



Central University of
Technology, Free State

RESEARCH AND INNOVATION REPORT 2017

SIGNIFICANT ACHIEVEMENTS IN 2017





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Responses to Research and Innovation 2017



Foreword by the Vice-Chancellor and Principal Professor Henk J. de Jager

The year 2017 was one that witnessed the commitment to, and strengthening of, the research and innovation agenda within our university. This commitment was consistent with our Vision 2020 statement, and aligned with the spirit of our theme for 2017, namely “The Year of the Human Project”. This theme entailed a renewed focus on our people – our staff, students, alumni and stakeholders. As a university, we acknowledge that the building of a high-performance research and innovation culture is at the heart of *people excellence*. It is with great pride that I look back on the university’s research and innovation achievements of 2017.

Our steady increase in financial investment, both by the university and through grants towards research from the National Research Foundation (NRF) and the Department of Higher Education and Training (DHET), has contributed to an increasing trend in master’s and doctoral enrolment, research outputs, and a steady growth in the academic development of staff members, 32% of whom hold doctoral degrees – which serves as justifiable evidence of our commitment to the research agenda.

The culmination of research and innovation collaboration has seen the establishment of a Research Chair in the Collaborative Programme in Additive Manufacturing, supported by the Department of Science and Technology (DST). This collaborative programme, complemented by the existing Research Chair in Medical Product Development through Additive Manufacturing, resulted in our university establishing itself as the leading South African university in the application of additive manufacturing for the production of customised medical implants and surgical guides.

Furthermore, we were privileged to host a number of national events, such as the NRF Excellence Awards, as well as international conferences, providing our university with the opportunity to profile itself both locally and internationally. Other initiatives and achievements by our researchers, and contributions through our research entities towards the research agenda, have not gone unnoticed, and will be highlighted in this Research Report.

As the Vice-Chancellor and Principal, I wish to express my sincere gratitude towards the CUT Council, members of Executive and Senior Management, the Section for Research Development and Postgraduate Studies, staff, students, and local and international partners, who all worked tirelessly during 2017 to achieve outstanding research contributions. The support to CUT and the contributions from the DST, NRF, Technology Innovation Agency (TIA), Science Councils, the DHET and many others during 2017 are acknowledged with profound sincerity.

I look forward to, and am positive that we will have great accomplishments in 2018!



Prof. Henk de Jager
Vice-Chancellor
and Principal



Message from the Deputy Vice-Chancellor: Research, Innovation and Engagement Professor Alfred B. Ngowi

I am pleased to present our Annual Research and Innovation Report 2017. This report describes our progress in operationalising strategies to develop a strong research and innovation culture and contributing positively to our research community and stakeholders.

The year 2017 can be seen as the year in which the university repositioned its research and innovation agenda – the year was used mostly to lay the foundation upon which new initiatives and support structures will be built to ensure a more sustainable research and innovation agenda. The foundation was laid for the university to focus more strongly on applied research leading to innovation and commercialisation against the backdrop of the fourth industrial revolution.

The report reflects the strong performance of the Central University of Technology, Free State, especially in capacity building of both postgraduate students and staff as researchers. Most significantly, about 30% of the capacity development funding was allocated towards the development of black female staff and postgraduate students. This allocation, together with initiatives such as the Joint CUT/UFS Research Collaboration programme, has contributed towards making an impact in growing our research capacity and towards an increased research impact on regional development.

The increasing trends in research outputs, funding, collaborations and most importantly innovation impacting on improving the livelihoods of ordinary community members, has established new opportunities for the future. After all, we do not consider our current achievements and strengths as the ideal; rather we are looking ahead towards improving the university's performance and contribution to the overall research and innovation agenda.

This annual report documents our evolution and our strategies over the 2017 academic year. I invite you to take a look and see what our university has achieved and how it has progressed over the year!



Prof. Alfred Ngowi
Deputy Vice-Chancellor:
Research, Innovation
and Engagement





Institutional Performance: Highlights and Achievements



Repositioning of the Research Development and Postgraduate Studies Leadership

Under the newly established Research, Innovation and Engagement Portfolio and the Research Development and Postgraduate Studies (RD and PGS) Section, the RD and PGS Office is constituted of the following staff members.

The Research Development and Postgraduate Office Staff



Professor Laetus Lategan
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Research and innovation is further strengthened at faculty level by the Assistant Deans:
Research, Innovation and Engagement



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Front row left to right: Ms Mary Mokhoa, Ms Kgalalelo Maputle, Mr David Kareli,
Mr Fred Matongo and Prof Albert Strydom.
Back row left to right: Prof Herman Vermaak, Prof Crispen Chipunza, Prof Michael Mhlolo, Ms Riana
Dessels, Prof Carlu van der Westhuizen, Prof Laetus Lategan, Ms Edith Sempe and Prof Alfred Ngowi.



Research Development Plan, 2014 – 2020

Research is guided at the Central University of Technology, Free State by the Research and Development Plan, 2014 – 2020. The plan was implemented during the first term of 2014, with the following focus areas, objectives and activities as reflected in the table below:

Focus	Objective	Activity
Scholarly development through research and innovation training	Scholarly engagement with the research process and research cycle	<ul style="list-style-type: none"> • Pre-doctoral training • Doctoral training • Post-doctoral training • Programme on postgraduate supervision • Programme on scientific writing • Programme on technology transfer and innovation • Annual faculty research seminars • Colloquiums and discussion groups
Research partnership development	Capacity growth of research projects	<ul style="list-style-type: none"> • Multi-, inter- and transdisciplinary research • Joint ventures with national and international universities, research bodies and research councils • Joint ventures with government/ business/industry
Development of research clusters and programmes	Strengthening of research capacity	<ul style="list-style-type: none"> • Student retention and throughput • Publications • Conference attendance • Patents • Rated researchers • Research funding

The aim of the plan is to contribute to:



The objectives of this plan are:

- To grow "seniority" of academic staff profile
- To grow the publication profile – 75% of DHET norm of 1.1 credit unit per full time academic staff
- To grow postgraduate enrolment – 5% of student body
- To grow the number of completed M and D projects
- To grow the external funding basis
- To grow the number of rated researchers
- To grow multi-, inter- and transdisciplinary research

The university's R & D Plan 2014 – 2020 emphasises the following ten strategic research programmes:

- Undergraduate to Graduate Programme
- Master's Programme
- Doctoral Programme
- Next Generation Researchers Programme
- Postdoctoral Fellowship Programme
- Early Career Researchers Programme
- Mid-Career Researchers Programme
- Established Researchers Programme
- Women in Research Programme
- Rated Researchers Programme

The following additional strategic programmes and projects have also been introduced in support of the R & D Plan:

- CUT and UFS Joint Research Programme (optimising capacity and sharing of resources)
- Research Entities (Centres, Units and Groups Projects)
- Sabbatical Leave Programme
- SARChI Programme (Nationally funded Research Chairs)



Review of the 2017 research development achievements

Research funding and support

The R & D Section had a total budget of R 44 315 351 available for research activities supported by different funding sources as reflected below.

Agency	Funding objective	Amount
CUT	Operational Research Funds	R 14 000 000
DHET R & D Grant	Support research capacity building	R 9 941 466
NRF	Support research projects and student training	R 20 273 885
PA & A Malan Trust	Studies in art and project on research education	R 100 000
Total		R 44 315 351

Annual research breakaway

The 5th Annual Research Development and Postgraduate Studies Breakaway was held on 14 September 2017 under the theme of "CUT quest for research impact".

The following important issues were highlighted in the discussions:

- Since a large portion of the staff are also students, a programme should be available for these staff members to complete their studies.
- Faculties should secure competitive funding to support research and postgraduate studies. The university cannot provide in all the needs.
- Attention should be given to three budgets: research development, postgraduate studies and equipment (based on top slicing from the university budget in a three-year cycle).
- Joint degrees should be developed with international universities.
- Offerings of inbound and outbound capacity building opportunities should be taken up.
- Consideration should be given to whether all programmes should be offered up to doctorate level or whether such offerings should be limited to two or three programmes.
- The faculties should bring more diversity to research policies and practices.
- Capacity-building of staff should extend beyond graduation.
- Attention should be given to the need for permanent postgraduate facilities in the library.
- Doctoral candidates should become part of Faculties and given a limited lecturing responsibility and extensive research activities.
- Match funding should be developed.



Capacity development activities supported by the DHET Research and Development Grant

Since 2013, the DHET has approved and provided R & D Grants for the financial years 2013/2014, 2014/2015, 2015/2016 and 2016/2017. As the grant ended in the 2017 DHET financial year, April to December 2017 was used as a phasing out period for the R & D Grant.

The following projects were identified for the R & D Grant:

Project	Programme	Focus
Project 1:	Mentorship/Supervisor training	The focus of this programme is to train and mentor the new generation of researchers and post graduate students in doing research.
Project 2:	Research capacity development	The focus of this programme is to build the capacity of researchers.
Project 3:	Postgraduate study support	This programme is in line with the main objective of the DHET grant allocation, namely for staff to improve their qualifications.
Project 4:	Post-doctoral research fellowship	The programme is intended to support post-doctoral fellows with their research projects.
Project 5:	Academic exchange	The University took the initiative to promote active participation with Cluster A and B universities that will deliver on joint postgraduate supervision and joint publications. The programme will enhance existing expertise and will support identified networks and collaboration with other universities.
Project 6:	Topping up of NRF funds	NRF projects will be supplemented.
Project 7:	Management/Administration of the Research Development Grant	A project facilitator was appointed to assist with the capacity building of grant holders.

The following capacity development activities were achieved:

- **Mentorship/Supervisor Training Programme:** The focus of this programme is to train the new generation of researchers and students in doing research. A series of workshops were held as either university-wide or discipline-specific, focusing on the following research development themes: research process, doctoral education, statistical methods, analytical tools training, grant proposal writing, thesis proposal and article writing. Cumulatively 1045 staff and postgraduate students from both the Bloemfontein and Welkom campuses participated in the research development workshops.
- **Research Capacity Development Programme:** The focus of this programme is to build research capacity in the Faculties. This was achieved through support in developing **Research Centres, Units and Groups** that delivered on critical mass, postgraduate students and publications. During

this period, six (6) of the total of seventeen (17) research entities were supported to improve their research capacities and to undertake research projects in line with the university's vision statement. Through the **Emerging, Mid-Career** and **Established Researcher Programmes**, sixty-three (63) researchers were supported through different initiatives to development their research competencies.

- **Postgraduate Study Support Programme:** This programme is in line with the main objective of the DHET grant allocation, namely for staff to improve their qualifications. According to the DHET 2015 Research Outputs Report, the university has 32% staff with doctorates and 43% with a master's degree as their highest qualification. The funding was used to support a total of eighty-three (83) staff members constituting of 29 master's (19 females and 10 males) and 54 doctorate's (22 females and 32 males).
- **Academic Exchange Programme:** The programme enhanced existing expertise and supported identified networks and collaborations with universities, both locally and internationally. The university allocated funding to eight (8) projects to promote active participation with Cluster A and B universities that will deliver on joint postgraduate supervision and joint publications. Six (6) other research related initiatives were undertaken with international universities, including universities on the African continent.
- **Topping up of NRF Funds:** NRF projects were supplemented through this programme. The funding of ten (10) rated researchers and twelve (12) Thuthuka grant holders was supplemented.
- **Management/Administration of the Research Development Grant:** A project facilitator was appointed to assist with the capacity building of grant holders.

Support to postgraduate students

For 2017 the following grants were awarded to M and D degree students and post-doctoral fellows:

Year	M students	D students	Postdocs
2017	R 6 547 880	R 3 337 380	R 940 000
Total			R 10 825 260

This can be compared to the period 2014 – 2016 during which R 6 565 744 was awarded to M and D degree students and post-doctoral fellows:

Year	M students	D students	Postdocs
2014	R 957 880	R 628 494	R 880 000
2015	R 1 972 340	R 1 147 030	R 1 000 000
2016	R 5 229 930	R 3 205 660	R 600 000
Total	R 2 930 220	R 1 775 524	R 1 880 000
<i>Grand Total</i>	R 11 090 370	R 6 756 708	R 6 585 744

NRF Funding 2017

For the period January – December 2017 the university continued to benefit from the following allocations made from NRF awards:

- 46 staff members were funded in 13 different NRF calls/grants, with a total funding of R 10 175 885.39.
- 13 master's and 13 doctoral students were funded with a total of R 2 650 000.
- 144 B.Tech students were funded with a total of R 7 303 000.

The awards are reflected below:

Programme	Number of awards	Award amount
Staff awards: 49 (35 male and 14 female) (50.19% of total NRF funding)		
European Research Council partnership (1 M)	1	R 1 500 000,00
Incentive funding for rated researchers (9 M 1 F)	10	R 640 000,00
Indigenous knowledge systems (1 F)	1	R 797 297,63
Competitive support unrated researchers (1 M)	1	R 300 650,00
Knowledge interchange and collaboration (11 M 5 F)	16	R 403 000,00
National Equipment Fund (1 M)	2	R 263 667,47
TWAS Post-doctoral Fellowship Programme (1 M)	1	R 318 893,00
SA Research Chairs (1 M)	1	R 1 768 959,46
Sabbatical Grant (1 M)	1	R 196 880,00
Research Advancement Career Award (1 F)	1	R 450 000,00
Thuthuka (7 M 5 F)	12	R 3 256 537,83
nGap (1 M 1 F)	2	R 60 000,00
Early Career Researchers from United Kingdom (1 M)	1	R 220 000,00
Subtotal		R 10 175 885,39
Student awards - 202 (55% of total funding)		
SKA	1	R 95 000,00
S&F - Innovation master's scholarships	7	R 630 000,00
S&F - Scarce Skills master's scholarships	4	R 360 000,00
S&F - Scholarships block grant master's	2	R 100 000,00
S&F - Innovation doctoral scholarships	7	R 840 000,00
S&F - Scarce Skills doctoral scholarships	6	R 720 000,00
NRF- Free standing master's scholarship	1	R 50 000,00
BTech block grants	144	R 7 303 000,00
Subtotal	172	R 10 098 000,00
NRF awarded - Grand Total		R 20 273 885,40

DHET Publication submission

In 2017 the Central University of Technology (CUT) submitted a claim for the 2016 research publications of books, conference proceedings and journals, amounting to **143.61** units. The submission was assessed by the DHET based on the newly implemented Research Outputs Policy (2015) which replaced the Policy for Measurement of Research Outputs of Public Higher Education Institutions (2003).

Based on the DHET assessment report of December 2017, CUT was allocated a total of **117.09** research output units. This is an increase of **10.61** units from the **106.48** units awarded for 2015, representing a **9.96%** growth from 2015 to 2016. The institutional publication trend for all publications (books, journals and conference proceedings) over a period of 2012-2016 is shown in figure below.

From the figure below the following is evident:

- **Journal publications:** In 2016 there was a decline of **10.35%** (7.71 units) relative to the **86% growth** experienced from **2011 to 2015**. The decline was mainly as a result of publication in journals identified by the DHET as predatory, and a significant reduction in contribution of publications under CESM categories (1, 9, 10, 13 & 14) within the Health Sciences.
- **Conference proceedings** continue to be regarded as a sustained research output for the university with a **30.9% growth** from 2015 – 2016. The greatest growth was in the Faculty of Engineering and Information Technologies which grew by **32%** from 2015 to 2016, and by **40.6%** from 2014 to 2015. It is evident that the Faculty of Engineering and Information Technologies continues to benefit from this research outlet.
- **Books:** Units increased by 790% due to increased credit allocations on units per page for books introduced by the new policy.

CUT total research output units by type of publication, 2011 – 2016

The table below reflects the publication outputs trend since 2004:

Publication outputs 2004-2016												
Year	2004	2005	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Articles	26.99	25.23	28.3	22.38	33.04	31.71	40.11	54.33	55.02	72.83	74.52	66.81
Proceedings	2	1.6	0	0.5	1.67	7.85	6.75	4.6	13.02	13.65	30.85	40.39
Books	0	0	0	0	0.55	0	0.45	0	0.44	0.69	1.11	9.89

From these outputs the following observations can be made:

- There has been a continuous growth in article publication outputs since 2004.
- A major growth in published conference proceedings has been experienced since 2013.
- The research outputs are not focusing on scholarly books for peers but presumably more for the textbook market.



Postgraduate studies

The following 2017 enrolment figures compared to those of 2016 can be reported:

Qualification type - level description	2016	% column	2017	% column
Doctoral	163	1,04	166	0,91
Master's	294	1,87	368	2,02
Other	30	0,19	124	0,68
PG to master's	587	3,74	597	3,29
Undergraduate	14 634	93,16	16 918	93,09
Grand Total	15 708	100,00	18 173	100,00
Total percentage of enrolments (doctoral, master's and postgraduate to master's)	1 044	6,65	1 131	6,22

Various activities took place in support of the development of a Graduate School:

- First draft on the development of a Graduate School completed and presented to URIC
- First Doctoral Summer School (15 and 16 November) presented.
- An integrated manual on postgraduate information was published (compiled by L.O.K. Lategan)
- Book on how to do doctoral research was published (Get ready, get set, go! Preparing for your doctoral studies and doctoral education – by L.O.K. Lategan - editor)
- A compendium on research education was published (Research education at the Central University of Technology – E.M. Bitzer).

In 2017, the following numbers of students graduated with postgraduate qualifications relative to 2016:

D graduates 2016	D graduates 2017	M graduates 2016	M graduates 2017
19	16	53	47
Target: 19	Target: 16	Target: 62	Target: 45

For the period 2001 – 2017 the trend in M and D graduates is reflected below:

Completed postgraduate studies 2001 – 2017																		
Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
M degrees	11	16	19	19	13	17	31	22	25	27	17	35	29	37	29	53	47	447
D degrees	1	2	6	5	5	8	4	11	5	6	3	6	3	13	13	19	16	126
M course work	-	-	-	-	3	2	-	-	-	-	-	-	-	-	-	-	-	5

Note 4: Course work programme discontinued.

Staff and student training

The RD and PGS Section presented 18 workshops in 2017. A cumulative total of 785 staff and students attended.

