UJ's Department of Architecture is the continent's first school to adopt the Unit System method of teaching, pioneered by London's Architectural Association 40 years ago, and now a way of life at the world's top architectural schools. Lesley Lokko, Associate Professor of Architecture and the Postgraduate Programme Convener at UJ, says it's an exciting time for African schools and departments of architecture.

Pioneered in the 1970s in the UK, the Unit System sees professors and tutors 'sell' their research interests and approaches to prospective students at the start of each year. Simultaneously, students 'sell' their skills and enthusiasm in order to join the different 'units'. This modern approach is competitive and flexible, allowing for a much closer relationship between the fast-changing and evolving world of practice, and the slower, more experimental environment that the best schools of architecture provide.

"UJ is extremely proud to be the first to offer the Unit System to African and international students looking to study in Africa," says Prof Lokko. "This puts our Department of Architecture firmly on the international map."

Offered for the first time in 2015, the Department saw its intake jump from 12 to 52 students, all of whom are now enrolled on one of the Graduate Programme in Architecture (GPA)'s three Units on offer: Unit 1 (Architecture & Infrastructure), headed by Alex Opper, Senior Lecturer, with assistance from Unit Tutor Lorenzo Nassimbeni; Unit 2 (Architecture & Agency), headed by Associate Professor Amira Osman, with assistance from Unit Tutors Jhono Bennett and Tariq Toffa, and Unit 3 (Architecture & Speculation), headed by Lokko and Tutor Craig McClenaghan.

"UJ has South Africa's youngest department of architecture and as such, it's the perfect space for thinking outside the box," Prof Lokko continues. "Africa is often seen as lacking in innovation, too crippled by problems to change the script – and we need to change that. Many of our most successful and globally recognised architects studied abroad: David Adjaye, Francis Kéré and Kunle Adeyemi are the continent's 'architectural ambassadors', yet they all attended European or American schools.

"Africa needs to create more home-grown role models, architects whose vision and skill are honed here, not elsewhere. UJ could one day play an important role in creating the right environment to produce the next Adjaye; the next Adeyemi; the next great African architect. That's what we're working towards. Imagination is key – and that's what we're hoping to instil."

"UJ has South Africa's youngest department of architecture and as such, it's the perfect space for thinking outside the box"

UJ MULTI-STAKEHOLDER PROJECT ENCOURAGES A SUSTAINABLE FOOD SYSTEM IN SOWETO

The Izindaba Zokudla (Conversations about Food): Innovation in the Soweto Food System is a multi-stakeholder engagement research project, co-headed by Dr Naudé Malan of Department of Anthropology and Development Studies (UJ) and Mr Angus Campbell of the Department of Industrial Design (UJ). In their quest to highlight the impact of urban farming, two University of Johannesburg (UJ) lecturers embarked on a multi-stakeholder engagement project that aims to create opportunities for urban a griculture in a sustainable food system in Soweto.

"In 2013, a series of workshops identified the need for increased training and knowledge generation for urban farmers and food producers. This is an important aspect of a sustainable food system. Food, and in particular its distribution and transportation, is a key contributor to climate change and we aim to counter this with the establishment of local food economies that produce food close to where it is consumed," says Dr Malan.

He stressed that the creation of a local economy also holds potential to conserve and reinvest capital in our townships and this holds promise for an alternative approach to economic development that benefits food security. The Izindaba Zokudla project is a joint initiative by the University's Department of Anthropology; Department of Development Studies; Department of Industrial Design; Department of Business Management (Soweto programmes); Department of Graphic Design; Department of Multimedia Design; Department of Strategic Communications (Public Relations); the City of Johannesburg: Directorate Food Resilience; Region D Farmers forum; and the Meadowlands Agriculture Forum.

The project, a free service offered (with limited space) to all farmers in Soweto, started with urban farmers and gardeners in Soweto and is aimed at resource-poor, emergent, established and commercial urban farmers.

In 2015, the intended focus is on horticulture, developing appropriate technology and on establishing networks that can assist in developing viable and sustainable food enterprises.

UJ Engineering students joined students from Industrial Design, Anthropology and Development, Graphic Design and Business Management, as interdisciplinary teams from the UJ Energy Movement researched effective solutions to support urban farmers through their Community Factories initiative in Soweto.

"It's important that we teach our students to not just plug into the existing system," says Mechanical Engineering Science lecturer, Nickey Janse van Rensburg. "They need to be active in inventing new systems. We want our students to shift from a jobseeker mindset and to develop a passion for creating jobs. We need to be proactive in the way we train engineers, using authentic integration and interaction with the community. We should be co-creating new solutions that are relevant and valuable to society."

Janse van Rensburg is co-founder and programme manager of the UJ Energy Movement, a programme established in 2010, which is entirely run by student members. Its aim is to promote skills development, energy conservation and sustainability through technology innovation.

The engineering students used intermediary technology to add to the Izindaba Zokudla value chain by developing an off-grid Community Factory, which will produce products that are useful for urban farming, thereby promoting food security.

"These interdisciplinary initiatives are enhancing teaching and learning at UJ, enriching research opportunities and pushing the boundaries of innovation through co-creation," says Janse van Rensburg.

Izindaba Zokudla Farmers' school demonstration.

DISMANTLING DATA OBSTACLES WITH INTELLIGENT SYSTEMS FOR NATIONAL BENEFIT

For generations, scientists have attempted to create a substitute that can perform the same tasks as a human. The arrival of the computer 50 years ago has helped scientists progress quickly towards this goal. Rapidly advancing technology now makes it possible to create computer-based 'human-like thought processes' that can solve complex problems based on big data, says Prof Bheki Twala, Director of the new Institute for Intelligent Systems (UJ IIS) at the University of Johannesburg.

The UJ IIS partners with industry, Government and communities to dismantle big data problems for the economic benefit of South Africa.

"A good example of an intelligent system is determining if borrowers are likely to default on their loans from past experiences. This in turn affects whether the loans are approved or not. Intelligent systems are deployed at banks in South Africa to deal with the huge numbers of financial transactions generated every day and to determine credit risk.

"Such systems have also been used to make decisions when the available information is incomplete. Taking credit risk as an example, one should be able to assess an individual's credit card application even when attributes such as income or proof of residence are missing.

"Intelligent systems can be also used to predict future wind turbine energy production using past production patterns and weather data; analyse road traffic accident information and develop precautionary measures; or to start understanding public health challenges such as diabetes, HIV/AIDS and malaria better."

The UJ IIS will recruit a multi-disciplinary team of highly qualified scientists and engineers from UJ and industry, ranging from Computer Science through Health Sciences, Management, Accounting and more.

In terms of research, the institute focuses on Systems Intelligence and Cognitive Computing; Big Data Analytics and Deep Learning; Digital Revolution and Machine Learning; and Industrial Application of Intelligent Systems and Cognitive Computing.

In 2015, Prof Twala served as Head of Department of Electrical and Electronic Engineering Science at the UJ. Prior to that he was Professor in Artificial Intelligence and Statistical Science in the same department from 2010 to 2013. He previously served at the CSIR Advisor: Information Security Competence Area and Principal Research Scientist: Digital Intelligence Competence Area from 2008 to 2012.

His industry experience includes, among others, managing the methodology section for a Labour Force Survey Re-Engineering Project for Statistics South Africa; consulting on a project at London Imperial College addressing the impact of HIV/AIDS on education systems in developing countries; and serving as Chief Technical Officer for the Ministry of Public Works and Transport in Swaziland managing road transport statistics, technical aspects of vehicles, vehicle operating costs, road transport legislation and the enforcement of such legislation.

UJ'S LASER RESEARCH CENTRE INVESTIGATING HEALING OF DIABETIC WOUNDS

UJ's Laser Research Centre (LRC) joined the World Health Organisation (WHO) and millions of concerned people around the world to recognise World Diabetes Day, the primary global awareness campaign for diabetes.

Under the World Diabetes Day theme is "**Beat Diabetes**": Scale up prevention, strengthen care and enhance surveillance.

"The Laser Research Centre (LRC), a research centre within the Faculty of Health Sciences at the University of Johannesburg, under the directorship of Prof Heidi Abrahamse (NRF SARChI Chair: Laser Applications in Health), has a group of researchers working on the underlying mechanisms of action of Photobiomodulation (PBM) for application in diabetic wound healing," says Dr Nicolette Houreld, UJ's Senior Lecturer: Laser Research Centre.

"We conduct in-vitro studies in artificial cell culture (growth of cells in an artificial environment outside a living organism) where diabetic wounded fibroblast cells are exposed to low-powered laser light (either visible red or near infra-red (NIR) laser light) and various biochemical pathways involved in wound healing are studied, for example collagen synthesis."