The training and workshops conducted are summarised below.

Staff and postgraduate student training			
Date	Venue	Theme	Attendance
27 January	Bloemfontein	Policy on Measurement of Research Outputs	60
24 February	Bloemfontein	How to be successful in your postgraduate studies	121
20-21 April	Bloemfontein	Supervision training	12
25 April	Bloemfontein	Stepping stones in doctoral education	66
3-4 May	Welkom	Doctoral supervisors	22
9 May	Welkom	Growing your research - research workshop	28
17 May	Bloemfontein	Discussion on doctoral education	15
6-7 June	Bloemfontein – series	Workshop for doctoral supervisors	36
23 June	Bloemfontein	NRF training for postgraduates - How to apply for funding	31
24 June	Bloemfontein	NRF training for postgraduates	07
27 June	Bloemfontein	Proposal writing - NRF training for postgraduate students	34
1-2 August	Bloemfontein – series	Workshop for doctoral candidates	38
5-6 Sept	Bloemfontein – series	Workshop for master's candidates	48
14 Sept	Bloemfontein	CUT quest for research impact – research breakaway	56
19 Sept	Welkom	Growing your research profile	22
18-19 Oct	Welkom – series	Doctoral education	30
15-16 Nov	Bloemfontein	Taking the next step – First doctoral education summer school	105
Sept – Nov	Bloemfontein	Analytical and statistical training	159



Joint CUT and UFS research programme

In 2015 the Central University of Technology, Free State (CUT) and the University of the Free State (UFS) jointly undertook a research call with equal funding by both institutions. This collaboration was a first between the two universities and aimed at strengthening research within the institutions in the Free State province. The research collaboration focused on the following objectives: 1) building research critical mass; 2) improvement of research outputs – publications and postgraduate supervision; and 3) producing of joint funding proposals

A third round of calls consisting of two tracks was posted in April 2017 and a total of twelve (12) applications were received. Generally, the selection committee was impressed by the number of applications, the quality and maturity of the applications, and the increase in the collaboration between the two universities. The following research project awards were made:

- Project on novel synthesis and chemical characterisation of gold, silver and platinum nanoparticles and characterisation of their anti-fungal activity
- Project on deciphering the genomic response of *Mycobacterium smegmatis* to human steroid sex hormones
- Project on developing a framework for empowering postgraduate students to grasp the importance of different variables within a dissertation
- Project on development of a sustainable transportation framework for Maluti-a-Phofung Local Municipality, South Africa
- Project on assessment of climate change vulnerability and adaptation using ICTs and indigenous environmental knowledge: Case of two informal settlements in the Free State
- Project on immunologic memory to hepatitis B vaccine following childhood vaccination
- Project on STEAM education: the technological entrepreneur as artistic marketer
- Project on re-engineering of civic infrastructure towards sustainable human settlements in the Free State: A case study of Kopanong Municipal area

The third round was preceded by a call for and funding of research projects for the period July 2016 – June 2017.

The following awards were made:

- Project on bio prospecting for plant products for application in animal, human and plant health
- Project on housing markets and socio-economic development in Mangaung
- Medical education research training and capacity building
- A book on Healthcare Ethics

The first round was posted for the period 2015 – 2016. The following projects were awarded:

- Project on bioprospecting for plant products for application in animal, human and plant health: Chemistry / Health Sciences
- Project on detection and characterisation of emerging microbial pathogens and contaminants from drinking and recreational surface water in the Mangaung area: Environmental Microbiology / Water Quality within Natural Sciences
- Project on re-engineering of civic infrastructure towards sustainable human settlements in the Free State, South Africa: A case study of Kopanong Municipal area: Civil Engineering / Urban Planning
- Project on using soil maps to infer engineering properties for optimising urban planning: Civil Engineering / Urban Planning

Research Ethics and Integrity Committee

A Research Ethics and Integrity Policy Framework together with a Constitution for the Research Ethics and Integrity Committee, as a sub-committee of the URIC, were approved by Senate in November 2016. The Policy Framework was implemented in 2017.

The following activities can also be reported:

- REI community established
- Documentation developed to guide process





University publications

The university publishes two journals: the Journal for New Generation Sciences, a DHET accredited journal, and the Interim, an in-house journal to promote writing skills.

INTERIM

The INTERIM is the university's developmental journal to assist (a) our novice researchers and postgraduate students to publish their research papers and by doing so, growing their publication writing skills, and (b) for mid-career and established researchers to publish preliminary research results. In 2017 we decided to recruit the services of an external expert in publication writing to comment on papers, to provide some suggestions for publishing papers in the INTERIM and generally to advise on publication writing. A total of 13 papers were received. Six will be published in the Interim 2017 16 (1) and the rest will be reworked / updated to meet the publication standard and criteria.

First edition	Number of editions up to 2017	Number of papers published	Number of participating authors
2002	27	281	418

Journal for New Generation Sciences (JNGS)

The Journal for New Generation Sciences (JNGS) publishes original research-based papers in the technological sciences. Technological science refers to the development of knowledge through application and goes beyond disciplinary borders and subject specific issues. The JNGS aims to develop use-oriented research. Use-oriented research is a combination of applied research and use-inspired basic research. The objective is for business, industry and government, as well as social communities (known as the "quadruple helix") to benefit from the application of the research results. Used-oriented research should be executed in the context of Gibbons's Mode 2 Knowledge Production. This mode of knowledge production implies that knowledge is produced in the context of application, is transdisciplinary in nature and is reflective of and responsive to societal needs.

First edition	Editions published since 2003 to date	Authors	Participation of public universities (SA)
2004	34	454	20/26
		Papers	
		352	

The JNGS focuses on papers which reflect the scientific results of:

- science, technology, engineering, mathematics and arts (STEAM) and the management of STEAM research (Arts covers humanities and social sciences.)
- applied research informed by problems and challenges as faced by industry, business, government and social communities
- partnerships with industry, business, government and social communities ("quadruple helix").
- knowledge creation in the context of Mode 2 Knowledge Production
- scholarship in teaching and research
- research projects leading to SET+A and management qualifications
- income generation through research
- entrepreneurship through innovation



Summative progress

The following summative progress can be reported.

Table: Progress with CUT R & D programmes and projects

Programme/Project	Target	R & D support	Output
Undergraduate to graduate programme	Grow total postgraduate student enrolment by 5% of overall student enrolment (5% x 16 000 = 800)	Funding support Training support Publication support	<ul style="list-style-type: none"> • 145 B.Tech students were funded R 7303 0000 through NRF Block Grant • 1 x B.Tech student was funded R 95000 by SKA • 3 x workshops • 600 postgraduate to master's (3.75%)
Master's programme	Grow total postgraduate student enrolment by 5% of overall student enrolment (5% x 16 000 = 800)	Funding support Training support Publication support	<ul style="list-style-type: none"> • R 6067 330 awarded • 8 x workshops • 307 master's students (1.84%) • 47 master's students graduated

Programme/Project	Target	R & D support	Output
Doctoral programme	Grow total postgraduate student enrolment by 5% of overall student enrolment (5% x 16 000 = 800)	Funding support Training support Publication support	<ul style="list-style-type: none"> • R 5467 930 awarded • 13 x workshops • 49 student enrolments • 1.04% of total enrolment • 16 doctoral students graduated
Next Generation Researchers programme	50% of staff with doctorates by 2020	Funding support Training support Publication support	<ul style="list-style-type: none"> • R 2774 630 funding support available • 83 staff members benefitted from DHET R & D Grant to promote qualifications • 105 staff members with doctorates • 100 staff members active in postgraduate supervision
Post-doctoral fellowship programme	5	Funding support Training support Publication support	<ul style="list-style-type: none"> • Track 1 (4) and Track 2 (4). Living stipends awarded = R 940000 and project expenses of R 370 000
Women in research programme	Grow number of female researchers	Funding support Training support Publication support	<ul style="list-style-type: none"> • DHET grant recipients to improve qualifications = 41 • CUT awards to postgraduate students = 95 • NRF grant holders = 14 • CUT and UFS grants = 1 • Research publications 2016 = 16
Rated researchers programme	10	9 rated researchers	<ul style="list-style-type: none"> • R 400 000 allocated to sustainability of rated researchers; • three applications submitted; two approved
CUT and UFS joint research programme	5	Funding support	<ul style="list-style-type: none"> • 8 applications funded • = R 245 000
Centres, Units and Groups Project	2 Centres 7 Units	Funding support Training support Publication support	<ul style="list-style-type: none"> • R 321 600 allocated to six entities for research • Repositioning of entities • 2 Centres, 12 Units and 2 Groups
Sabbatical programme	Grow annual staff qualifications by 10%	Funding support Training support Publication support	1 x award
SARChI Chair	2 SARChI Chair	Funding support	NRF approved SARChI chair in medical product development





03

Building research structure and capacity

Research Centres, Units and Groups



The Senate approved a University Policy on Centres, Units and Groups on 25 August 2014. The policy was implemented in 2015 and it is informed by the University Research and Development Plan, 2014 – 2020.

The objectives of this policy are directed at building a critical mass in research and optimising opportunities to grow research outputs. The policy identified the approved Research Clusters and Programmes as a meaningful vehicle to meet the outputs of the Plan by 2020. Strategy 2 of the R & D Plan suggests meaningful structural support to achieve the desired outputs. One such mechanism is research performed by a critical mass organised in Centres/Units/Groups.

A total of 2 Centres, 12 Units and 2 Groups were approved in 2016 and are clustered in line with the three themes below:

CUT Research Clusters, Programmes and aligned Research Entities.	
Research cluster 1	Research programmes per research entity – Centre/Unit/Group
Technologies and Innovations for Sustainable Development Objective: To investigate and apply technologies and/or innovation to foster and promote sustainable development	Centre for Rapid Prototyping and Manufacturing (CRPM) Unit for Evolvable and Manumation Systems (RGEMS) Unit for Lean Construction and Sustainability Group for Sustainable Urban, Roads and Transport (SURT) Group for Soil Mechanics Unit for Sustainable Water and Environment Unit for Research on Informatics for Droughts in Africa (URIDA) Research Group in Engineering Education (ARGE)
Research Cluster 2	Research programmes per research entity – Centre/Unit/Group
Quality of Health and Living Objective: To apply scientific research in different disciplines to improve on the quality of health and living standard of humans, animals and plants.	Centre for Applied Food and Biotechnology (CAFSB) Unit for Drug and Discovery Research
Research Cluster 3	Research programmes per research entity – Centre/Unit/Group
Socio-Economic and Entrepreneurship Development Objective: To do scientific research that empowers society for invaluable contribution to sustainable socio-economic development.	Unit for Public Management and Administration Unit for Enterprise Studies Unit for Tourism Destination and Management Unit for Research in Scholarship of Teaching and Learning (RSoTL) Unit for Scholarship in Research Education Unit for Foundations of Education Unit for Mathematics, Science and Technology Education Research

The Collaborative Programme in Additive Manufacturing Chair

The Central University of Technology, Free State (CUT), through its Centre for Rapid Prototyping and Manufacturing (CRPM), has established itself as the leading South African university in the application of additive manufacturing (AM) for the production of customised medical implants and surgical guides. This has, to a large extent, been made possible through the funding support of the Department of Science and Technology (DST) since 2015 for the national Collaborative Programme in Additive Manufacturing (CPAM). From 2015 to 2017, the DST supported CUT to the tune of R5.5 million for the CPAM and has approved a further R11.7 million for this purpose for the period 2018 to 2020.

Additive manufacturing is globally accepted as one of the key technologies in the so-called 4th Industrial Revolution. The CPAM is the primary implementation programme of the national South African Additive Manufacturing Strategy (published at www.rapdasa.org). It has four sub-programmes and CUT-CRPM contributes to all of these. A key part of the overall aim of the CPAM is to achieve full acceptance of AM by the South African manufacturing industry as technology that can improve productivity and competitiveness. In order to achieve this, the reliability, reproducibility and sustainability of AM have to be proven. Sufficient research data has to be produced and published to prove that parts produced through AM can fully comply with the accepted international standards for material, physical, chemical and mechanical properties of such parts. The two sub-programmes of the CPAM on Qualification of Additive Manufacturing of Ti6Al4V for Medical Implants and Aerospace Components, and Polymer Additive Manufacturing, are designed to reach these goals.

Another objective of the CPAM is to demonstrate the benefits that can be derived from the characteristics of AM. This implies research aimed at establishing approaches and procedures that will substantiate the key benefits of AM, namely design freedom, more productive and faster product development, improved efficiency over conventional manufacturing, AM as green technology and empowerment of individuals (the "maker" community). The Design for Additive Manufacturing sub-programme of the CPAM deals with the benefits related to design freedom.

The fourth sub-programme of the CPAM, Industry Development, focuses on creating awareness in industry, and with the general public, of the power of AM. It provides the platform for close collaboration with the South African industry in transferring the AM technology to industry, thereby contributing to its competitiveness in the 4th Industrial Revolution. The Rapid Product Development Association of South Africa (RAPDASA) is a strong collaborator in this regard.



Professor
Willie du Preez



Research Chair in medical product development through additive manufacturing (AM) and NRF-rated researcher



Professor Ihar Yadroitsau (Igor Yadroitsev) was appointed Research Professor at the Central University of Technology, Free State (CUT) on 1 January 2014. In August 2015, CUT was awarded a Research Chair in Medical Product Development grant with Prof. Yadroitsau as the grant holder. His background includes PhD and MSc degrees in laser physics and optics along with 30 years of academic experience in applied optics and laser technologies (selective laser melting/sintering, laser cladding, interferometry and optical monitoring systems, material science). Prof. Yadroitsau has a strong interdisciplinary background and broad experience in the fields of Physics and Engineering which allows him to comprehend thoroughly scientific and technical problems with the purpose of finding original solutions in different fields of laser applications. It should be specially mentioned that Prof. Yadroitsau has produced more than 140 scientific publications. His H-index of citation is 20 in Scopus and 25 in Google scholar. Prof. Yadroitsau is an NRF-rated researcher (C1).

Under the Research Chair initiative, a metallographic laboratory for the study of material properties was created in 2015. In addition to already purchased equipment from 2014 – 2016, the following equipment was added: Smartzoom 5 Digital Microscope (Carl Zeiss) and LectorPol-5 (Struers ApS). Licenses for Mimics and Structures Module software was purchased. Mimics is software specially developed by Materialise for medical image processing. The Materialise Magics Structures Module enables the transfer of a solid 3D model into a lightweight version. A lattice structure can be applied to reduce the weight of the design or to reinforce it.

Prof. Yadroitsau has supervised one doctoral and ten master's students in Engineering. Their studies were devoted to Selective Laser Melting (SLM), residual stresses, heat treatment and mechanical properties of additive manufacturing objects, non-destructive testing. In 2017, Ms Gloria Moletsane Morakane finished her thesis "Microstructure and mechanical properties of Ti6Al4V (ELI) parts produced by DMLS" and graduated with an MEng degree at the March 2017 ceremony of CUT. Students actively participated in international and national conferences during 2017.

A new patent 2017/05071 "Method of depositing multiple materials in a selective laser melting process, and apparatus for use in such method" was completed in 2017. This patent describes the multi-material layered device for manufacturing objects consisting of more than one material in a one-step SLM process. Multi-material objects have great potential in the fast-growing AM market, which requires complex objects with prescribed properties. For medical usage, special advanced implants combining different material properties allow the implants to be more bio-compatible and their lifespan to be increased. The rising costs of healthcare may be attributed to an increasing number of medical procedures of great complexity and needing costly instrumentation. Advanced innovative materials and devices must be developed to reduce the time, economic cost, and physical pain associated with implants, hence the urgent need for this life-saving research work.

In 2017 Prof. Yadroitsau, in cooperation with other researchers from RSA, Brazil, Sweden, France, USA, Australia and Russia, published seven articles indexed in Scopus, as well as ten conference proceedings. Prof. Yadroitsau participated in a number of scientific seminars at the CSIR, Stellenbosch University, University of Cape Town, Vaal University of Technology, and Nelson Mandela Metropolitan University, National Institute of Standards and Technology (USA).

The optimal process parameters for the Laser Powder Bed Fusion of Pt powder by EOSINT M280 machine were identified in 2017. The empirical data were compared to the melt pool width and depth predicted by numerical simulations. Finally, in October 2017, South Africa's first 3D printing prototype using pure platinum was manufactured.



Rated researchers



Professor David P. Ngidi is a C NRF-rated researcher, currently occupying the position of Deputy Vice-Chancellor: Teaching and Learning at the Central University of Technology, Free State. His specialisation is in the field of Psychology of Education and key research focus areas are in teacher education, curriculum, attitudes, and personality dimensions. Over his research career, Prof. Ngidi has contributed more than twenty publications, supervised seven master's and doctoral postgraduate students and presented more than thirty papers at national and international conferences and seminars.

Additional responsibilities related to his research work and career are, amongst others:

- National editorial board member: South African Journal of Education (SAJE) (2006-2010)
- Consulting Editor: Journal of Educational Review (JER), Nigeria (2008 – date)
- National editorial board member: International Journal of Educational Development in Africa (IJEDA) (2013 – date)
- Editorial Committee member: Southern African Journal of Research and Innovation (2014 – date).
- International editorial board member: African Journal of Pedagogy and Curriculum (2014 – date).
- General Secretary and Treasurer: Southern African Society for Education (SASE) (2006 – date).



Professor Alfred Beati Ngowi is a C NRF-rated researcher currently occupying the position of Acting Deputy Vice-Chancellor: Research, Innovation and Engagement at the Central University of Technology, Free State. He is a registered professional construction project manager (Pr. CPM), member of the Botswana Institute of Engineers (BIE); a Member of the Institution of Engineers, Tanzania (MIET); a Member of the Chartered Institute of Building (MCIOB); and member of the International Association of Housing Sciences (IAHS). His research interests are multi-disciplinary and they include engineering, the built environment, human capital, strategic management and performance management with an extensive record in human capacity development, having produced technicians and degree graduates as well as supervising 21 master's and doctoral students. Some of these students have proceeded with doctoral studies at

leading universities such as MIT and Princeton in the USA and Cambridge in the UK. He has published over 100 papers in journals, proceedings and book chapters.