Dr Houreld explains that their results have shown that exposure to such light is directly absorbed by the cells, which in turn increases various cellular processes necessary for wound healing such as cell migration and collagen production.

"We have also conducted a small pilot study on humans with lower limb diabetic ulcers. This study showed favorable results; ulcers irradiated with the LED light (combination of red and NIR) healed faster than those exposed to placebo irradiation, there were also no side-effects reported. In fact, some patients regained feeling in areas of the feet where they had lost all sensation (Ntelei et al., 2016).This is an ongoing study," says Dr Houreld.

"Diabetes Mellitus (DM) has been declared as a global burden, with 415 million cases (adults aged 20-79) worldwide in 2015, and a further estimated 193 million undiagnosed cases. The estimated number of people with DM on the African continent in 2015 was at 14.2 million, and is thought to increase to 140.2 million by 2040 (International Diabetes Federation, IDF, 2015). It was also estimated that at the end of 2015 there would be 5 million deaths worldwide related to DM at a cost of between USD673 billion and USD1 197 billion in healthcare."

"To put this into perspective, there was only 1.5 million deaths related to HIV/AIDS, 1.5 million related to tuberculosis and 0.6 million related to malaria (IDF, 2015). Patients with DM commonly develop a number of life-threatening health conditions, and repeatedly suffer from non-healing, chronic and frequently debilitating lower limb ulcers, which often necessitate amputation."

"A number of underlying pathologies contributes to the impaired wound healing seen in diabetes. These include, but are not limited to, increased oxidative stress, advanced glycation end products, inflammation and infection, and decreased immunity, angiogenesis (growth of blood vessels), circulation and fibroblast migration, as well as a disruption in the extracellular matrix (ECM, non-cellular component present within all tissues and organs and provides essential physical support), hypoxia (decreased oxygen levels), ischemia (restriction in blood supply to tissues, causing a shortage of oxygen and glucose) and neuropathy (damage or dysfunction of nerves typically causing numbness or weakness)."

In diabetic wound healing there is a disruption in the formation and synthesis of the ECM, including collagen, an essential component in wound healing. The decrease in collagen seen in diabetes may be as a result of decreased synthesis/ production and/or enhanced metabolism/breakdown.

"Photobiomodulation (PBM), commonly also known as laser therapy, phototherapy, and low level laser therapy (LLLT) is a non-invasive, non-ablative and non-thermal therapy which involves the application of low powered light (typically from a laser or light-emitting diode, LED) to stimulate cellular processes. It is used to treat a wide variety of conditions, including chronic diabetic ulcers. Light-absorbing structures within the cell, or chromophores, absorb this light (photon energy) which is then converted to chemical energy. This stimulates the cells to repair themselves and produce essential cellular components, including collagen, required for wound healing," she says.

"The type of lasers and light instruments used in PBM should not be confused with the high-powered ablative lasers commonly used in aesthetics and dermatology. Ablative lasers are dependent on the thermal damage of the target tissue, thereby forcing it to repair itself and hence make more collagen. These types of instruments are typically used for skin resurfacing and rejuvenation. The light sources used in PBM are low-powered, and their effects do not rely on thermal damage, and commonly make use of light in the visible red and near infra-red spectrum of light. This treatment calms down inflammation, speeds up the formation of new blood vessels and speeds up healing, when applied correctly to wounds and painful areas."

NATIONAL WELFARE SYSTEM FACES DEEPENING CHALLENGES

Prof Patel is the Director of the Centre for Social Development in Africa (CSDA) at the University of Johannesburg (UJ), and former Director-General of Social Welfare in South Africa. This is an edited extract of her latest book 'Social Welfare and Social Development'.

Twenty years ago South Africa embarked on a bold strategy to renew its welfare system. This was part of a larger project to transform South African society to achieve peace and social justice and overcome the social divisions of the past.

Significant policy and legislative achievements have been made, and a rights-based approach to social welfare has been promoted. Formal racial discrimination in access to services has been abolished and a nationally integrated single welfare system has been created for all South Africans.

South Africa is acknowledged as the leader and an innovator on social development in the global South. But the implementation of social development policies has not been seamless, writes Prof Layla Patel.

Grants as a Political Tool

Social grants have had a major effect on poverty reduction and some effects on reducing inequality. But without growth in employment it will be difficult to reduce income poverty substantially.

Despite the achievements of the social protection system, there is still considerable debate about whether or not this is the right way forward for the country. Issues include the widespread belief that grant beneficiaries abuse the money and that social grants encourage teenage pregnancies and dependency on the state.

Although there is no evidence that social assistance, or social grants, have these unintended effects, these views pose a threat. They could lead to a backlash against the programme among politicians, taxpayers and the public. Recent local and national election campaigns also show how social protection can be used by the ruling party for its electoral gain. The discourse among politicians in the ruling party during the 2014 election campaign was that grant beneficiaries who voted for the opposition were betraying the hand that feeds them. Grant beneficiaries were also unsure as to whether their grants would be protected if they voted for another political party.

This has given rise to a view that social grants are a form of 'vote buying', for example by distributing food parcels during elections. These issues are relevant to the future outlook of social assistance.

Flaws in the System

The White Paper for Social Welfare set out a policy framework, proposals and recommendations for implementation. But confusion remained about the theory undergirding the approach. There was a lack of clarity about definitions and the application of the approach. This was believed to be a major factor in the slow progress that was made in implementation.

Different interpretations exist, such as that individual therapeutic interventions and statutory child protection services were to be replaced with community development and with income generation programmes. Social workers felt ill equipped to implement the new approach. Some saw it as marginalising the social work profession.

This was historically the primary profession in the welfare field. Resistance was therefore evident.

Large-scale transformation of a country's welfare system requires substantial change management interventions. These help professionals and service providers make strategic shifts. This didn't happen in a systematic way. There has also been inadequate monitoring and evaluation of social development policies. A lack of agreed indicators to measure and track changes over time does not exist. Without leaders able to champion the transformation, momentum was lost in the implementation of developmental welfare services.

Welfare Services Crowded Out

In the latter part of the 1990s the government adopted the Growth, Employment and Redistribution policy (GEAR). It signalled a retreat from the basic needs approach of the earlier Reconstruction and Development Programme. Although this did not result in a significant lowering of social spending, government was concerned with reducing its debt burden.

GEAR could be described as a voluntary structural adjustment programme and was severely criticised by the labour movement and civil society organisations. They campaigned against creeping neo-liberalism in social and economic policies.

Later, as economic growth and the state's capacity to raise taxes improved, increased resources were directed to the social sector. Political support also increased, resulting in the expansion of social grants.

But the expansion of social assistance at the time had a negative impact on education and health services. The trade-off between growing one social development programme at the expense of other important programmes was highlighted by both government and groups in the social sector.

While National Treasury tried to balance these trade-offs, welfare services continued to be crowded out as social assistance expanded. Although there have been some increases in recent years to address the imbalance, welfare services and community development programmes remain neglected. They continue to lack funding and social policy innovation.

Implementation Stymied

Challenges of an institutional, economic and political nature influenced the way in which the developmental approach was implemented.

Social welfare services are delivered as a concurrent function by provincial governments. The ability of provinces to redirect welfare funds to other services and priorities means that developmental welfare services continue to be underfunded.

A lack of capacity in provincial governments to plan, implement, monitor and evaluate service delivery outcomes also hampered service delivery.

Power struggles between government officials and non-profit organisation (NPO) partners also held back the potential benefits that might have been realised by the partnership model.

In addition, services delivered by NPOs reached a limited number of people and were not extended to rural and under-serviced areas. Many NPOs are concentrated in urban areas.

A lack of institutional capacity, including loss of staff by NPOs to government, inadequate numbers of social workers, community development workers, child and youth care workers and paraprofessionals, has been a serious impediment.

But increasing the number of practitioners to implement a social treatment approach to social work and service delivery will not have the desired outcome. Greater attention needs to be given to appropriate training of students and existing personnel in developmental welfare.

There is also need for a culture of research and innovation in the welfare field. A lack of resources to support innovation, together with a lack of transformation leaders to champion social development, are other barriers.

Corruption is widely reported at different levels in government. In the welfare field, this is significant in the administration of the social grants system.

Service delivery protests in local communities are drawing attention to corruption by public officials and to the failure of local authorities to meet community needs.

Labour disputes also spiral into local protests and violence in communities especially in areas with mining operations. Party political divisions and dynamics also play out in communities and underlie community-level conflict and tensions.