He is also a co-chief editor of the Journal of Construction in Developing Countries (JCDC); an associate editor of the Journal of Built Environment and Asset Management (BEPAM); and a reviews editor of the Botswana Journal of Technology (BJT). Currently Prof. Ngowi's research effort is geared towards embedding sustainability in all construction activities, starting from planning and procurement, to execution on project sites. Specifically, work has been carried out regarding how construction firms could benefit from the sustainable development goals (SDGs) in general, and how firms could create competitive advantage by embracing sustainable construction in particular. Future work will ensure that the approach used in developing construction firms takes cognisance of creating an environment that shows the firms embracing the attributes of sustainability, particularly sustainable construction leading to a competitive advantage.

Professor Laetus O.K. Lategan is a C NRF rated researcher and currently the Director: Research Development and Postgraduate Studies at Central University of Technology, Free State. His research outputs have been commended with a C Rating from the National Research Foundation (NRF) and the awarding of an extraordinary professorship in research and professional ethics at the University of the Free State (2007-2010). His research contribution goes beyond own research activities. He is the founding editor of the Journal for New Generation Sciences, a Department of Higher Education and Training accredited research journal. His current research interests centre around three themes: Medical humanities, Research ethics and integrity and How to educate a new generation of researchers.



As a researcher he has an extensive research publication list comprising almost 200 publications as author or co-author (ranging from accredited articles, chapters in books, published conference papers, monographs, books, chapters in books and public intellectual comments) in various fields of study (philosophy, ethics, higher education, research education and research management). His professional qualifications are at doctoral level in philosophy and theology.



Professor Ryk Lues is a C-rated researcher and is currently Full Professor in Food Safety in the Faculty of Health and Environmental Sciences at the Central University of Technology (CUT), Free State, South Africa. He is the Director of the Centre for Applied Food Safety and Biotechnology (CAFSaB) and coordinator of the Regional Innovation Forum for the Free State Province, an entity mandated to facilitate discourse amongst various academic, business and regulatory stakeholders in the regional innovation value chain.

He holds an MSc (Microbiology) and a PhD (Food Science) from the University of the Free State and his field of specialisation comprises social-behavioural aspects impacting on food microbiology and hygiene. He also has an interest in organic acid preservatives and microbial acid tolerance. His research into food safety behaviour has seen him being invited to a number of industries both within and outside the food sector to speak on issues related to risk, organisational culture and motivation. He is an NRF-rated scientist and has to date authored 67 articles in ISI accredited journals, 3 book chapters and 1 book on topics related to research methodology, food preservation, food safety culture and food hygiene systems management



Professor Isaac Ntshoe is a C-rated researcher currently occupying the position of Research Professor in Academic Development and Support and the leader of the **Unit of Research in Scholarship of Teaching and Learning**. His research extends and complements the research area on curriculum design, higher education policy and planning, the sociology of knowledge and the economics of education. Prof. Ntshoe has numerous publications and has supervised several master's and doctoral postgraduate students. His research focuses on investigation into curricula design and pedagogical practices in the professional and sectoral fields of practice offered by traditional universities and universities of technology, and technical and vocational education and training (TVET) institutions.



Professor Arthur James Swart is a Y-rated researcher currently occupying the position of Associate Professor in the Department of Electrical, Electronic and Computer Engineering. His key performance areas include teaching Electronic Communication and research into engineering education. His research focus area on metrology is one of his fields of specialisation where he measures different photovoltaic module parameters in order to verify the application of the module within specific environments.

These parameters include tilt and orientation angles, photovoltaic module voltages, currents and temperatures. The objective of this research is to

try and optimise the output power of a given photovoltaic module for different electrical and environmental conditions. Most of his recent research in this field has been done with Dr Pierre Hertzog, a colleague in the department. Engineering education is his other field of specialisation, where he focuses mainly on the use of educational technology to help fuse theory and practice for engineering students in higher education. Throughput rates remain low in higher education, which mandates academics to search for innovative methods to help students demonstrate the graduate attributes that are required by industry today. He considers himself privileged to be part of a research group in Engineering Education (ARGE) within the faculty; this group has published 5 accredited journal articles and presented 15 international conference papers over the past two years.

Professor Rambe Patient is a C-rated researcher and holds a PhD in Educational Technology from the University of Cape Town, South Africa. He holds the position of Senior Researcher in the Faculty of Management Sciences at the Central University of Technology, Free State in South Africa. Dr Rambe is also a Convener of the Master's and Doctoral Programme Stream at the same university. He has previously served as a post-doctoral research fellow and Assistant Director in the Office of International Academic Projects at the University of the Free State, South Africa. His research is widely acknowledged and is rated by the National Research Foundation of South Africa. His areas of research interest include emerging technologies and SMMEs, social media and HE, and MOOCs in HE.



Professor Elmarie van den Heever-Kriek is a C-rated professor of Clinical Technology and an NRF-rated researcher since 2012. Her primary research fields include medical science and systems, disease control and health sciences. Clinical technology is divided in seven specialisation fields namely: Cardiology, Pulmonology, Perfusion, Nephrology, Reproductive, Neurophysiology and Critical care. Due to the nature of the programme, her research involvement is extremely diverse, covering all seven specialisation fields as displayed in her publication list. However, her core research areas and interests are HIV and cancer (especially throat and breast cancer). Prof. Van den Heever-Kriek has published over 35 scientific papers in peer-reviewed journals, presented over 50 papers at international and national conferences and continues to review manuscripts for accredited scientific journals. She has successfully supervised more than 25 masters' and 7 doctoral students and has also mentored two post-doctoral research fellows. During her academic



career she has received various academic awards. In 1998, she received the Junior Ernst Oppenheimer Memorial Trust medal for her PhD project proposal and in 2000 the Struwig Germeshuysen Trust award for cancer research. In 2001, the South African Association for Woman Graduates awarded her for her contribution towards cancer research. In 2001 she was nominated by the Japanese Government to attend a 4-month course in advanced microbial enzyme technology, in Japan. The Central University of Technology, Free State also awarded her with the Vice-Chancellor's medal for best researcher in 2005 and 2010.



Professor Herman Vermaak is a C-rated professor and currently the Assistant Dean: Research, Innovation and Engagement in the Faculty of Engineering and Information Technology: Department of Electrical, Electronics and Computer Engineering. He was head of the department for eleven years and acting dean of the Faculty for fourteen months. He has presented numerous papers at international conferences, published widely in international journals, and supervised twenty-eight completed postgraduate studies. He has also produced two technical reports for the Council for Scientific and Industrial Research (CSIR) on Reconfigurable Assembly Systems. Prof. Vermaak was inaugurated as a full Professor on 7 September 2016. His address was a summation of his prowess as a scholar of note in the field of engineering. In his address, he presented Design-for-Testability: the solution to improved test engineering and product quality as a tribute of his work of many years as Artisan, Technologist and Engineer.

Post-doctoral fellows



Dr Arc Evelyn Lami Ashelo Allu is currently a post-doctoral research fellow at the Department of Built Environment, Central University of Technology, Free State (CUT), South Africa. She has published 16 journal research papers and 8 conferences papers on national and international platforms. Currently she has 1 book chapter and 4 conference papers in the press.

Dr Allu (Fnia) obtained her PhD in Sustainable Architecture and Climate Change from De Montfort University (DMU), Leicester UK in December, 2014. Dr Allu is a senior lecturer at the University of Jos-Nigeria, where she has been an academic staff member of the Department of Architecture. Dr Allu's research interests include: climate change and buildings, traditional architecture, sustainable design and construction and sustainability of the built environment. Dr Allu is also an architect and member of the following:

the Nigerian Institute of Architects (NIA), the Architects Registration Council of Nigeria, the Association of Researchers in Construction Management UK, the Network for Comfort and Energy Use in Buildings (NCEUB) UK, the Co-operative Network for Building Researchers and the International Society for Development and Sustainability.

Dr Allu has been involved in teaching, research, architectural design studio mentorship and student supervision since 2006, with both undergraduate and postgraduate students, after her confirmation as an academic staff at the University of Jos. She has supervised and graduated over 30 undergraduates' projects, 13 master's students and currently has one PhD student. Dr Allu is an external examiner for the Department of Architecture, Ahmadu Bello University, Zaria-Nigeria. She also serves as a reviewer for journals and conferences nationally and internationally.

Dr Michael Oladokun is a post-doctoral research fellow in the Department of Built of Environment, Faculty of Engineering and Information Technology, Central University of Technology, Free State, Republic of South Africa and also a senior lecturer in the Department of Building, Faculty of Environmental Studies, University of Uyo, Nigeria.

Dr Oladokun completed his PhD in June 2014 at the Centre of Excellence in Sustainable Building Design of the then School of the Built Environment (now School of Energy, Geosciences, Infrastructure and Society), Heriot-Watt University, United Kingdom. His PhD focused on issues of energy consumption and carbon emissions in housing. Before this, Dr Oladokun graduated with a BSc (Hons) degree in Building from Obafemi Awolowo University, Nigeria in 2001 and completed his MSc degree in Construction Management in 2008 at the University of Lagos, Nigeria.

Dr Oladokun's research interests cover sustainability issues in the built environment, modelling complex systems, system dynamics applications to construction, and construction project management in general. His research outputs are published in high impact academic and professional journals and refereed conference proceedings. His work on energy consumption in buildings received the 2016 Emerald Literati Award for the most outstanding paper in the International Journal of Energy Sector Management.

Dr Oladokun is a reviewer for a number of local and international journals such as Sustainable Cities and Society; Engineering, Construction and Architectural Management; Facilities; and Ecological Indicators, amongst others. He has also been a member of the scientific review committees of many local and international conferences.





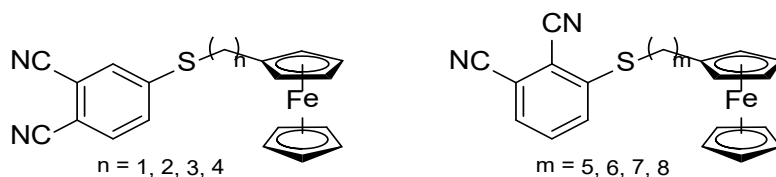
Dr Pravin Kendrekar is currently working on four different projects, including the development of novel anti-cancer, TB and malaria drugs, and also GCPR as targeted drug discovery. It has been believed that estrogen plays a vital role in the progression of breast cancer and the pathway affected by the estrogen receptor positive pathway which includes the D1 cyclin dependent kinase CDK4/6 complex. The CDK4/6 in collaboration with the retinoblastoma and E₂F (transcription factors) complex in conjunction to inactivate retinoblastoma since it is a tumour suppressor gene which stops cell progression when active. The analysis of expression levels of thousands of genes at the same time using a technology known as microarray is thought to be a major breakthrough needed in science. The technology of microarrays can be used to differentiate between cancer cells and normal cells so that the expression levels of certain genes are expressed in both the normal genes and also in the cancer cells. The major players in the estrogen receptor positive pathway are cyclin D1, cyclin dependent kinases 4/6, retinoblastoma (RB) and E2f transcription factor which work together to activate the cell to move from G1 to S phase.

The main aim of the project was to find a novel drug or inhibitor which can be used to stop proliferation and also to discover methods that can be used to overcome the anti-cancer drug resistance in the form of RB1 mutations and also CDK4\6 phosphorylation, thus finding new methods to try and develop a drug that overcomes resistance and patients don't relapse after taking the molecule for receptor positive breast cancer. Microarray technology can be used to analyse the expression levels of the regions and areas in the retinoblastoma and also CDK4\6 protein complexes in cancer cell lines and also in normal cells to look at the expression levels of the genes and areas which can help analyse what causes the resistance of the anticancer drugs. (There are currently four master's students working on this project).

Dr JP Lewtak is currently working on four different projects namely:

- Food safety assessment and microbiological analysis of Kombucha Tea prepared from Rooibos (*Aspalathus linearis*). A Kombucha tea sample was prepared using a symbiotic culture of bacteria and yeast. pH, antioxidant properties, DPPH, conductivity and LC-MS analyses were obtained. A manuscript for publication is in the process of being written by J.P. Lewtak, O. De Smidt, and I.T. Manduna, to be submitted in 2018 to the *Food Microbiology Journal*.
- Comparison of 4-Ferrocenylmethenyloxo-, thio, aza and carbophthalonitriles. Synthesis, spectroscopical characterisation, crystal structure and electrochemical studies of novel precursors for the synthesis of phthalocyanines. metallocene phthalonitriles with oxo-, thio, aza and carbo- linkages have been synthesised, characterised spectroscopically and studied electrochemically. A manuscript is in the final stages of being written, by J.P. Lewtak, E. Langner, and J.C. Swarts, to be submitted in 2018 to a journal of Inorganic Chemistry.
- Electrochemical studies of series of 3 and 4-Ferrocenylalkylthiophthalonitriles. Progress made has been that a series of eight ferrocenylalkylthiophthalonitriles, 3-Fc(CH₂)_nSPn and 4-Fc(CH₂)_nSPn where n = 1 through 4, Fc = ferrocenyl and Pn = C₆H₃(CN)₂ were synthesized. Electrochemical measurements of the series of compounds were performed. The phthalonitriles were not reported in the literature to date. Manuscript in writing by J.P. Lewtak and J.C. Swarts will be submitted in 2018 to the *Journal of Organometallic Chemistry*.
- The composition of hard resins of Humulus Lupulus of South African origin and their potential role in medical nutrition therapy.

Lewtak was involved in other research related activities which include guidance and teaching of advanced techniques to MSc and PhD students were performed. Moderation of the ECP and Chemistry 1 courses in Life Sciences has been completed. Two workshops were attended on GC-MS contemporary techniques, and the Biotechnology of Yeast Award for the Best label design at SAB World of Learning, was presented to the Leader of the CUT team, 2017.





The background features a close-up of a water droplet on a surface, with a blue semi-transparent overlay covering the upper portion. Large, white, outlined numbers '04' are positioned in the upper right area.

04

Research and Innovation: Impact and Excellence

Stats at a glance

Funding

R 44.2 m

funding available for funding from CUT, DHET and NRF.

R 18 838 260

funding awarded to 444 students (postgraduate to master's, master's and doctoral students).

R 2 774 630

funding available for staff from DHET R & D grant for capacity building, including the improvement of qualifications

Postgraduate students

597

postgraduate to master's students (3.29%)

368

master's of total enrolment (2.02%)

166

doctoral students of total enrolment (0.91%)

6.22%

of the total enrolments

47

master's degrees were awarded

19

doctorates were awarded

83

staff members as students benefitted from DHET R & D grant to improve qualifications.

Training/Workshops

18/1

Eighteen workshops presented (Bloemfontein and Welkom campuses) and one seminar series on postgraduate supervision

785

A cumulative total of staff and students attended

Research outputs

9.96%

growth for research publication outputs from 2015 – 2016

117.09

credit units were awarded to the university in 2016

The university had:

2 Research Centres

7 Groups

12 Units

10

rated researchers in 2016

5

post-doc scholarships for 2017

CUT Journals

INTERIM collectively had almost

30 000

views and downloads

The JNGS collectively had more than

35 500

views and downloads

Appointment of professors

The following new associate professors were appointed as from 1 July 2017.

Professor E. Muthoni Masinde is a distinguished computer scientist with BSc, MSc and PhD Computer Science degrees from the University of Nairobi, the Free University of Brussels and University of Cape Town respectively. One of her achievements in the realm of computer science is a novel drought prediction tool dubbed ITIKI, which taps into the rich body of African indigenous knowledge on droughts and augments this with ICTs, wireless sensor networks, artificial intelligence and mobile phones in this case. The novelty of this contribution was recognised by the IITU's Focus Group – Bridging the gap: From Innovation to Standards. Her contribution was also featured on the BBC World Service, New York Times, Reuters TEDx Talks and Global Aidpreneur. ITIKI also saw Masinde emerge the winner of the 2016 Distinguished Young Woman Scientist – Research and Innovation Awards of the Department of Science and Technology.



Masinde is among the 2017 awardees for 2017 Securing Water for Food (SWFF) by USAID. Through SWFF, she has received funding worth US\$500,000 for the 2016-2019 period. This funding has enabled her to develop entrepreneurship skills that have seen her become the founder and director of two private companies.

Masinde is currently an associate professor at the Department of IT, Central University of Technology (CUT), Free State, where she also doubles as the Head of the Department. She is the head and founder of the Unit for Research on Informatics for Drought. Through this Unit, she has spawned postgraduate projects and produced over 50 publications. Her interest in mentoring women in STEM saw her initiate the Women in Engineering and IT (WEIT) organisation, for which she is also the patron.



Professor Pule A. Phindane is an Associate Professor and Head of Department in Language and Social Science Education at Central University of Technology (CUT), Free State. He is currently responsible for research studies in language education. He has produced more than ten internationally published articles and chapters in both linguistics and language teaching. From 2012 – 2015 he was involved in a European Union multimillion rand project which involved four universities in South Africa. He was a coordinator representing the Central University of Technology. The main aim of the project was to strengthen and develop Foundation Phase education in South Africa. His research interests are in both mother tongue education and second language teaching and learning.



Professor Patient Rambe graduated with a PhD in Educational Technology from the University of Cape Town. He is an Associate Research Professor and a Postgraduate Streams Convenor in the Faculty of Management Sciences at the Central University of Technology, Free State. Before this appointment, Prof. Rambe served as an Assistant Director in the Office of International Academic Projects and as a Prestigious Postdoctoral Research Fellow in the Department of Computer Science and Informatics at the University of the Free State. Prof. Rambe has published extensively in the fields of Educational Technology, Business Management and Entrepreneurship in emerging economies. He has successfully supervised numerous master's and doctoral candidates. The National Research Foundation in South Africa has rated Prof. Rambe as an established researcher.



Professor Kanzumba Kusakana has a BSc Eng. in Electromechanical Engineering, as well as an MTech and a DTech in Electrical Engineering.

His research interests are electrical power and energy systems, energy management, renewable and alternative energies.