Government has implemented various interventions to increase efficiency, particularly in the administration of social grants. But welfare and development agencies and practitioners continue to face numerous challenges in service delivery and how to best facilitate participatory development.

ENHANCE SCHOOL, UNIVERSITY LINKS

SPECIAL PARTNER SCHOOLS CAN INTEGRATE THEORY, RESEARCH AND PRACTICE TO PRODUCE GOOD TEACHERS, WRITES **PROF SARAH GRAVETT,** EXECUTIVE DEAN AT THE FACULTY OF EDUCATION.

Teacher education institutions have been criticised for delivering graduates who are not well prepared for the reality of schools.

So what is the current situation regarding initial teacher education policy and practice? How do we compare with international exemplary practice? How valid is the criticism? The Council on Higher Education (CHE) report (2010) on the national review of academic and professional programmes in education concluded that teacher education in South Africa is `riddled with difficulties` and that several teacher education programmes fail to prepare student teachers for practice in diverse environments.

Teacher education quality was also highlighted at the Teacher Development Summit (2009). A main discussion point was that teacher education emphasises theory at the expense of practice. It was also claimed that teacher education programmes were not aligned with what schools needed.

The summit called for the development of a national plan for teacher development.

Two policy initiatives took account of the review and summit recommendations. The Minimum Requirements for Teacher Education Qualifications, promulgated in 2011 and revised in 2015 (with mostly technical changes), requires a redesign of teacher education programmes to align them with the policy. This sets out the requirements for initial teacher education programmes regarding the knowledge mix that should be present (disciplinary, pedagogical, practical, fundamental and situational learning) and it provides guidelines for practical work (learning in and from practice). The policy also specifies the minimum set of competences required for a newly qualified teacher.

The minimum requirements drew on local and international research and responded to issues raised in the CHE review and stakeholder consultations.

But the effect of this policy will only become evident in a few years` time. Higher education institutions are either currently designing programmes aligned with the minimum requirements or have only recently started to offer these programmes.

Stakeholders who were involved in the Teacher Development Summit collaborated to develop the Integrated Strategic Planning Framework for Teacher Education and Development in South Africa, 2011–2025.

This framework seeks to direct the improving of the quality of teacher education and development. Activity 4.5 pertains specifically to initial teacher education. This states that initial teacher education programmes will be strengthened by the establishment of teaching schools and professional practice schools to support meaningful work-integrated learning. Teaching schools are described as teaching laboratories where student teachers can learn from practice. Professional practice schools are the schools at which students will engage in work-integrated learning. Thus, the framework proposes the two will play complementary roles.

Both policy initiatives reflect powerful teacher education practices that are prevalent internationally. Research on successful teacher education programmes shows that such programmes are characterised by the integration of knowledge for teaching with knowledge of teaching – neither theory nor practice is privileged. The design of such programmes draws optimally on collaboration between teacher education institutions and schools. If I was to single out one aspect that could contribute significantly to strengthening the quality of teacher education, it would be planned collaboration between schools and higher education institutions. In my view, this is the Achilles' heel of teacher education.

Why? It is the case that school practicals form part of all teacher education programmes in South Africa. The minimum requirements specify the time that student teachers must spend at schools for formally supervised and assessed school-based experiences. The minimum requirements also state that practicals must take place in functional schools that are committed to the role they need to play to support the development of student teachers.

But even if student teachers are placed in functional schools that are committed to hosting them (which is regrettably not always the case), it does not necessarily imply that the experience will be educative. Implicit in arguments for the extension of school experience is the assumption that this results in learning. So more experience is probably valuable. Yet, educationists John Dewey and Lee Shulman have noted that experience is not necessarily educative. Shulman argues that a precondition for learning through experience is reflection on experience. Dewey cautioned that experience can be `miseducative`.

Teacher education researchers raise concerns that school experience can have detrimental socialising effects by, for example, perpetuating the status quo. These researchers advocate that attention must be paid to the quality of school experience rather than the quantity.

Inherent to educative school experience would be that student teachers encounter practices that could be emulated, coupled with reflective mentoring by expert teachers.

In addition, a powerful school experience would imply that the school and the teacher education institution jointly negotiate a shared vision regarding the type of teacher that should be developed, what good teaching entails and what each of the partners, namely the school and the institution, can contribute to achieve this shared vision. This requires a strong negotiated partnership.