Professor Kusakana is a member of the South African Institute of Electrical Engineers (SAIEE); he is a Professional Engineer registered with the Engineering Council of South Africa (ECSA), a Certified Energy Manager (CEM) and is currently an NRF Y2-rated researcher. Prof. Kusakana has supervised seven master's and one doctoral student to completion. He has produced more than 100 publications including accredited DHET journal articles, book chapters as well as conference papers.

He is currently an Associate Professor and Head of the Electrical, Electronic and Computer Engineering Department at the CUT.

Professor Wendy N. Setlalentoa is an Associate Professor and Head of Mathematics, Science and Technology Education at the Central University of Technology, Free State in South Africa. She has published numerous articles in accredited journals and a book chapter in the field of Assessment and Evaluation in Education, Mathematics and Science Education. She has acted as a reviewer of several internationally accredited journals and has also served as a co-editor. She supervises master's and doctoral students and also serves as an external examiner for master's and PhD studies. Through participation in the EUSPSP Strengthening Foundation Phase Teacher Education Project research unit, she has contributed towards the development of teaching and learning material (focus area: Mathematics, Science and Technology) intended for use by student teachers registered for the BEd Foundation Phase in all South African Universities and their lecturers. She is a mentor in the Scholarship of Teaching and Learning (SoTL) project and also participates in the Teacher Identity Project for Early Childhood Care Education (ECCE) research group funded by the EU (a collaboration between international, regional and national universities).



Professor Freda van der Walt holds a bachelor's degree in Personnel Management, an honours degree in Personnel Management, and a master's in Personnel Management (Industrial Psychology) from the University of the Free State. After completing her formal education and internship, she registered as a psychologist with the Health Professions Council of South Africa (HPCSA). In 2008 she completed a PhD in Organisational Behaviour at the University of Pretoria. Other formal qualifications she has obtained include a certificate in Outcomes-Based Education (University of South Africa) and a National Higher Diploma in Education (Vista University). She is currently registered for a master's degree in Programme Management at Cranefield College. Her research interests over the past few years have been in the field of management, spirituality and religion as well as individual behaviour within the workplace. She enjoys conducting research on minority groups, in order to understand the work experiences of different groups of people. She has presented various research papers at national and international conferences and has published 16 research papers in acclaimed accredited, peer-reviewed journals. Freda has been appointed as external examiner on postgraduate level by various South African universities and is an editorial member of two academic journals. She has successfully supervised eight master's degree students.



Prestigious Vice-Chancellor Research and Innovation Awards

The annual VC's Awards aim to acknowledge the exceptional performance of staff members for their sustained and outstanding achievement in research, innovation, teaching, curriculum innovation, community engagements and support services, which are aligned with the university's vision in regard to social and technological innovations in delivering quality education in the higher education landscape.

Research and Innovation Awards categories were:

- Early Career Research Award: Dr B Awuzie, Faculty of Engineering & IT
- Established Researcher Award: Prof. PJ Fourie, Faculty of Health and Environmental Sciences
- Innovation Award: Mr LR Masheane, Prof. WB du Preez, Mr J Combrinck, Mr GJ Booysen and Mr J Els from the Faculty of Engineering & IT, Centre for Rapid Prototyping and Manufacturing



Winners in the Innovation Award category, from left: Prof. Alfred Ngowi, Deputy Vice-Chancellor: Research, Innovation and Engagement; Mr Jacques Combrinck, Lecturer: Mechanical and Mechatronic Engineering; Prof. Willie du Preez, Professor: Faculty of Engineering and Information Technology; Mr Lebohang Masheane, Technical Assistant: Mechanical Engineering; Mr Johan Els, Project Engineer: CRPM, Mr Gerrie Booysen, Director CPRM and Prof. Henk de Jager, Vice-Chancellor and Principal.



Dr Molapo Qhobela, Chief Executive Officer: NRF; Prof. Brian O'Connell of the University of the Western Cape receiving the Lifetime Achievement Award and Minister of Science and Technology, Ms Naledi Mandisa Pandor.

CUT Hosts NRF Excellence Awards

On 14 September 2017, the Central University of Technology, Free State (CUT) hosted 250 great South African minds under one roof at the 2017 National Research Foundation (NRF) Awards. The ceremony, themed *"Sustainable Development through Knowledge Creation"*, brought together a sterling line-up of renowned experts in various fields to celebrate research excellence, including Prof. Brian O'Connell, retired Rector of University of the Western Cape (UWC), who received the Lifetime Achievement Award, and distinguished scholars who, together, won nine special awards, and obtained two P-ratings and sixteen A-ratings.

Regarded as the benchmark for research excellence, the 2017 NRF Awards purposely places the spotlight on the role of knowledge creation in supporting and enabling sustainable development in South Africa, as envisaged in the National Development Plan 2030.

The hosting of these awards at the CUT did not happen by accident: this occasion followed after the NRF acknowledged the University for being the most improved institution in terms of its research performance and output in 2015. For the CUT, this accolade attests to the hard work that the University has invested in its research and development, and its Vision 2020. The University has seen an increase in the number of master's and doctoral degrees that are awarded, as well as an increase in the number of NRF-rated researchers amongst its staff. Amongst others, Prof. Ryk Lues of the Faculty of Health and Environmental Sciences, and Prof. Kanzumba Kusakana of the Faculty of Engineering and Information Technology (IT) added their names to these "Oscars of Academia" in 2016.

In addition, there was an 82% increase in research outputs from articles published in scientific journals, whilst the proportion of permanently appointed academic staff holding doctorates increased to 33% – a relatively high percentage in the university of technology (UoT) sector. Furthermore, in 2015, approximately 50% of the University's research outputs were published in international scientific journals.

The CUT continues to align the academic projects and research and innovation programmes with its Vision 2020, which focuses on producing quality social and technological innovations in socio-economic development, primarily in the central region of South Africa.

South Africa currently boasts 3 392 NRF-rated researchers. From 2013 to 2017, the number of Black researchers in the country increased by more than 70%, whilst the number of female researchers increased by more than 51%.

A photo of the the local organising committee that organised the SAARMSTE conference



Hosting the Southern African Association for Research in Mathematics, Science and Technology Education (SAARMSTE)

SAARMSTE is the Southern African Association dedicated to the advancement of research in Mathematics, Science and Technology Education (MSTE) in Southern Africa. Some of the aims of SAARMSTE include: fostering a sense of community among researchers in MSTE; promoting research to improve and develop MSTE programmes in response to current and future needs; and organising conferences at which the results of MSTE research can be presented.

In line with the latter aim of organising conferences, from the 17 – 20 January 2017 the Faculty of Humanities was privileged to host the 25th Annual Conference of the Southern African Association for Research in Mathematics, Science and Technology Education (SAARMSTE). The theme of the conference was "Research to learn and teach for diversity in Mathematics, Science and Technology Education".

Plenary speakers included:

Judith Bennett is the Salters' Professor of Science Education and leader of the University of York Science Education Group (UYSEG). UYSEG has an international reputation for its research and research-informed curriculum development work. Prior to taking on the role of Salters' Professor in 2014, Judith was head of the Department of Education at the University of York for eight years.



Prof. Judith Bennett from York University, United Kingdom. Her talk was entitled "What does research uncover about strategies for engaging more young people with STEM subjects and widening participation?". She also ran a workshop entitled: "Teaching difficult ideas in secondary science – how research can help".

Mike Askew is a Distinguished Professor of Mathematics Education at the University of Witwatersrand. He has previously been Foundation Chair Professor of Primary Education at Monash University, Melbourne, Professor of Mathematics Education at King's College, London and Director of BEAM Education, London. In 2006/07 Mike was distinguished visiting scholar to the 'Math in the City' project, City College, New York, and in 2011 he was awarded the Claude Leon Foundation Distinguished Scholar and Visiting Professor position at the University of Witwatersrand. He was recently elected President Designate for the UK's Mathematical Association. His talk was entitled: "Quality teaching: an under-researched imperative?" He also ran a workshop entitled: "Qualitative data analysis: from codes to themes".



Prof. Mike Askew from the University of Witwatersrand, previously from Monash University, Australia.

Piet Ankiewicz is currently head of the Department of Science and Technology Education in the Faculty of Education, University of Johannesburg. Prof. Ankiewicz originally trained as a Physical Sciences teacher, before becoming a Deputy Director of Education Policy for science education as well as technology education at the former Department of National Education, and a science teacher educator at the Faculty of Education at the then RAU. Due to his exposure to technology education at the former Department of National Education he also took it upon himself to establish technology education at university level, and then became involved mainly in the teaching methodology of technology education as well as research in the broader field of technology education. His research interests include the implications of the philosophy of technology for technology classroom pedagogy, teacher education and STS studies.



Prof. PJ (Piet) Ankiewicz from the University of Johannesburg. His talk was entitled: "The affordances of the philosophy/nature of technology for diversity in technology education". He also ran a workshop on: "Using a stage model as organisational framework to develop technological procedural knowledge through practice".





Prof. Laetus O.K. Lategan, Director: Research Development and Postgraduate Studies at CUT launched another book titled: 'Get Ready, Get Set, Go! – Preparing for your doctoral studies and doctoral education'

Book authors:

New book to prepare for doctoral studies

Get ready, Get Set, Go! is a guideline intended for supervisors and postgraduate students on their research journey; it also guarantees them a better understanding of the doctoral research process and a better comprehension on how to deliver their doctoral studies.

The book presents different perspectives on support in the doctoral education value chain. Themes such as the scope of doctoral education, planning and rollout of the research project, student and supervisor responsibilities, publication writing, grant applications, the application of research results and research ethics and integrity are also addressed. It also forms one of the three pillars of postgraduate research, namely research capacity building. The other pillars are policy and methodology, which are addressed in other publications.

The author and editor of the book, Prof. Laetus O.K. Lategan, explained that the book is for both the supervisor and the student to understand that research is not only about having a problem or defining a solution, but also about going beyond solving the problem. He also mentioned that research involves many role players and it is important to understand the roles they play. "We need to be mindful that there are many role players in the production of new knowledge. What is important is that we understand the many roles and role players there are in the completion of doctoral studies." He added that he is confident that the book will encourage collective engagements with all the role players and assist in creating relationships that are more professional.

"Research is a teamwork effort even though this may not be acknowledged. Student, supervisor and the university should be in collaboration when delivering research projects. No research can be done in a vacuum. In the context of universities of technology and traditional universities, it is important to embrace multidisciplinary research and to go beyond the well-known ways of producing knowledge in order to be beneficial to government, industry and business. This book is evidence of teamwork and collaboration of over three years," he said.

He further acknowledged the efforts of students and said that he has learned just as much from students as he has learned from his colleagues, stating that "very often we forget that our students are also a very important resource and reference base."

Prof. Lategan completed his doctoral studies in Philosophy and Theology at the University of the Free State. Professionally, he has an extensive background in senior and executive management. His research interests are in the areas of research ethics, healthcare ethics, applied ethics and doctoral education. He is the author and co-author of close to 200 publications in various disciplines, and is the editor of the Journal for New Generation Sciences. He is also a National Research Foundation (NRF) rated researcher.

New book sheds light on healthcare ethics

The Central University of Technology, Free State (CUT), in partnership with the University of the Free State (UFS), launched a newly published book, *Healthcare Ethics for Healthcare Practitioners*, which is intended to raise awareness amongst healthcare practitioners and patients, of the various ethical challenges faced by the profession in both the private and public sectors.

Although the world of medicine is monitored and regulated so that patients are treated according to an acceptable standard, the book covers a range of fundamental issues including vulnerability in healthcare, decisions between right and wrong, quality of healthcare, life-ending decisions, community based research, ethical decision making and spirituality in healthcare.

The authors, Prof. Laetus Lategan, Director: Research Development and Postgraduate Studies at CUT, and Prof. Gert van Zyl, Dean: Faculty of Health Sciences at UFS, aim to provide a moral compass that can guide healthcare professionals in terms of ethics and their relations with patients.

In the book, Profs Lategan and Van Zyl focus on modern-day healthcare ethics, and how those ethics apply to both patients and healthcare practitioners, including doctors, professional nurses and therapists. Renewed emphasis is placed on the importance of healthcare ethics due to the diverse range of healthcare services, and the deterioration of such services – particularly in developing countries. Ways of integrating the findings into real-life situations facing the profession, are also addressed.



The book is an elaborate reference work that will enable healthcare practitioners to make informed decisions should they be faced with ethical dilemmas in their practices, and will assist them to obtain a better understanding of, and devise solutions to, problems faced by communities at large. The guest speaker at the book launch, Dr Susan Vosloo, a cardiothoracic surgeon, said that practical results were achievable if most decisions were based on the interest of the individual patient.

"Most people know the difference between what is right and what is wrong and that healthcare decisions based on right or wrong may evolve from time to time depending on the availability of resources, religion, legal and cultural issues, daily practicalities, scientific progress, as well as the patient, the community and many more," she said.

In his address Prof. Gert van Zyl said that the book is "a joyful journey of collaboration between the two universities, a journey of academic colleagues becoming friends, journey of co-authors and the journey of supervisors and students becoming co-authors". He explained that the book deals with relationships between practitioners, patients and the community (family), and the influence of technology on how healthcare practitioners practise. He also mentioned that they wanted to focus on creating new approaches to healthcare from an ethical perspective and to provide guidance on ethics – not only to healthcare practitioners, but also to patients. "We hope that this book will make a difference in healthcare delivery," he concluded.

Prof. Laetus Lategan said that modern science must become more interdisciplinary, and that this would transcend the way science is conceived. He stated that the book is his contribution to The Year of the Human Project at CUT, which is closing the gap on the challenges experienced in society. "The essence of healthcare is to be of service to other people and to have a relationship with other people, I think it is high time for us to start caring for one another especially in the academic environment. If we are really looking after the health of other people, whether it be mental, spiritual or physical health, it should start with caring for other people."



Book signing by Profs Gert van Zyl (picture on the left) and Laetus Lategan have been an overwhelmingly exciting and positive experience after years of digging deeper into matters that impact on the healthcare sector in the 21st Century.



I Dr Solomon Makola delivering his address

A manual tool to assist youth to find meaning

On 31 May 2017, Dr Solomon Makola, Campus Director at Welkom campus, launched a new book entitled *Find Meaning, Stop Wondering*. This book is aimed at assisting youth and adults to find meaning and achieve success in their studies. Rooted in the philosophy and practices of Holocaust survivor Dr Viktor Frankl, *Find Meaning, Stop Wondering* proposes that meaning can be found even under the most devastating and stressful of circumstances.

In delivering an address at the launch, Dr M.A. Kanda, Principal Medical Officer in a community mental health unit in West Rand District, Gauteng province, a Logotherapy facilitator at Centre for Applied Psychology and an e-tutor for an Anthropology module at UNISA, reflected on why it is important to read this book. He addressed the very challenging issues of power, money and knowledge in the context of violence and displacement. He said poverty, violence and displacement have an impact on human beings at a community and family level. "When you have a disconnected, fragmented community in the context of poverty, violence and displacement, there is a very high risk that the family structure is also disconnected and fragmented, which is a point where tradition is transmitted from generation to generation in the family, and because of that a point of transmission of tradition becomes destroyed."

He said that people start to wander around when they don't have a sense of direction. "I believe one of the sources of our sense of direction is the tradition but the context of poverty, violence and displacement makes it difficult to have that sense of tradition which can be shared as a community. The moment we don't have a strong tradition, the only way we are left with to find ways of surviving as human beings is to exercise some of our spiritual capacities called intuitive knowledge, which allows us to get a glimpse of a situation showing us that what is meaningful is good, beautiful and true."

He continued that one way of mobilising spiritual forces is to listen to meaning which can be fulfilled through three types of values namely, the experiential value, creative values and attitudinal values. Logotherapy calls us to say that these are different ways we can find meaning in life and stop wondering. In his response Dr Solomon Makola said his journey started as a personal journey where he suffered a loss. He said after reading the book of Dr Viktor Frankl, *Man's Search for Meaning* he realised that life is not about replacing what was lost, and there is more to live for than material things. He added that he started to review philosophy on his own to heal and understand his suffering. When he got the opportunity to study, he met a study leader who happened to be a student of Dr Frankl. That was the beginning of his professional journey that started as a personal journey. "Sometimes things happen to us but it is all about the choices we make before responding to that particular situation. It is very important that whenever you are given an opportunity to do something for the benefit of all, that your responsibility is to seize that particular moment, each and every situation presents us with wonderful opportunities to find meaning," he concluded.



Fulbright Scholarship in the USA – Prof. Yali Woyessa's experience

Fulbright is the most widely recognised and prestigious international exchange programme in the world, supported for more than half a century by the American people through an annual appropriation from the US Congress and by the people of partner nations. Prof. Yali's Fulbright Visiting Scholar programme was from August 2017 to January 2018 at the University of Minnesota, Twin Cities Campus, Minneapolis, Minnesota, USA. His experience at the University of Minnesota in particular and in the US in general has been very enriching both professionally and personally. It was a life changing experience and had a profound influence on his professional and personal endeavours. Prof. Yali has been able to successfully complete the research project *"Investing impact of climate change on water security in South Africa"*. Furthermore, he had the privilege of visiting institutions such as Morgan State University, to share his research findings and explore potential collaborations.



Professor
Yali Woyessa

The **Fulbright Enrichment Programme**, held at the University of San Diego, was one of the highlights of his stay in the US where more than 84 Fulbright Visiting Scholars from across the world gathered to gain experiences from the University of San Diego on *"Leveraging strategic innovation and entrepreneurship in higher education for long-term success"* and meeting and interacting with great academics and international scholars along the way. Prof. Yali acknowledged the Fulbright Programme and the US Embassy in South Africa for giving him such a prestigious opportunity, and CUT for allowing him to develop his research career.

5th World Conference on Research Integrity preconference workshop on how to set up a national or regional network for research ethics and integrity

The 5th World Conference on Research Integrity was held on 28 – 31 May 2018, in Amsterdam, the Netherlands, with the aim of fostering the exchange of information and discussion about responsible conduct of research. Professor Laetus O.K. Lategan convened a preconference workshop in collaboration with Ms Edith Sempe of the Central University of Technology, Free State, South Africa, Dr Feneke Blom of the Free University of Amsterdam, Amsterdam, the Netherlands, and Dr Nicole Föger of the Austrian Agency for Research Integrity.

The title of the workshop was: *How to set up a national or regional network for research ethics and integrity. The purpose was to empower and enable research ethics and integrity managers, research managers and officers, research leaders and teams to set up research ethics and integrity systems in support of respectful research. The presentations and dialogue were translated into a framework that can assist in setting up a system for research and integrity. This framework reflected on matters such as:*

- policy and disciplinary rules for staff and students in terms of behavioural conduct;
- policies regarding intellectual property, copyright and financial matters;
- a Code of Ethics for employees that underlines the responsibility of staff members to focus their professional efforts and objectives;
- university structures and committees to support research ethics and integrity; and
- legislative requirements in compliance to research and access to information.

A total number of **29 delegates from 15 countries participated in the workshop.**

The Honourable Minister of Science and Technology, Ms Naledi Pandor, provided a keynote address at the conference, highlighting the importance of research and innovation within the South African context, and most significantly the importance of the responsible conducting of research.



Prof Laetus Lategan, Ms Naledi Pandor, Honourable Minister of Science and Technology and Ms Edith Sempe at the 5th World Conference on Research and Integrity



Changing faces – Changing lives: Communities benefiting from 3D printing technology

A team from the Centre for Rapid Prototyping and Manufacturing (CRPM) at the CUT, in partnership with three Durban surgeons, medical specialists, and Life Chatsmed Gardens Hospital, gave a new lease on life and restored dignity to three Durban patients who had benign tumours that were slowly causing their jawbones to disintegrate and disfiguring their faces. The patients were successfully operated on and received titanium implants which were manufactured at the CRPM. This story was covered by Carte Blanche and broadcast on 9 July 2017.

The CRPM team of experts led by Prof. Cules van den Heever (CUT Professor Extraordinary in the Faculty of Engineering and Information Technology), played a vital role in the reconstructive surgery through the use of additive manufacturing (AM) technology, also known as 3D printing, in assisting surgeons to plan complicated surgery down to the finest detail; thereby shortening the operating time considerably and mitigating risks of complications due to prolonged procedures which may result in infections, excessive blood loss and exposure to radiation. Through this technology, the CRPM's capabilities in the design and manufacturing of patient-specific implants have undergone significant strides and its goal is to expand its wealth of knowledge and research while forming deeper alliances with partners within business and industry, government, medical professionals, and also private and public hospitals.

The innovative nature of the work requires both medical and technological teams in the operating room. While the medical teams perform the surgery, the technical team observe to improve design or process in the next cycle.

According to Dr Vivesh Rughubar, maxillofacial and oral surgeon from King Edward state hospital, this procedure not only changed the way in which the medical community views 3D printing, but also costs much less than traditional jaw implant surgery. "Our past frustrations are over now; the 3D printing technology is the way to go and has reduced the surgical operations that would have otherwise taken us the entire day to perform."



The project research team from CRPM and partners including the Fuchs Foundation and Life Hospital team members.



Prof. Henk de Jager, Vice-Chancellor and Principal (left), Prof. Cules van den Heever CUT Professor Extraordinary in the Faculty of Engineering and Information Technology and Head of Maxillofacial Periodontics Unit based in Bloemfontein, and Mr Gerrie Booysen, Director of the Centre for Rapid Prototyping and Manufacturing (CRPM) (right back) with four patients who benefitted from the 3D printing technology. L-R: Amogelang Rasedimo (baby girl), Thabo Masa, Chevane Lawan and Valerie Taaibos.

Impacting on medical science in Africa

The CUT has proudly taken the lead in innovation and technology through additive manufacturing (AM), also known as 3D printing, changing the face of medical science in Africa. The university has proven to be a true university of technology by breaking barriers and sparking innovation in the medical field through this technology. On 23 August 2017, CUT-CRPM invited media houses, partners and investors to create a more interactive session and showcase the ground-breaking work that the University has done to date on medical product development through 3D printing.

Prof. Henk de Jager, Vice-Chancellor and Principal, said that the CUT has made a commitment in its vision to produce social and technological innovations to improve the lives of people and to enhance the socio- economic development of the region. "CUT as a university of the people is playing a fundamental role in addressing social responsibilities and making a difference in people's lives. Today as we are celebrating with our community members and partners within the region, we are proud to say that our university does not merely pay lip service but makes a difference in the immediate environment."



CUT's Extraordinary Professor in the Faculty of Engineering and Information Systems and head of the Maxillofacial Prosthodontics Unit based in Bloemfontein, Prof. Cules van den Heever displaying Mr Chevane Lawan's head model that was developed at the CUT to show surgeons where to place implants for future ears and a positioning device. CRPM played a vital role in collaboratively addressing national priorities in research areas.



Another beneficiary, Mr Chevane Lawan from Kimberly, Northern Cape, was born without ears and his day was made when he received his new prosthesis ear on the morning of the event.

One of the beneficiaries and a living testimony to the fundamental role the institution plays in changing lives of ordinary citizens is Mr Thabo Masa from Botshabelo, who lost his ear in a traumatic situation. Mr Masa said that after healing from the physical trauma, he suffered an emotional one, as he could not accept his loss and could not face the community with only one ear. "I am happy that the CRPM team managed to design a prosthesis ear that fits perfectly. I am no longer hiding under my beanie. I feel confident and normal again and I am very grateful and ready to face the world."

A maxillary frame implant

This patient below presented with a myxoma of the midface. A maxillary frame implant was designed and manufactured by the CRPM in titanium in order to restore facial profile and symmetry. The Carl and Emily Fuchs Foundation funded the prosthesis development. An obturator and dental bar will restore mastication and speech functionality.

This operation took place at Kimberley Hospital Complex and the surgeons were Drs Kobus and Werner Hoek, Dr Cules van den Heever and Dr Cornelius Borstlap. The operation was very successful and the patient had a follow-up consultation three weeks after the operation. The patient is in high spirits and is able to swallow and has started to speak.



I Planning model



3D printed titanium implant after post processing



Tylor Baker with both colour and texture matched external silicone ears.

Prostheses development through the use of AM technology

This life changing journey started when Prof. Cules van den Heever and Mr Gerrie Booysen were contacted by Dr Estie Meyer to do a presentation on how additive manufacturing (AM) could benefit the Ear, Nose and Throat (ENT) department at Groote Schuur hospital. At the time Dr Meyer had a case of a boy who had been born without ears and had asked her for ear prostheses.

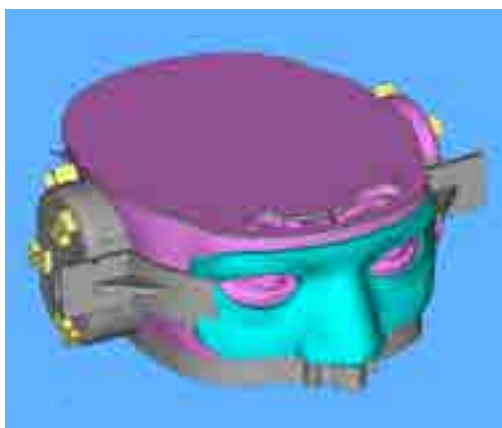
Due to steep costs related to a procedure of this nature, the CRPM deemed it fit to discuss this project with the Carl and Emily Fuchs Foundation, towards the design and manufacturing of external prostheses. The CRPM was awarded R2.25m for the period 2016 to 2019 to assist with these patient-specific devices.

Tylor Baker was the first patient to undergo this kind of procedure at the Groote Schuur hospital. The excellently done procedure left Tylor and his family both overwhelmed by emotion and ecstatic at the same time. The team from the CRPM played a vital role in the reconstructive surgery and prostheses development through the use of AM technology, also known as 3D printing. The CRPM made it possible by designing, 3D printing of drill guides and moulds, to accurately place the prosthetic implants and external prostheses which completed the boy's facial features. The prosthetic ears and surgery were sponsored by the Fuchs Foundation to the tune of R62000.

The images give a brief background of how Tylor looked before and after the procedure.



Positioning mask/moulds 3D printed by CRPM



3D design of patient's skull, soft tissue and positioning mask completed by CRPM

Product development technology station (PTDS)

Wheelchair Rugby Development Programme

The PTDS, together with Jared Macintyre, has started developing a wheelchair rugby development programme for disabled athletes enrolled in schools in Bloemfontein. Wheelchair rugby (WCR) is a team sport for athletes with physical disabilities that is practised in forty (40) countries around the world. WCR allows persons with most disabilities to compete even against abled-bodied persons at the same level of performance.

The main problem hindering the growth and development of this life changing sport in developing countries is the high cost and availability of these wheelchairs. There are currently no South African manufacturers of these wheelchairs, which are imported at a cost of about R120 000 each. Due to the financial pressures already on the families that have a child with a disability, there are no financial means to enable the child to participate in a sport specifically for persons with disabilities. The implication is that these people tend to have less opportunity for participation in recreational and social activities, which leads to exclusion from friends and the community. By lowering the cost of the wheelchairs, a development programme can be started in local schools for persons with disabilities in South Africa. Mr Jared Macintyre and the PTDS started an initiative to manufacture rugby wheelchairs at an eighth of the imported cost. A pilot project has been done that entailed creating a Wheelchair Rugby (WCR) team at Tswelang School. This pilot project proved that the concept was viable, and now the PTDS is seeking more funding from large organisations to expand the WCR concept so that more schools locally and eventually nationally, can participate.

The advantages offered by this sport are wider than just providing a fun social activity. WCR will give disabled sportsmen the opportunity to participate in a sport on a competitive level, leading to stimulation of the brain in ways not usually given provided for, and leading to improved physical health because of the building of stronger muscles. Brain stimulation, building muscle and encouraging fitness are but a few of the many benefits that can be offered to persons with disabilities by the WCR project in local schools. Furthermore, social participation and group cohesion will develop due to the sense of belonging, leading to improvement of communication skills (verbal and non-verbal), conflict management, respect for others and discipline (both on and off the court). Thus, it is clear that WCR holds advantages on physical, psychological and emotional levels that lead to improving the general well-being of persons with physical disabilities in South Africa.





This development project has been structured in a way as to empower other disabled people in Bloemfontein, who are involved in actually producing the rugby wheelchairs locally. Empowering people with disabilities with the knowledge and skills to be able to manufacture wheelchairs will help to overcome their state of occupational injustice by giving them an opportunity to be part of the open labour market, leading to feelings of belonging and well-being. This part of the project aims to uplift people in the disabled community by providing skills development and employment. The manufacturers of the wheelchairs will be able to feel needed and valuable in the community. The wheelchairs will therefore be manufactured for disabled athletes by persons with disabilities.

The PDTs has set up a pilot workshop that employs two people, each with a different disability. This workshop can produce twenty (20) rugby wheelchairs per month. The wheelchairs produced in this process will have a huge impact on the wheelchair rugby community. The aim of the project is to grow this pilot into a full-scale factory producing disabled sports equipment by persons with disabilities.

The learners from Tswelang School are already taking part in Saturday morning practices with the Mustangs (Bloemfontein wheelchair rugby team) at the UFS RAG farm. This shows the enthusiasm that they have for the sport and how eager they are to participate on a competitive basis against other people with disabilities. By implementing the pilot project at Tswelang school, stumbling blocks like transport, travelling time, and only practising once a week will be limited and even overcome. The facility is closer to their homes, allowing them to involve their communities in the practice sessions and even competing against abled-bodied persons.

Being part of a team drives the individual to greater heights, to become more aware of the challenges in the game, and to work with the game plan rather than just following one's own head and playing only for oneself. Once they are part of a team and enjoying the game, they do not want to disappoint their teammates and try to be the best they can be. When the project is fully implemented and more schools get involved with more teams competing in a league, these benefits will only become greater. To see these people bursting with enjoyment and pride is truly a heart touching experience.





Musa Simelane (Mustangs athlete) – A success story

Musa Simelane is a former Tswellang scholar, headboy in Grade 7 and a member of the Wheelboks (South African National Wheelchair Rugby Team). Musa has been given the opportunity to represent his country by taking part in wheelchair rugby. The project to further encourage disabled athletes to take part, together with the project to enable other disabled persons to get involved in manufacturing the wheelchairs, will empower persons with disabilities by becoming involved in sport at the highest level, as well as by job creation and skills development. To start off, disabled members of the school will be able to participate in wheelchair rugby at a competitive level, close to their homes to ensure easy accessibility. The project is seeking further funding in order to reach other local schools for persons with disabilities. This will lead to greater well-being and even an interschools competition in a WCR league, thus generating future national sportsmen.

Q Bell tooling

All hospitals have a system in place where patients can call for assistance by pressing a call button. Many of the call buttons in use in South African hospitals offer a range of functions, including a nurse call, adjusting of the bed, and changing the television channel. Patients with reduced motor function (forms of paralysis) however, do not have the dexterity necessary to select or press the correct button to call a nurse for assistance. There is therefore a need for a call button designed for patients with reduced motor function.

The Qbell is a device compatible with existing hospital systems, which will assist weak and vulnerable patients by making it simpler and easier to call a nurse. The aim of the Qbell is to give back independence and security to vulnerable people, even though they are confined to a hospital bed. The applicant and innovator behind the Qbell, Heinrich Williams, came up with the idea when he was left disabled after contracting a bacterial infection in China. With the help of eNtsa and the Nelson Mandela University Innovation Office, the initial R & D was conducted and the technology was developed to the point that several prototypes of the device have been made and tested at local hospitals. The PDTS was contracted to design a 2nd generation QBell, and to manage manufacturing of the tooling and the production of the first 500 sets. The manufacturing of the tooling and production was outsourced to Hanren Precision Engineering, because of their extensive experience in injection moulding tooling.



I Qbell Prototype

Description of the Qbell device:

- The Qbell device incorporates the following key features:
- A simple, large and easy to press button for calling assistance
- The force required to press the call button is low enough to allow those with minimal motor control to easily operate the unit
- The body has an outer surface that does not irritate the user or cause discomfort
- The unit is resistant to water ingress and has no inaccessible areas, thus making disinfecting the unit possible
- The button plugs into the existing hospital infrastructure, making it a plug and play solution
- There are multiple actuators within the unit for redundancy and reliability
- A power light indicates that the unit is operational

The device features a rigid plastic housing to accommodate the electronic hardware, and an elastic rubber sleeve to cover the electronics. The rubber sleeve gives the device a comfortable feel and keeps the inner parts clean.

This device will make a massive difference to patients in hospitals. It can be easily operated with minimal pressure and the large activation area allows a patient to use other limbs or appendages to operate the device. The client already has hundreds of orders, and still many to come. This device will make hospital life much easier for injured, handicapped, or disabled patients.



I Product run and design

FABLAB: SAB KickStart Entrepreneurship Programme

The Central University of Technology (CUT) and South African Breweries (SAB) signed a Memorandum of Understanding in 2015 to run the SAB KickStart Challenge through the CUT Incubation Programme. In 2017, CUT entered the SAB KickStart competition with four (4) participants, and the FabLab assisted with development of the prototypes. CUT came 3rd nationally, with one participant winning R200 000.



Ms Didi Mohapi receiving the winning prize from the Honourable Ms Lindiwe Zulu, Minister of Small Business Development.



National Science Week

On 5 August 2017, at the launch of National Science Week, the Fabab demonstrated science-based activities to high school learners in order to boost interest, advance public awareness and encourage the appreciation of science, mathematics, engineering and technology (STEM) in South Africa. School learners from various schools in the Free State came and observed how the machines are operated in the FabLab. Toys and other educational accessories were printed in front of them using the laser cutting machine, for example. This initiative demonstrated the impact that modern technology has had on science in today's life and encouraged more young people to follow careers in the STEM fields.



Image on the left is Danti Nkosinathi from Louis Botha Technical School. He won himself a Science Expo Certificate and a Bronze Medal, for his project; Line Follower, started and completed at the FabLab.



The background of the slide is a composite image. The upper portion is a blue-tinted photograph of a robotic arm, possibly a KUKA model, with its articulated joints and gripper visible. The lower portion is a photograph of a breadboard with various electronic components, including integrated circuits and resistors, connected by jumper wires. A small blue component is also visible on the breadboard.

05

Faculty of Engineering and Information Technology (FEIT)



A message from the Acting Dean Professor F.A. Emuze

The vision of the Central University of Technology, Free State (CUT) places a significant emphasis on socio-technological innovations, primarily in the central region of South Africa. The paradigm of the research *cum* innovation promoted in the FEIT is akin to consistent production of "phronesis", which is practical wisdom. The units and groups in the faculty, as well as the very reputable CRPM, are responding adeptly to socio-technical needs of today through pragmatism, which is about solving problems with all available tools in various disciplinary spaces.

In this faculty, major strides are being made in achieving sustainable development goals, including goals related to such diverse needs as the supply of clean water, energy, shelter, and infrastructure. The funnel approach adopted by scholars has ensured that emergent findings filter into teaching and learning through curriculum renewal with the sole purpose of producing work-ready graduates from the faculty.

The increase in the research outputs of the faculty is testament to the evolving culture of positive inquiry, where established scholars mentor early career academics. The research culture in the faculty thus facilitates the coming together of new ideas to address the needs of the society. The collegial atmosphere in the faculty, supported by the realisation that the quest for knowledge is a frontal attack on industrial and societal problems, ensures that the relevance of research, innovation, and engagement activities in the faculty are never over-emphasised.



Prof. F.A. Emuze
Acting Dean
Faculty of Engineering
and Information
Technology (FEIT)

A message from the Assistant Dean: Research, Innovation & Engagement Professor H.J. Vermaak

The FEIT has shown during 2017 what is possible with hard work and commitment. The faculty has exceeded all expectations and has produced more research outputs of higher quality than ever before. The research of the FEIT staff has made a global impact, postgraduate students have obtained outstanding research experience, and staff are provided with the opportunity for a lifelong engagement with research thereby improving research productivity.