To enable this, some countries use special types of school. For example, in the United States, many teacher education institutions join forces with school districts to create professional development schools, also referred to as partner schools. In the Netherlands, some universities place student teachers in a specific kind of designated school, called training schools or 0ple2`dz`ngsscholen. In Finland, special practice schools are used to enable the integrating of theory, research and practice in the education of teachers.` This is where Activity 4.5 of the Integrated Strategic Planning Framework for Teacher Education and Development holds much promise – strengthening teacher education through teaching schools and professional practice schools.

The Faculty of Education at the University of Johannesburg has been involved in developing two schools to serve as teaching schools. The one at the Soweto campus is now established and our research has shown that it enables the integration of knowledge for teaching with knowledge of teaching in ways that were not possible before.

But setting up this school and trying to transform a second school in Mpumalanga into a teaching school has been challenging. We have persisted because we are convinced that a teacher education model incorporating a teaching school, coupled with also placing student teachers in other schools for work-integrated learning, does result in powerful teacher education. At the teaching school, student teachers encounter mentoring and good practice that can be emulated. But they also experience the varied conditions and difficulties of the wider schooling system.

Policy initiatives are promising but take a long time to come into fruition. What can be done in the meantime?

Currently faculties and schools of education struggle to support and monitor work-integrated learning. Many have large numbers of students and have neither the human nor the financial resources to supervise student teachers adequately during school placement or to collaborate actively with the schools.

This presents a significant challenge for quality teacher education. During the past few years the Education Deans Forum has been advocating (unsuccessfully) for ring-fenced funding to support work-integrated learning.

The Department of Higher Education and Training provides a clinical grant to higher education institutions to support healthcare training. A similar type of grant for teacher education could go a long way towards enabling strengthened work-integrated learning and set up true teacher education partnerships between higher education institutions and schools.

**This article first appeared in the Mail and Guardian.*

UJ GEOLOGISTS SAY METEORITE CRASH STARTED FORMATION OF MONSTER GAUTENG CAVE

Two billion years ago, the biggest known meteorite crashed into Earth and formed the Vredefort Dome south of Johannesburg. University of Johannesburg (UJ) geologists believe that this crash formed the geological structures that started the formation of a unique, colossal cave system west of the city.

UJ postgraduate student Mr Pedro Boshoff, supervised by Prof Jan Kramers and Dr Herman van Niekerk, is exploring the ancient geological secrets this monster cave holds for his Master's thesis. As part of the Speleological Exploration Club (SEC), Pedro was amazed to discover revealing rock formations when he ascended into the depths of the cave. As with many great scientific discoveries, this colossal cave system was revealed by fortuitous circumstances.

In the 1990s, a farmer west of Johannesburg woke up with a start in the early hours of the morning. He heard a tremendous crash. After sunrise, one of the farm workers with eyes as wide as saucers ran to him with the news. There was a sinkhole in the mealie field. It was later measured to be 18m across and deep enough to swallow a 12-storey office building.

A few years later, another crash. On one side, the bottom of the sinkhole had fallen through into something even deeper.

On 13 January 2013, a bunch of professionals, called SEC, who explore caves in their free time, saw the sinkhole for the first time.

"From the top of the sinkhole we could see that, in one corner at the bottom, a shadow hinted at possibilities of darkness beyond. But we weren't too optimistic to find a new cave," says Steven Tucker, a SEC member.

A week later, they went back. Tucker was the first person to descend to the bottom of the sinkhole and enter the shadow. That shadow turned out to be the entrance to the deepest dry cave system in South Africa.

They decided to call the cave Armageddon.

"We called it Armageddon for two reasons. One, the cave is dangerous because of loose rocks. Those rocks made it very difficult for us to set up the three ziplines, or foefieslides, over the very deep pits in the cave," says Tucker.

"The other reason we called it Armageddon is because of a cave called Apocalypse. Apocalypse is also in South Africa. That cave is the biggest cave in the country, if you measure the total length of passages.

"But this cave, Armageddon, is much deeper. Armageddon is also longer if you keep walking along the same level. So it extends across a larger horizontal distance and takes longer to explore."

"So far we have just over 4kms of cave mapped out with laser devices. The roof is so high, the only way we can measure it is with laser range finders. We keep finding more extensions and more levels... we know the Armageddon system has at least three levels, and is at least 350 meters deep."