The CRPM has strengthened its industry partnerships and has once again proven its leadership in the field both nationally and internationally. The research entities were all active and the process of re-alignment started in October 2017.

The faculty is currently focusing on the implementation and challenges of Industry 4.0 and already has a number of projects within an Industry 4.0 environment. Collaboration with international universities focusing in particular on Industry 4.0 projects were established towards the end of last year. The challenge however is to build capacity for study supervision and to enrol more full-time postgraduate students. The vibrant research culture, with more staff involved, is bearing fruit, and several joint multi-departmental projects were also initiated.



Prof. H.J Vermaak
Assistant Dean
Faculty of Engineering
and Information
Technology (FEIT)





Annual Research Seminar

The FEIT hosted its 20th Annual Research Seminar on 17 October 2017 at the Japie van Lill auditorium with over 130 delegates from CUT, industry, consultants and academia in attendance. This event has been in existence for the last twenty years and has proven itself valuable as a means to showcase industry-related research that is being done in the faculty by staff members and postgraduate students. This year once again we invited a keynote speaker, and the accepted full papers will be published in the *INTERIM* Journal of CUT. A total of thirteen papers were presented.

This year's seminar theme was "Engineering: A catalyst for Socio-Economic Development". Sessions were organised around common themes to facilitate discussions and the emergence of new technology in the developing world. The keynote speaker, Professor Muthoni E. Masinde, HOD of the Department of Information Technology at the Central University of Technology, Free State gave a thorough presentation about the ITIKI (Information Technology and Indigenous Knowledge with Intelligence) Early Drought Warning System.

At the end of the seminar, prizes were handed over after the presentations had been adjudicated by a team of judges.

Research Culture Workshop

The FEIT hosted the 4th Research Culture Workshop on 4 September 2017. The theme was “The Influence of Supervision on the performance of the postgraduate student”. The opening of the workshop was done by Professor Herman Vermaak of the Central University of Technology (CUT), Free State. This was followed by a welcoming message by Professor Muthoni Masinde and Professor Alfred Ngowi, both also from the CUT.

Following the opening and welcoming, the day began with presentations from keynote speakers. Keynote speakers of the day were: Professor Lukas Snyman (Director of the School of Engineering of the College of Science, Engineering and Technology, UNISA); Professor Ashley Ross (Deputy Dean in the Faculty of Health Sciences, DUT); Professor Hesta Friedrich-Nel (Head of Department: Clinical Sciences at the Faculty of Health and Environmental Sciences, CUT); Professor James Swart (Associate Professor in the Department of Electrical, Electronic, and Computer Engineering at CUT), Dr Noluntu Mpekoa (Senior Lecturer in the Department of Information Technology at CUT) and Ms Dina Moloja (Junior Lecturer in the Department of Information Technology at CUT Welkom Campus), and also a Master’s student.

The workshop covered various topics which included:

- Integration of underground teaching with high end research and development, with emphasis on technology transfer (Professor L Snyman)
- The student-supervisor relationship: Experiences of the supervisor’s role in student success (Professor A Ross)
- Supervisor and student relationships (Professor H Friedrich-Nel)
- Supervisor perceptions of postgraduate supervision using a role perception rating scale (Professor J Swart)
- Why do research? (Dr N Mpekoa)
- Student supervisor relationship: It is NOT personal (Ms D Moloja)

Overall, 47 people attended the workshop, with attendees consisting of staff members and full-time master’s and doctoral students from the Central University of Technology, Free State.

From left to right: Professor James Swart, Professor Herman Vermaak, Ms Dina Moloja, Professor Muthoni Masinde, Professor Hesta Friedrich-Nel, Professor Ashley Ross and Professor Lukas Snyman.





Research entities' activities

Centre for Rapid Prototyping and Manufacturing (CRPM)

The CRPM had an exceptional 2017 with a record total income in July 2017 (the highest monthly income in 20 years). We noticed an increase in enquiries for medical implants and the total medical-related income amounted to around R 900 000. The value of the 587 projects completed at the CRPM during 2017 was R 5 284 071, which was an increase of 12% compared to 2016. Approximately 12 893 parts were manufactured from the 587 industrial and research projects. Furthermore, a total of R 946 755 was spent on 42 research projects compared to R 439 880 spent on research projects during 2016.

The research of the CRPM aligns with the following focus areas:

- Additive manufacturing of medical implants and devices, using titanium alloy powders and polymers powders
- Additive manufacturing of aerospace components
- Additive manufacturing of advanced tooling
- Additive manufacturing for direct end-use by companies
- Design for additive manufacturing as cross-cutting enabling competence.

The research and development activities in these focus areas are supported by the DST funded national *Collaborative Program in Additive Manufacturing (CPAM)* and the NRF/DST SARCHI research chair in *Medical Product Development through Additive Manufacturing*.

Research in the CRPM went from strength to strength, with all outputs committed to for 2017 surpassed. Increased interest in the field of additive manufacturing ensures a steady flow of postgraduate students approaching the Centre not only from South Africa but also from other countries in Africa. Twenty master's and five doctoral students were registered at the Centre in 2017. Three staff members (Combrinck, Booysen, and Nsengimana) are presently reading towards their doctoral degrees. Three master's degrees were awarded to members of staff and students who completed their studies through the centre. Dr Ina Yadroitsava, who was previously a post-doc student in the Centre, was appointed as senior researcher during the year. Research outputs of the Centre during 2017 are summarised in the Table below.

Summary of research outputs and external funding for 2017	
Papers published in accredited journals	10
Papers at SA conferences	16
Papers at international conferences	12
Students graduated with master's degrees	3
Published book	1
External funding received	R5 439 277

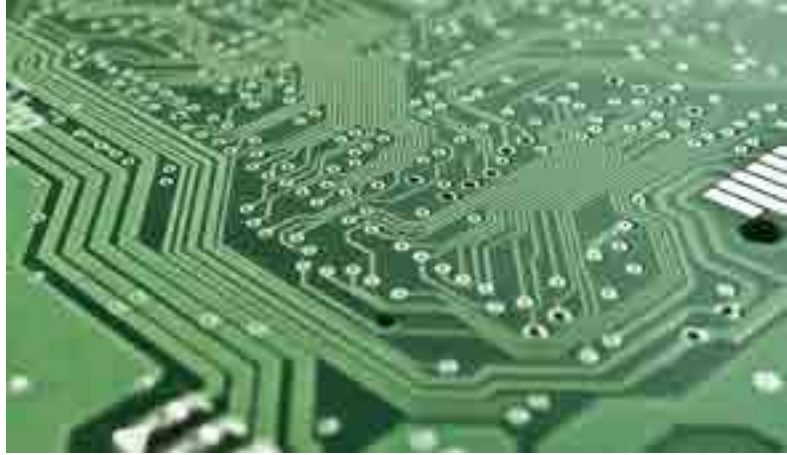
During 2017, further funding of R 11.8 million for the CRPM activities in the CPAM for the period 2018 to 2020 was also secured. The Centre is continuously involved in community engagement by assisting patients with facial disfigurements caused by cancer and tumours. Most of these patients are from state hospitals, where the tumours are removed and where reconstruction is done. The Centre assisted 24 patients with medical devices, implants and external prostheses as part of the Fuchs Foundation's "Changing faces, changing lives" project during 2017. From 2013 to date more than 70 patients have been assisted and supported. These life changing initiatives are made possible by support from and collaboration between the SARCHi Research Chair in Medical Product Development through Additive Manufacturing, the Collaborative Programme in Additive Manufacturing (CPAM), CUT Innovation Services (CUTis), Technimark Medical, Central Analytical Facilities (CAF) at Stellenbosch University, Special Alloys and Metallurgical Services (SAMS), the CSIR, HEPRO, the Carl and Emily Fuchs Foundation and Life Healthcare Group.

Further information on the project refer to page 60-63 of the report.

CRPM also collaborated in the PlatForum consortium with Lonmin PLC, North-West University and Vaal University of Technology, which is working towards establishing and commercialising additive manufacturing of platinum alloys. At the 18th Annual RAPDASA International Conference in Durban from 7 – 10 November 2017, the first prototypes of pure platinum jewellery were exhibited. CRPM also participated in a panel discussion on the PlatForum initiative at this conference.



Proof of concept jewellery piece produced by PlatForum



The Research Unit for Evolvable and Manumation (RGEMS)

The RGEMS is going from strength to strength. The Unit completed the final phase of a collaboration project with the University of Stellenbosch on reconfigurable assembly systems. This collaboration started in 2008. The Unit has started to focus on external projects for industry and government and was very successful in 2017. Some examples of focus areas are provided below.

- Energy: Technologies and Management: The aim of this activity is to undertake and promote fundamental and applied research alongside industrial development in the areas of renewable energy technologies and energy management.
- Vision: Machine Vision and Quality Systems' activity is to promote and undertake fundamental and applied research alongside industrial development in the areas of machine vision applications and implementations.

The well-established collaboration with the Applied University of Ulm and Aalen in Germany is growing, and a number of new projects are on the horizon. A new collaboration in the field of SMART manufacturing systems within the Industry 4.0 environment was initiated with the University of Aalborg in 2017.

The Unit for Lean Construction and Sustainability (ULCS)

The ULCS is a platform for a significant advance in lean construction and sustainability teaching, learning and research in South Africa. The Unit conducted and shared research findings on construction improvement, lean construction, health, safety, and well-being, people in construction, and sustainability in 2017. In addition, the Unit trained over 100 general contractors in the central region of South Africa in 2017. Training offered included the CETA accredited Certificate in Construction Contracting modules, presented in Parys, Bloemfontein, and Kimberly. The Unit also trained municipal and provincial government employees deployed in the Human Settlement space. Besides the short courses, the Unit hosted the CIDB (Construction Industry Development Board) Doctoral Workshop and the Joint CIB W099 (Safety and Health) and TG59 (People in Construction) Conference in 2017. The Unit hosted Professor Chris Gorse of Leeds Beckett University in October 2017. Prof. Gorse, who is the Director of Leeds Sustainability Institute, shared contemporary thinking on sustainability with colleagues at the CUT during two interactive seminars. He also interacted with a doctoral student in the Unit and with the two post-doctoral fellows also in the Unit (Dr E Allu and Dr M Oladokun). Furthermore, there is on-going research collaboration between Dr BO Awuzie (CUT staff member) and Prof. Lochner Marais of the Centre for Development Studies at the University of the Free State.

The Unit for Sustainable Water and Environment (USWE)

During the year 2017, the USWE was involved in various activities nationally and internationally:

- National Flood Studies Programme (NFSP): In collaboration with the Water Research Commission (WRC), the South African Committee of Large Dams (SANCOLD), the Department of Water and Sanitation (DWS), the South African Roads Agency Limited (SANRAL), the Royal Academy of Engineering, and the Universities of Stellenbosch, KwaZulu-Natal and Pretoria, the USWE contributed towards the establishment and further development of the NFSP. Currently, 5 postgraduate doctoral and master's students are directly involved and work on research topics as identified in the NFSP.
- Review of BSHWRM: The unit reviewed the Bachelor of Science Hydrology and Water Resource Management programme as requested by the professional body SACNASP.
- Study visit: Prof. Woyessa was a Fulbright Visiting Scholar at the University of Minnesota in the United State of America where he completed a research project entitled "Investigating the impact of climate change on water security in South Africa".
- WRC Symposium and Match-making: In collaboration with the CUT International office, USWE participated in the 2017 WRC Symposium and match-making. Danish and South African researchers were invited to this forum to explore areas of collaboration and water research. The USWE contributed to discussions on adaptation to the water challenges in the country.
- Postgraduate research: Four postgraduate proposals (3 D Eng. and 1 M Eng.) on water research from the USWE were approved by the FRIC.
- Conference presentations: The unit presented research papers at the following national and international conferences: the International Association of Hydrological Science (IAHS) Scientific Assembly; the South Africa Geophysical Association (SAGA) Conference; and the WaterNet/WARFSA/GWP-SA Symposium.

I Drought Tool Launch in Kenya - June, 2017



Unit for Research on Informatics for Droughts in Africa (URIDA)

For the URIDA, 2017 was the most successful year since its inception in 2014. Three of the members attained their master's degrees in IT and graduated during the September 2017 graduations. These are Liphoto, T.S., Maphatso, T.E. and Nyetanyane, M.J. As it is the tradition of URIDA to send at least one master's student to a conference each year, Mr MJ Nyetanyane attended the 1st EAI International Conference on Emerging Technologies for Developing Countries in Marrakech, Morocco on 27 and 28 March 2017. While there, he presented 2 papers and 2 posters on behalf of URIDA members. This year (2017) also saw the Unit attract funding worth US\$ 500,000 (over the 2017 – 2020 period) from the Securing Water for Food (SWFF) programme that is run by USAID. Through this funding, a commercial aspect of our research was spawned around running our Drought Prediction Tool (ITIKI) in South Africa, Mozambique and Kenya. In line with this, two MoUs were signed, one with the South African Weather Service and the other with the University of KwaZulu Natal.

With expanded membership that included 5 new master's students, visiting Professor Dr Ulrich Klauck from Aalen University, Germany, and Dr QPM Mtshali, the number of activities in URIDA grew substantially. One of these new activities was a successful Workshop on the Internet of Things (dubbed the *Workshop on IoT4Skills Development*) that was held together with the 2017 South African Institute of Computer Scientists and Information Technologists (SAICSIT 2017) Conference in Thaba Nchu on 26 and 28 September 2017.

Research Group in Engineering Education (ARGEE)

ARGEE in the FEIT currently has seven active members representing four of the six departments in the faculty. The members of the ARGEE have continued to excel in researching and reporting on their teaching practice and on student learning. Academics who joined ARGEE in 2014 have been able to increase their publication research outputs, contributing to the overall success of the group as they completed a total of 37 publications over a three-year period (2014 – 2017). This encompasses 25 full conference papers with two or more authors, 5 full conference papers with one author and 7 accredited journal articles. On average, each participating member generated R 107 053 per year in third-stream income, based on the overall research publications, while the average return on investment was 544%. Funding was primarily sourced from the Centre of Innovation in Teaching and Learning (CILT), for which ARGEE is deeply grateful. In 2017, two young black female mentees from our group (Ms Boniswa Mafunda and Ms Morakane Moletsane) presented their research at National Educational Conferences. Research topics for 2017 focused on the use of educational technology and reflective practice to improve student engagement and achievement, the importance of incorporating HIV and AIDS education into the engineering curriculum, the assessment of student learning, and the importance of linking learning outcomes to graduate attributes.





The research group Sustainable Urban, Roads and Transportation research group (SURT)

The SURT had an efficacious 2017 as the research group members managed to publish 4 articles in accredited journals, 11 articles in national and international conferences, and 1 book chapter. The research activities included publication of 4 other types of research output in addition to accumulative external grants of R 438 000. The research group is currently supporting more than 16 full and part time master's and 11 doctoral students. These students are working in the three different areas of interest for the group in different research projects including, but not limited to, sustainable roads, sustainable and smart cities, urban infrastructure, pavement, and road life cycle assessment. Some of these research projects are running in collaboration with Brunel University (UK), Illinois University (USA), Pune University (India), Suez Canal University (Egypt) and IIT Roorkee (India). One doctoral student has been accepted by the Southern African Systems Analysis Centre (SASAC), and awarded a bursary to conduct his PhD research under SASAC. Other activities include securing free training for a few M and D students at one of the industrial laboratories, in order to raise their skill levels.

The Soil Mechanics Research Group

The SMRG was started due to the high level of failure in light masonry structures, particularly in government subsidised housing. The Department of Civil Engineering was approached by the private sector in 2010 for possible involvement through the soil mechanics laboratory. A team of staff and students started to assess current procedures. This team discovered major weaknesses in current testing procedures and the Soil Mechanic Research Group was established to seek solutions. The SMRG has contributed papers to international conferences and technical journals dealing with shortcomings in current procedures and presenting new possibilities for identifying and assessing expansive clays. These papers led to an invitation to submit a paper on these methods to a major international Geotechnical journal. The group has identified serious problems with current methods of assessing the clay fraction of soils. A paper in the South African Institution of Civil Engineering on this work was awarded the J.E. Jennings award for 2017. The focus of the SMRG has broadened to more general soil mechanics problems and papers dealing with establishing probability density functions for soils and agglomeration in the hydrometer have been accepted for the 7th International Unsaturated Soils Conference in Hong Kong. The SMRG now has access to advanced equipment including automated oedometer and triaxial testing apparatus, allowing the scope of investigation to broaden further.

Fostering strategic partnerships

Project title	Pavement modelling for sustainability
Project leader	Prof. M. Mostafa
Collaborative parties	University of Illinois, (USA) Brunel University, London, UK Central University of Technology (SURT research group)
Description	<p>Prof. Mostafa initiated contacts with the Illinois Centre for Transport (ICT) in 2014 and Brunel University in 2016. He visited the ICT in January 2015 and agreed on activities for 2015 and beyond. Brunel university joined the project in 2016. The project is looking at modelling of pavement for sustainability with a focus on modelling of pavement incorporating non-conventional materials.</p> <p>In a time of decreasing highway funding and increasing expectations for performance and quality, it has become more important to understand the effect of environmental conditions on hot-mix asphalt (HMA) pavement performance. Considering the significant role of roadways in the economy and communication activities of modern societies, researchers have been searching for ways to attain the most suitable road pavement behaviour and consequently to design and construct safe, stable, cost-effective and environmentally friendly roads.</p> <p>Structural collapse in a flexible pavement structure is caused by the evolution of different types of damage mechanisms such as fatigue cracking, advanced crushing, temperature variation and increased moisture content resulting to delamination. The design standard adopted for this research will focus on South African and American codes for flexible road pavement design. The use of the finite element method to determine the stress-strain non-linear response behaviour of the pavement model structure considering mechanistic-empirical design guide will be developed. The analysis of pavement structures, using the finite element method which allows for the implementation of constitutive models that can properly capture the non-linear behaviour of unbound aggregate layers, will be considered. The general purpose finite element programme ABAQUS, which has been used to study pavement conditions such as multiple wheel loads, unbound aggregate behaviour, non-linear behaviour, and anisotropy will be implemented to determine the stress intensity of the road pavement. Necessary data required for the analysis will be acquired within situated study locations; since this forms the basis of the design for a reliable sustainable design. By the end of this research, data generated will be used in the design of hybrid flexible road pavement. in other words, to enhance a national sustainable development and enhance growth and development of the South African economic sector in the transportation of goods and agricultural products from state to state within the country.</p>

Project title	Sustainable transportation framework
Project leader	Prof. M. Mostafa
Collaborative parties	Central University of Technology (SURT research group) Free State University
Description	<p>Mountains and highlands have always played an important role in the history of humankind and have been sources of valuable assets – fresh water, refuges, natural barriers, and spiritual sanctuaries, to mention a few. Yet, for the most part, they have been viewed as peripheral to the rest of the global ecosystem, with an associated lack of attention to their sustainable development. Mountainous regions face important developmental questions concerning ecosystem services, as well as climate change. Although there is growing international interest in montane environments and livelihoods, the 'montane' element of South Africa/ Lesotho has not been adequately recognised in research or planning terms.</p> <p>The Drakensberg montane grassland, woodland and forest ecoregion is the centre of southern Africa's Afromontane region. It is the southernmost point of the Afromontane regional centre of endemism, and supports endemic plants, amphibians, birds and reptiles. The highest portions of this ecoregion have been equated with Alpine tundra vegetation by some researchers. Unlike mountains further north where Afromontane communities are found only above 2000 metres, here latitude compensates for altitude, allowing Afromontane communities to occur down to sea level. These mountains supply the industrial heart of South Africa with water, and give rise to southern Africa's longest river, the Orange River.</p> <p>The QwaQwa Campus of the UFS is ideally suited to be the home of a research unit that harnesses interdisciplinary expertise to focus on addressing the sustainable development of this important montane area. Sustainable development promotes the idea that social, environmental and economic progress are all attainable within the limits of earth's natural resources. While development is needed to overcome issues of poverty and unequal distribution of wealth and resources, this development must be sustainable so as not to cause the same problems of environmental degradation that were caused in the past. It is also necessary to understand and appreciate the unique histories and cultures of these regions.</p> <p>The area which will form the primary focus of the activities stretches across two countries - South Africa (Free State, KwaZulu-Natal and the Eastern Cape) and Lesotho, incorporating more than 600km of mountain range. The area is prone to a number of environmental stresses, including land degradation and loss of biodiversity – with associated effects on the communities who live there. Under predicted climate change conditions, these stresses will become more pronounced and hence will undermine sustainable development efforts.</p>
Project title	Research collaboration with Prof. Claudia Polese under the CPAM
Project leader	Prof. I. Yadroitsev
Collaborative parties	University of the Witwatersrand
Description	Collaboration in the fields of research of materials science, advanced materials and laser shock peening (LSP) technology, joint master's student supervision.

Project title	Research collaboration under SARCHI and CPAM projects
Project leader	Prof. I. Yadroitsev
Collaborative parties	Ecole nationale d'ingénieurs de Saint-Etienne, France
Description	Collaboration in the field of selective laser melting with Prof. I. Smurov, carrying out of joint experiments, discussion of results and writing of joint articles.
Project title	Research collaboration under SARCHI project
Project leader	Prof. I. Yadroitsev
Collaborative parties	Vitebsk State Medical University
Description project 1	Collaboration in the field of medical product development through additive manufacturing with Prof. A. Kabanova and Prof. I. Generalov, joint investigations and papers.
Description project 2	Collaboration in the field of medical product development through additive manufacturing with Prof. A. Kabanova, joint investigations and papers.
Project title	Research collaboration on AM of Ti6Al4V, surface finishing of polymer AM and design for AM
Project leader	Prof. Peter Mendonides, Mr Heinrich van der Merwe, Mr S. Havenga
Collaborative parties	Vaal University of Technology
Description project	Collaboration on AM of Ti6Al4V, surface finishing of polymer AM and design for AM. Joint master's and doctorate supervision.
Project title	Research collaboration with Prof. Deon de Beer under the CPAM and PlatForum
Project leader	Prof. Deon de Beer
Collaborative parties	North-West University
Description project	Collaboration on polymer AM, design for AM and AM of platinum.
Project title	Boeing research and technology
Project leader	Prof. I. Yadroitsev
Collaborative parties	Collaboration with Dr Kevin Slattery on support for a master's study.
Description project	Collaboration on AM of Ti6Al4V from blended powder.
Project title	Research collaboration with under the CPAM
Project leader	Dr Lethu Chikosha, Mr Pierre Rossouw and Mr Chris McDuling
Collaborative parties	CSIR Materials Science and Manufacturing
Description project	Collaboration on characterisation of Ti6Al4V powder for AM, AM patterns for investment casting and mechanical testing of AM parts. Joint master's supervision.
Project title	Research collaboration with Centre for Cardio-vascular Surgery
Project leader	Prof. Francis Smit and Robert WM Frater
Collaborative parties	University of the Free State
Description project	Collaboration on the development and testing of mechanical and polyurethane heart valves.
Project title	Ti6Al4V powder, spheroidisation of powder and AM of plasma system components
Project leader	Dr Etienne Snyders and Dr Jaco van der Walt under CPAM
Collaborative parties	Nuclear Energy Corporation of South Africa (Necsa)
Description project	Collaboration on characterisation of Ti6Al4V powder, spheroidisation of powder and AM of plasma system components.

Project title	Collaboration on design rules for AM tooling inserts
Project leader	Collaboration with Mr Frazer under CPAM
Collaborative parties	Altech UEC South Africa
Description project	Collaboration on design rules for AM tooling inserts.
Project title	Collaboration on design for AM under CPAM
Project leader	Prof. W. Du Preez
Collaborative parties	Technimark
Description project	Collaboration on design of AM tooling inserts in maraging steel for high volume plastic injection moulding.
Project title	Collaboration with Prof. Rob Knutsen of the Materials Engineering Centre under CPAM
Project leader	Prof. W. Du Preez
Collaborative parties	University of Cape Town
Description project	Collaboration on the physical metallurgy of titanium alloys produced through AM.
Project title	Research collaboration with Mr D. Louw and Mr T. du Plooy, National Rental Pool Programme
Project leader	Prof. W. Du Preez
Collaborative parties	CSIR, National Laser Centre
Description project	Collaboration in the field of research into optical diagnostics of selective laser melting. Carrying out of joint experiments, discussion of results, writing joint articles and joint master's student supervision.
Project title	Research collaboration with Dr A. Donmez and Dr S. Mekhontsev under SARCHI and CPAM programmes
Project leader	Prof. I. Yadrotsev
Collaborative parties	National Institute of Standards and Technology, USA
Description project	Collaboration in the field of optical monitoring of selective laser melting process (SLM), discussion of results and writing of joint articles.
Project title	Research collaboration with Prof. D.G. Hatting in Materials Science under SARCHI and CPAM programmes
Project leader	Prof. I. Yadrotsev
Collaborative parties	Nelson Mandela Metropolitan University
Description project	Collaboration in the field of residual stress of SLM objects, discussion of results and writing of joint articles.
Project title	Research and development of a quasi-isothermal compressor
Project leader	Collaboration between Prof. A. Romagnoli (NTU), Dr G.G. Jacobs (CUT) and Mr C. Plekker (CUT master's student) on the research and development of a quasi-isothermal compressor for application in compressed air and liquid air energy storage systems.
Collaborative parties	Nanyang Technological University(NTU), Singapore
Description project	Research collaboration with Dr Ernst Langer in polymer research under CPAM programme.

Project title	Summer School
Project leader	Prof. H. Vermaak
Collaborative parties	Aalen University, Germany
Description project	This is a one-week summer school on digital product development that is staged here at the CUT under the auspices of the Department of Mechanical and Mechatronics Engineering. The course is held for 13 students each from Aalen University and the Central University of Technology. The course is offered jointly by five members of staff from CUT and two from Aalen University. The course culminates in the design, development and eventual manufacture of selected products for each student on the DMLS EOS additive manufacturing equipment at the CRPM.
Project title	Research collaboration under SARCHI and CPAM projects
Project leader	Prof. I. Yadrotsev
Collaborative parties	Karlstad University, Sweden
Description project	Collaboration in the fields of selective laser melting and material science with Prof. P. Krakhmalev, carrying out of joint experiments, discussion of results and writing of joint articles. Joint DEng supervision.
Project title	Research collaboration under SARCHI and CPAM projects
Project leader	Prof. I. Yadrotsev
Collaborative parties	Stellenbosch University
Description project	Collaboration on non-destructive testing and material science with Dr A. du Plessis and Prof. D. Blaine; carrying out of joint experiments, discussion of results and writing of joint articles. Joint master's supervision.

Visiting professors

Professor Ashley Ross - Deputy Dean in the Faculty of Health Sciences, DUT

Professor Cules van den Heever – Advisor to the SARCHI Chair in Medical Product Development through Additive Manufacturing

Professor Chris Gorse – Director of Leeds Sustainability Institute, Leeds Beckett University, United Kingdom

Professor Deon de Beer – Chief Director: Innovation and Technology Transfer, North-West University, Honorary CUR Professor

Professor Dr Ulrich Klauck - Aalen University, Germany

Professor Lukas W. Snyman - Director of the School of Engineering from the College of Science, Engineering and Technology, UNISA

Professor Richard Ray - Department of Structural and Geotechnical Engineering, Széchenyi István University

Completed master's degrees

- Bokabo, B. (2017). Optimal schedule power flow for distributed PV/WT/DG with battery storage system. Central University of Technology, Free State.
- Coetzer, J. (2017). The effects of anthropomorphism and affective design principles on the adoption of mobile health applications. Central University of Technology, Free State.
- Kompi, M. (2017). An Information Technology instrument to enhance the development of abstract thinking for object oriented programming. Central University of Technology, Free State.
- Liphoto, T.S. (2017). Internet of things-based traffic management system for Maseru, Lesotho. Central University of Technology, Free State
- Maphatso, T.E. (2017). Fuzzy based security algorithm for wireless sensor networks in the internet of things paradigm. Central University of Technology, Free State.
- Monaheng, L.F. (2017). Finite element analysis of a Ti6Al4V medical implant produced through additive manufacturing. Central University of Technology, Free State. (cum laude)
- Moletsane, M.G. (2017). Microstructure and mechanical properties of Ti6Al4 (ELI) parts produced by DMLS. Central University of Technology, Free State.
- Ngancha, P.B. (2017). Flatness based control of micro-hydrokinetic river electrification system. Central University of Technology, Free State.
- Nyetanyane, M.J. (2017). UMobiTalk: Ubiquitous mobile phone-based speech language translator for Sotho language. Central University of Technology, Free State.
- Odufuwa, O.Y. (2017). Modelling of an organic rankine solar-thermal power plant. Central University of Technology, Free State.
- Phiri, S.F. (2017). Optimal energy control of a grid-connected solar-wind-based electric power plant applying the time of use tariff. Central University of Technology, Free State.
- Rabie, H.R. (2017). An automated guided vehicle utilizing thermal signatures for human identification and tracking. Central University of Technology, Free State.



Completed doctoral degrees

- Aggenbacht, F.C. (2017). The development and characterization of a cost-effective, renewable energy greenhouse for production of crops in atypical climate conditions. Central University of Technology, Free State.
- Aka, A. (2017). A mechanism for waste reduction in structural design process in South Africa. Central University of Technology, Free State.
- Isa, R.B. (2017). A mechanism for lean and sustainability: The case of infrastructure projects in South Africa. Central University of Technology, Free State.
- Niemann, J.A. (2017). Development of hybrid control and monitoring system within a reconfigurable assembly system. Central University of Technology, Free State.

List of national conference papers

- Adam, I., Du Preez, W.B. and Combrinck, J. (2017). Stress relieving of maraging steel injection mould inserts built through additive manufacturing. In Proceedings: 20th Annual Research Seminar, Faculty of Engineering and Information Technology, Central University of Technology, Free State. 17 October 2017. ISBN: 978-0-620-77329-4
- Bezuidenhout, L., Booysen, G. and Van der Merwe, A.F. (2017). Emerging technologies: commercial readiness index (CRI) for medical additive manufacturing (AM). In Proceedings: 18th RAPDASA Annual International Conference, International Convention Centre, Durban. 8 – 10 November 2017, pp 29-43. ISBN: 978-0-620-77329-4
- Coetzer, J., Grobelaar, L.A. and Masinde, E.M. (2017). Making Software Humane: The effects of affective and anthropomorphic design on the adoption of an M-Health application. In Proceedings: South African Institute of Computer Scientists and Information Technologists (SAICSIT 2017). Thaba Nchu, Free State. 26 – 28 September 2017. ISBN: 978-1-4503-5250-5/17/09
- Das, D.K. and Ngobeni, T.S. (2017). Influence of smart mobile travel apps enabled on taxis local urban road transportation systems in developing countries. In Proceedings: Southern African Transport Conference. Pretoria, South Africa. 10 – 13 July 2017. (M.Eng: Civil). ISBN: 978-1-920017-73-6
- Das, D.K. (2017). 1. Perils and antidotes of construction workers in community development projects in India: An explorative outlook. 2. Feudalistic attitude: a barrier against respect for personnel engaged in construction in India. In Proceedings: Joint CIB W099 and TG59 International Safety, Health, and People in Construction Conference. Cape Town, South Africa. 11 – 13 June 2017. ISBN: 978-1-920508-78-4
- Das, D. (2017). Sustainability challenges and significance of informal sector in urban economy in cities of India. In Proceedings: The 1st International Conference on Entrepreneurship Development (ICED) 2017, Bloemfontein, South Africa, pp 323-329. ISBN: 978-0-9946995-0-3
- Das, D. (2017). The influence of urban infrastructure on the Information Communication Technology (ICT) industry: A case of an Indian City. In Proceedings: The 1st International Conference on Entrepreneurship Development (ICED) 2017, Bloemfontein, South Africa, pp 227-234. ISBN: 978-0-9946995-0-3
- Dzogbewu, T. (2017). Evaluation of Ti15Mo alloy manufactured by DMLS from elemental powders. In Proceedings: 18th RAPDASA Annual International Conference, International Convention Centre, Durban. 8 – 10 November 2017, pp 75-84. ISBN: 978-0-620-77329-4

- Hertzog, P. (2017). Detecting the presence of pigeons on PV modules in a Pico solar system. In Proceedings: IEEE AFRICON 2017. Cape Town, South Africa. 18 – 20 September 2017. ISBN: 978-1-5386-2774-7
- Kinnear, W.A., Van der Walt, J.G., Rossouw, V. and Booysen, G.J. (2017). Benchmarking of FDM printed replacement parts for rural wheelchairs. In Proceedings: 18th RAPDASA Annual International Conference, International Convention Centre, Durban. 8 – 10 November 2017, pp 105-118. ISBN: 978-0-620-77329-4
- Kouprianoff, D., Du Plessis, A., Yadroitsava, I. and Yadroitsev, I. (2017). Destructive and nondestructive testing on small and intricate SLM components. In Proceedings: 18th RAPDASA Annual International Conference, International Convention Centre, Durban. 8 – 10 November 2017, pp 119-130. ISBN: 978-0-620-77329-4
- Kouprianoff, D.R., Du Plessis, A., Yadroitsava, I. and Yadroitsev, I. (2017). Destructive and non-destructive testing on small and intricate SLM components. In Proceedings: RAPDASA Pre-Conference Seminar on Additive Manufacturing of Titanium Parts. Durban, South Africa. 7 – 10 November 2017. ISBN: 978-0-620-77329-4
- Kouprianoff, D., Luwes, N., Newby, E., Yadroitsava, I. and Yadroitsev, I. (2017). On-line monitoring of laser powder bed fusion by acoustic emission for inspection of single tracks under different powder layer thickness. In Proceedings: Pattern Recognition Association of South Africa and Robotics and Mechatronics International Conference (PRASA-RobMech 2017). DOI:10.1109/RoboMech.2017.8261148.
- Kusakana, K. (2017). 1. Hydro aeropower, an option for electricity cost reduction in farming applications. 2. Flatness based control of a variable speed micro hydrokinetic generation system. In Proceedings: ICUE 2017. Cape Town, South Africa. 14 – 16 August 2017. ISBN: 978-1-5386-3557-5
- Kusakana, K. (2017). Impact of demand profiles on grid-interactive photovoltaic systems in South Africa. In Proceedings: IEEE AFRICON 2017. Cape Town, South Africa. 18 – 20 September 2017. ISBN: 978-1-5386-2775-4
- Kusakana, K. (2017). 1. Techno economic analysis of multiple paralleled diesel generators for micro isolated applications. 2. Modelling and simulation of a power converter for variable speed hydrokinetic system. In Proceedings: Domestic Use of Energy 2017. Cape Town. 3 – 5 April 2017. ISBN: 978-0-9946759-2-7
- Muiruri, A.M., Maringa, M., Du Preez, W.B. and Masu, L.M. (2017). Dynamic behaviour of direct metal laser sintered Ti-6Al-4V (ELI) under high strain rates in compression loading. In Proceedings: Additive Manufacturing of Titanium Parts pre-conference seminar, International Convention Centre, Durban, 7 November 2017, RAPDASA 2017 Conference Proceedings, pp 165-179. ISBN: 978-0-620-77329-4
- Newby, E.B., Kouprianoff, D. and Yadroitsava, I. (2017). In-situ alloying of Ti6Al4V-Cu structures by direct metal laser sintering. In Proceedings: 18th RAPDASA Annual International Conference, International Convention Centre, Durban. 8 – 10 November 2017, pp 180-188. ISBN: 978-0-620-77329-4
- Nkhasi, N.P., Du Preez, W.B., Van der Walt, J.G. (2017). Effectiveness of Primecast® and PMMA additive manufacturing processes to produce patterns for investment casting. In Proceedings: 18th RAPDASA Annual International Conference, International Convention Centre, Durban, 8 – 10 November 2017, pp 189-199. ISBN: 978-0-620-77329-4