Pedro Boshoff went on one of the many trips down Armageddon. When Boshoff got down into the gigantic cave, he

Dr Herman van Niekerk (UJ) rushes along the thin steel cable. Photo: Andre Doussy, SEC.

noticed something unusual about the rocks inside. They had been torn apart, much like a paper tissue can be torn apart.

"The rocks were sloping in a very unique way. I'd never seen anything like this before inside a cave. The rock structures had been mangled by tremendous forces. Forces so huge and so sudden that none of the usual suspects could be held liable. It was clear that something had to be behind these structures in the rocks, something that could instantly tear rocks apart," says Boshoff.

Boshoff decided to combine his hobby and his profession, researching how the cave was formed for his Master's thesis at the University of Johannesburg. His supervisor, Dr van Niekerk, joined Boshoff and SEC on the next expedition into the cave.

"We think is happened this way... When the meteorite struck the ground about 2 billion years ago in the Vredefort area, rocks over a huge area were suddenly compressed by the impact. What also happened is that some rock layers sort of 'slipped' across each other, creating new structures. We call these structures low-angle thrust faults. Where the rocks look 'torn', we're seeing low-angle thrust faults," says Boshoff. Immediately after the force of the impact, the dolomitic rocks expanded again, and deep vertical tears were formed. The combination of these structures allowed the process of cave formation to begin, a process still continuing today, says Dr van Niekerk.

It is almost impossible to measure the age of the cave. However, we know the Vredefort meteorite struck Earth near Johannesburg about 2 billion years ago.

Says Dr van Niekerk: "We hope to find a mineral called sericite, which we also call fine-grained mica, along the thrust faults in the cave. This mineral acts like a geological clock for us. We think the rock-shearing would have created some sericite. Once we find some and we are able to get a radiometric age from it, we will know for certain when the structures that started the process of cave formation were formed. Even then it will still be incredibly difficult to determine the age of the cave itself."

Deep inside the cave, 'cave popcorn' mineral deposits and sparkling needles of aragonite tell further stories about the formation of the cave after the meteor impact. Armageddon cave is one of only two known worldwide to be caused by meteorite impacts. Due to the regional abundance of the structures that resulted in the formation of the cave, it is possible that there are more of these below the western part of Gauteng.

FACULTY RESEARCH HIGHLIGHTS

FACULTY OF ART, DESIGN AND ARCHITECTURE (FADA)

46.81
DHET subsidy units produced by faculty

25.83
journal article units

10.83
conference proceeding units

8.52
book units

1.83
book chapter units

10.9%
modest but steady average growth per annum in research output maintained by the faculty over the past five years

28
research-active, full-time academic staff who contributed creative-work-as-research in 2015

Prof Leora Farber, Director of the FADA Research Institute Visual Identities in Art and Design, received a C2 rating from the NRF, bringing to six the number of NRF-rated researchers in the Faculty in 2015

Research Centres:
- Design Society Development (DSD)
- DESIS Lab
- Visual Identities in Art and Design (VIAD)

SARChI Research Chairs:
- Prof Brenda Schmahmann South African Art and Visual Culture

Introduced the Unit System in the Architecture Postgraduate Programme (GSA) in 2015

FACULTY OF ECONOMIC AND FINANCIAL SCIENCES (FEFS)

45.09
preliminary units (pending DHET submission) subsidised publications

31.86
journal article units

1.23
book chapter units

12
conference proceeding units

Research Centres:
- Centre for Competition Regulation and Economic Development (CCRED)
- Centre for Local Economic Development (CENLED)
- South African Accounting History Centre

SARChI Research Chair:
Prof Fiona Tregenna
Industrial Development

FACULTY OF EDUCATION

103.21

research units produced by the Faculty comprising articles in accredited journals, research-based books and conference proceedings

SARChI Research Chairs:

- Prof Elizabeth Henning
  Integrated Studies of Learning Language, Science and Mathematics in the Primary School
- Prof Jace Pillay
  Education and Care in Childhood

Prof Brenda Leibowitz
UJ Teaching and Learning Chair

Research Centres:

- Centre for Education Practice Research
- Centre for Education Rights and Transformation (CERT)
- South African Journal of Childhood Education
- Ali Mazrui Centre of Higher Education Studies

Institute:
Education Leadership Institute

FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT (FEBE)

4th

largest contact Engineering Faculty in South Africa and produces the largest number of FEBE graduates of all South African institutions

15

rated researchers

In 2015, the Institute of Intelligent Systems (IIS) was constituted, to be hosted by FEBE

Schools:

- School of Electrical Engineering
- School of Mechanical and Industrial Engineering
- School of Civil Engineering and the Built Environment
- School of Mining, Metallurgy and Chemical Engineering
- Postgraduate School of Engineering Management

Research Centres:

- Hypervision Research Group
- Centre for Telecommunications
- Mineral Processing and Technology Research Centre
- Composite Materials Research Group
- Photonics Research Group,
- Sustainable Energy Technology and Research Centre

Technology Stations:

- Metal Casting Technology Station (MCTS)
- Process, Energy and Environment Technology Station (PEETS)

FACULTY OF HEALTH SCIENCES

64.5
units related to journal articles were submitted by the Faculty and the remaining units a combination of books, chapters and conference proceedings

The Department of Nursing has identified "Caring" as a much-needed field of research

The Department of Human Anatomy and Physiology has identified Physiology as a niche area

R16m
Total External Funding

R1.7m
Laser Research Centre Funding

R1m
Water and Health Research Centre Funding (with a further R608 730 committed for 2016)

R12.85m
Sport and Movement Studies Funding

R180 000
Optometry Funding

R131 072
Thuthuka Funding
(50% NRF & 50% UJ)

Clinics:
- Biokinetic Clinic
- Chiropractic Clinic
- Homoeopathy Clinic
- Optometry Clinic
- Podiatry Clinic
- Somatology Clinic
- Radiography Clinic

Research Centres:
- Laser Research Centre
- Water and Health Research Centre

SARChI Research Chair:
- Prof Heidi Abrahamse
  Laser Applications in Health

FACULTY OF HUMANITIES

280.08
units submitted
97.08 (53%) more
than our 2014 total
of 183 units

SARChI Research Chairs
- Prof Peter Alexander
  Social Change
- Prof Chris Landsberg
  African Diplomacy and
  Foreign Policy
- Prof Leila Patel
  Welfare and Social Development

Institutes:
- Confucius Institute
- Johannesburg Institute
  for Advanced Study (JIAS)
  (launched in 2015)

Research Centres:
- Centre for Anthropological
  Research (CfAR);
- Centre for Sociological
  Research (CSR);
- Centre for Social Development
  in Africa (CSDA)

FACULTY OF LAW

48.50
subsidy-generating publication units in respect of 261 articles published by members of the Faculty

9
researchers with National Research Fund (NRF) ratings

Research Centres:
- Research Centre for Private International Law in Emerging Economies;
- Centre for Banking Law; the Centre for International Comparative Labour and Social Security Law (CICLASS);
- the South African Institute for Advanced Constitutional, Public, Human Rights and International Law (SAIFAC)

SARChI Research Chair:
- Prof Hennie Strydom
  International Law

FACULTY OF MANAGEMENT

According to QS World University Rankings, the Faculty is now ranked among the Top 300 in the world in the discipline of Business and Management studies

261
research output publications

6
Distinguished Visiting Professors appointed

13
National Research Foundation rated researchers in 2015

64%
growth in research output

Compared to 2014, subsidy generating research credits have improved by 34 credits (17%) to 200 credits; thereby contributing to 17% of 275 the UJ 2015 estimated research output. Of these outputs, 2% are from book chapters, 16% from conference proceedings and 81% from articles.

Research Centres:
- Centre for Small Business Development
- Centre for Social Entrepreneurship and Social Economy Management

FACULTY OF SCIENCE

271.95
research units subsidy claim submitted to the Department of Higher Education and Training (DHET) by the Faculty

231.52
journal units

34.77
conference proceedings units

4.98
book units

0.68
book chapter units

54
NRF-rated researchers

16
eminent scientists as Visiting Professors, Senior Research Associates or Research Associates

45
highest Scopus H-Index in Faculty

56
highest Google Scholar H-Index in Faculty

R118m
Total Funding

R72m
NRF Funding

R12m
URC Funding

R32m
Other External Funding

SARChI Research Chairs:
- Prof Fanus Viljoen
  Geometallurgy
- Prof Ben-Erik van Wyk
  Indigenous Plant Use
- Prof Vinod Gupta
  Nanotechnology for Water