- Nkhasi, N.P., Du Preez, W.B. and Van der Walt, J.G. (2017). Effectiveness of Primecast® and PMMA additive manufacturing processes to produce patterns for investment casting. In Proceedings: 20th Annual Research Seminar, Faculty of Engineering and Information Technology, Central University of Technology, Free State. 17 October 2017. ISBN: 978-0-620-77329-4
- Nyembwe, K.D., Van der Walt, K., De Beer, D.J. and Gonya, E. (2017). A case study of rapid sand casting defects. In Proceedings: 18th RAPDASA Annual International Conference, International Convention Centre, Durban. 8 – 10 November 2017, pp 215-225. ISBN: 978-0-620-77329-4
- Odufuwa, O. and Kusakana, K. (2017). Solar Thermal Organic Rankine Cycle (STORC) power plant as an alternative to the steam power plant with a parabolic trough system in South Africa. In Proceedings: Domestic Use of Energy 2017. Cape Town. 3 – 5 April 2017. ISBN: 978-0-9946759-2-7
- Oke, S.A. (2017). Geohydrological parameters estimation from electrical resistivity applications to the Dahomey Basin of Nigeria. In Proceedings: South Africa Geophysical Association. Cape Town, South Africa. 10 – 13 September 2017. ISBN: 978-0-620-77584-7 and 978-0-620-77587-8
- Oke, S.A. (2017). Geohydrological parameters estimation from electrical resistivity applications to the Dahomey Basin of Nigeria. Port Elizabeth, South Africa. 10 – 15 July 2017. IAHS 2017, Scientific Assembly. ISBN: 978-0-620-77584-7 and 978-0-620-77587-8
- Potgieter, P.H. and Blignaut, P.J. (2017). Using eye-tracking to assess the application of divisibility rules when dividing a multi-digit dividend by a single digit divisor. In Proceedings: South African Institute of Computer Scientists and Information Technologists (SAICSIT 2017). Thaba Nchu, Free State. 26 – 28 September 2017. ISBN: 978-1-4503-5250-5/17/09
- Swart, A.J. (2017). 1. Visualising the effect of different tilt angles on the switch-on time of small PV modules using a simplified measuring approach. 2. Reflecting on the balance between theory and practical grades of engineering students – A case study. In Proceedings: IEEE AFRICON 2017. Cape Town, South Africa. 18 – 20 September 2017. ISBN: 978-1-5386-2774-7
- Vermaak, H.J. and Rogers, L. (2017). Automated adapting component transfer system using real-time robot control within a KUKA RobotSensor Interface environment. In Proceedings: IEEE AFRICON 2017. Cape Town, South Africa. 18 – 20 September 2017. ISBN: 978-1-5386-2774-7
- Vermaak, H.J. and Motau, T. (2017). Utilizing on-line gas analyser to detect gassing transformer in a distribution substation. In Proceedings: South African Universities Power Engineering Conference (SAUPEC 2017). 30 January to 1 February 2017. ISBN: 978-0-620-74503-1
- Xoliswa, F., Das, D. and Mostafa, M.M.H. (2017). Integrating ICT as a solution to sustainable road transportation in South Africa. In Proceedings: 36th Southern African Transport Conference (SATC 2017). Pretoria, South Africa. 10 – 13 July 2017. pp 556-568. ISBN: 978-1-920017-73-6
- Zenani, Z., Du Preez, W.B. and Yadroitsev, I. (2017). Metal additive manufacturing of blended elemental Ti-6Al-4V powders. In Proceedings: Additive Manufacturing of Titanium Parts pre-conference seminar, International Convention Centre, Durban, 7 November 2017, RAPDASA 2017 Conference Proceedings, pp 297-306. ISBN: 978-0-620-77329-4



List of international conference proceedings

- Abejide, S.O. and Mostafa, M.M.H. (2017). Moisture content numerical simulation on structural damage of hot mix asphaltic pavement. In: Materials and Science Engineering Proceedings of the Second International Conference on Civil Engineering and Materials Science (ICCEMS 2017). Seoul, South Korea. 26 – 28 May 2017. pp 279-282. Online ISSN: 1757-899X and Print ISSN: 1757-8981
- Awuzie, B.O. (2017). Towards a Theory of Sustainability Governance in Mega Projects: An Exploratory Study. In Proceedings: 13th International Organization, Technology and Management in Construction (OTMC) Conference. Poreč, Croatia. 27 – 30 September 2017. ISBN: 978-953-8168-21-5
- Awuzie, B.O. and Monyane, T.G. (2017). Integrating social sustainability in the South African construction industry: Opportunities, Benefits and Barriers. In Proceedings: International Research Conference (IRC). University of Salford, Salford, England, United Kingdom. ISBN: 978-1-912337-04-02
- Awuzie, B.O. and Monyane, T.G. (2017). Achieving Sustainable Construction in South Africa through Digitization: An Exploratory Study. ATC Building, Swinburne University of Technology, Hawthorn, Melbourne, Australia. 20 – 23 November 2017. CRIOCM 2017, 22nd International Conference on Advancement of Construction Management and Real Estate. ISBN: 978-1-920508-70-8
- Das, D.K. (2017). Exploring Information Communication Technology and mobility linkage for smart and sustainable cities in developing countries. In Proceedings: 35th System Dynamics Conference, 2017. USA 16 – 20 July 2017. ISBN: 978-1-5108-5105-4
- Das, D. (2017). Influence of Information and Communication Technology (ICT) on travel characteristics for sustainable road transportation in Indian Cities. In Proceedings: VI International symposium of Transport and Communications, New Horizon 2017, Doboj, Bosnia and Herzegovina. pp 48-58. ISBN 978-99955-36-66-4
- Delport, D.H. (2017). The impact of a classroom intervention on first year students' learning in a mathematics- and statistics- related subject. In Proceedings: The 10th International Conference on Educational Research, ICER 2017. Khon Kaen University, Thailand. ISBN: 978-616-438-066-0
- Emuze, F.E. (2017). 1. The human contribution to unsafe construction acts and conditions in the central region of South Africa – Fidelis Emuze = ARCOM. 2. Are green construction materials influencing work in South Africa? – Lebohang Moloi and Fidelis Emuze = SEEDS. 3. Low Carbon Building: Implementation Strategies Utilised in South Africa – Chikezirim Okorafor, Fidelis Emuze and Dillip Das = SEEDS. In Proceedings: SEEDS and ARCOM. Cambridge, UK, 4 – 6 September 2017 (ARCOM); Leeds, UK, 13 – 14 September 2017 (SEEDS). ISBN: 978-0-9955463-1-8
- Gopinath, R. (2017). Predicting depth of carbonation of concrete for varying climatic conditions. In Proceedings: 2nd International RILEM/COST Conference on early age cracking and serviceability in cement-based materials and structures (EAC-02). 12 – 14 September 2017. ISBN: 978-2-35158-200-8

- Kinnear, T.C., Dzugbewu, P., Krakhmalev, I., Yadroitsava, I. and Yadroitsev, I. (2017). Manufacturing microstructure and mechanical properties of selective laser melted Ti6Al4V-Cu. In: Lasers in Manufacturing Conference, LiM 2017 Munich, 26 – 29 June 2017. ISBN: 978-0-620-77329-4
- Kusakana, K. (2017). Feasibility analysis of pumped hydro storage in the South African electricity market. In Proceedings: World Engineers Summit – Applied Energy Symposium & Forum: Low Carbon Cities & Urban Energy Joint Conference (WES-CUE) 2017. Singapore. 18 – 21 July 2017. ISSN: 187-6-6102
- Kuriakose, R.B. (2017). A review of the literature on Assembly Line Balancing Problems, the methods used to meet these challenges and the future scope of study. In Proceedings: 3rd Advanced Research in Material Sciences, Manufacturing, Mechanical and Mechatronic Engineering Technology International Conference (AR4MET 2017). Melaka, Malaysia. 5 – 9 November 2017. ISBN: 978-84-9048-590-3
- Kusakana, K. (2017). 1. Hybrid PV-Wind with groundwater pumped hydro storage system for electricity cost minimization. 2. Flatness based control of a variable speed micro hydrokinetic generation system. 3. Performance analysis of load connected AC-DC-AC power converter for variable speed hydrokinetic system. In Proceedings: 2017 2nd Applied Mathematics in Science and Engineering International Conference. Phuket, Thailand. 10 – 12 October 2017. ISBN: 978-1-5386-4950-3; 978-1-5386-3557-5
- Kusakana, K. (2017). Using PV with borehole pumped hydro storage systems for small farming activities in South Africa. In Proceedings: ISGT Asia 2017 (The 7th Innovative Smart Grid Technologies Asia). Auckland, New Zealand. 4 – 7 December 2017. ISBN: 978-1-5386-4950-3
- Makanda, G. (2017). Free convection fluid flow from a spinning sphere with temperature dependent physical properties. In Proceedings of the 4th International Conference of Fluid flow, Heat and Mass Transfer (FFHMT'17). ISBN: 978-1-927877-37-1
- Makanda, G. and Sypkens, R. (2017). Investigating the dynamics of knowledge acquisition in learning using differential equations. 19th International Conference on Applied Mathematics and Numerical Analysis ICAMNA 2017. ISSN: 2522-3631
- Makanda, G. and Sypkens, R. (2017). Students' perception on the relevance of high school mathematics in university education in South Africa. 19th International Conference on Applied Mathematics and Numerical Analysis ICAMNA 2017. ISSN: 2522-3631
- Makoana, N.W., Moller, H., Louw, D. and Yadroitsev, I. (2017). Preliminary Investigation on Selective Laser Melting of 17-4PH Steel using High laser Powers of up to 1500W. In Frontiers in Optics 2017, OSA Technical Digest (online) (Optical Society of America, 2017), paper JTu3A.43. <https://www.osapublishing.org/abstract.cfm?URI=LS-2017-JTu3A.43>. ISBN: 978-1-943580-33-0
- Maringa, M. and Masu, L.M. (2017). Developing analytical solutions for transverse, matrix strain magnification and fibre strain reduction in uniaxially aligned continuous fibre reinforced composites, based on the principle of conservation of strain energy and the Reuss rule. In Proceedings: 2017 Global Conference on Polymers and Composite Materials (PCM 2017), IOP Conf. Series: Materials Science and Engineering 213, IOP Publishing. pp 1 – 24. ISSN: 1757-899X
- Maringa, M. (2017). Developing analytical solutions for transverse, matrix magnification and fibre strain reduction in uniaxially aligned continuous fibre reinforced composites, based on the principle of conservation of strain energy and the Reuss rule. In Proceedings: Global Conference on Polymer and Composite Materials (PCM 2017). Guangzhou, Guangdong, China. 23 – 25 May 2017. ISBN: 978-1-5108-4415-5

- Moloja, D. (2017). Securing M-voting using cloud intrusion detection and prevention system: A new dawn. In Proceedings: IST Africa 2017 conference. Namibia, Windhoek. 31 May – 2 June 2017. ISBN: 978-1-905824-56-4
- Monyane, T., Awuzie, B.O. and Emuze, F.E. (2017). Performance Indicators for Lean Construction in South Africa: Lessons from the Port Elizabeth province. In Proceedings: University of Johannesburg, University of Zambia, Copperbelt University. August 30 – 1 September, 2017. ISBN: 978-0-620-74121-7
- Mostafa, M.M.H. (2017). The Free State public transportation system: A comparison between buses and taxi services and adaptation of ICT solutions. In Proceedings: GeoMEast 2017. Sharma Elshikh, Egypt. 15 – 19 July 2017. ISBN: 978-3-319-61644-5
- Mpekoa, N. (2017). 1. Towards a Cloud Intrusion Detection and Prevention system for M-voting in South Africa. 2. m-Government Maturity Model: A Qualitative Investigation. In Proceedings: iSociety 2017 Conference. Dublin, Ireland. 17 – 19 July 2017. ISBN: 978-1-908320-80-3
- Raath, J. (2017). On the Micciancio-Voulgaris algorithm to solve the long-horizon direct MPC optimization problem. In Proceedings: 4TH Symposium on predictive control of electrical drives and Power Electronics, PRECEDE 2017. Poland. 4 – 6 September 2017. ISBN: 978-1-5386-0507-3
- Swart, A.J. (2017). 1. Using reflective self-assessments in a learning management system to promote student engagement and academic success. 2. The impact of student unrest on freshmen engineering students in South Africa. 3. A framework to encourage the use of reflective practices by undergraduate engineering students in a design-based module. 4. Design and development of practical instruction for freshmen engineering students in a renewable energy course. In Proceedings: EDUCON. Athens, Greece. 25 – 28 April 2017. ISBN: 978-1-5090-5466-4/17
- Taimu, M., Ngowi, A.B. and Awuzie, B.O. (2017). Towards a stakeholder relationship management model for construction SMES in Botswana: An Exploratory Study. In Proceedings: International Post-Graduate Research Conference (IPGRC). University of Salford, Salford, England, United Kingdom. ISBN: 978-1-912337-05-7
- Yadroitsev, I. (2017). Additive Manufacturing Technology by Selective Laser Melting (SLM). In Proceedings: 15th World Conference of ISTMA Special Tooling & Machining Association, Joiville, Brazil, 28 – 30 June 2017. <http://istma2017.com/en/cronograma-detalhado> (invited).
- Yadroitsev, I. (2017). A systematic approach to manufacturing parts with desired properties by Selective Laser Melting: from fundamental to applications. In Proceedings: 9th Brazilian Congress of Manufacturing Engineering, 26 – 29 June 2017. <https://eventos.abcm.org.br/cobef2017/programacao-do-evento/agenda/> (keynote).
- Van der Walt, I.J., Crouse, P.L. and Du Preez, W.B. (2017). Plasma Torch Optimisation by Additive Manufacturing of Components. In Proceedings: ISPC23, Montreal, Canada. 13 July – 4 Aug 2017
- Vermaak, H. and Niemann, J. (2017). Virtual Commissioning: A tool to ensure cost-effective system integration. In refereed conference proceedings of the 2017 IEEE International Workshop of Electronics, Control, Measurement, Signals and their application to Mechatronics (ECMSM) from 24 – 26 May 2017: San Sebastian, Spain. pp 247-252. ISBN: 978-84-697-3416-2

List of books/chapters

- Awuzie, B.O., Emuze, F.E., and Ngowi, A.B. (2017). Towards a social ontology on sustainable development in CUT: Understanding stakeholder perceptions. Handbook of Theory and Practice of Sustainable Development in Higher Education. Volume 2. ISBN: 978-3-319-47888-3
- Das, D. (2017). An appraisal for apt teaching and learning methods for effective student learning in engineering education. SAARMSTE Southern African Association of Research in Mathematics, Science & Technology Education Book of Long Papers. ISBN: 978-0-9922269-4-7
- Emuze, F.E. (2017). Using case-based methods in construction research with complementaries. Research Methodology in the Built Environment: A Selection of Case Studies Book. ISBN: 978-1-138-77842-8
- Emuze, F.E., Opoku, A. and Smallwood, J.J. (2017). Lean and Sustainability in Construction: Creating Value. Value and Waste in Lean Construction Book. ISBN: 978-1-138-90370-8
- Emuze, F.E. and Saurin, T.A. (2017). Waste in Construction: Concepts and Types. Value and Waste in Lean Construction Book. ISBN: 978-1-138-90370-8
- Kusakana, K., Madiba, T., Bansal, R.C. and Justo, J.J. (2017). Optimal control system of under frequency load shedding in microgrid system with renewable energy resources. Smart Energy Grid Design for Island Countries: Challenges and Opportunities Book. ISBN: 978-3-319-50196-3, 978-3-319-50197-0
- Kusakana, K. (2017). Optimal Power Flow of a Battery/Wind/PV/Grid Hybrid System: Case of South Africa. Smart Energy Grid Design for Island Countries: Challenges and Opportunities Book. ISBN: 978-3-319-50196-3, 978-3-319-50197-0
- Moloja, D. and Mpekoa, N. (2017). Information Technology – New Generations. Advances in Intelligent Systems and Computing Book. ISBN: 978-3-319-54978-1
- Mangara, B.T. (2017). Model development for analysis of steam power plant reliability. Recent Improvements of Power Plants Management and Technology Book. ISBN: 978-953-51-3357-5
- Mangara, B.T. (2017). Model Development for Reliability Cannibalization. System Reliability Book. ISBN: 978-953-51-3706-1
- Oke, S.A., Bonotto, D.M., Roveratti, G., Kumar, P., Saraswa, C., Kumar Mishra, B. and Herath, S. (2017). An Overview of Aquifer Vulnerability. Aquifers' Properties, Roles and Research Book. 978-1-53611-069-2, and 978-1-53611-084-5





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- Awuzie, B.O. (2017). Barriers to Sustainability Governance of Infrastructure Delivery Systems. *Journal of Construction*. Vol.10 (4) pp: 38-48. ISSN:1994-7402
- Awuzie, B.O. and Isa, R.B. (2017). Stakeholders' perception of critical success factors for sustainable facilities management practice in universities in sub-Saharan Africa. ISSN: 1023-0564 e-ISSN 2415-0487
- Awuzie, B.O. and McDermott, P. (2017). Towards an understanding of the influence of national culture on organisational viability: an exploratory study. ISSN: 1179-0776
- Awuzie, B.O. and Emuze, F.E. (2017). Promoting Sustainable Development Implementation in Higher Education: Universities in South Africa. ISSN: 1467-6370
- Awuzie, B.O. and McDermott, P. (2017). An abductive approach to qualitative built environment research: A viable system methodological exposé. ISSN: 1443-9883
- Das, D. and Emuze, F.E. (2017). A Dynamic Model of Contractor-Induced Delays in India. Online ISSN: 2180-4222, Print ISSN: 1823-6499
- Das, D. (2017). Exploring the Politico-Cultural Dimensions for Development of Smart Cities in India. ISSN: 2187-3666 (online)
- Du Plessis, A., Yadroitsava, I., Le Roux, S.G., Yadroitsev, I., Fieres, J., Reinhart, C.H. and Rossouw, P. (2017). Prediction of mechanical performance of Ti6Al4V cast alloy based on microCT-based load simulation. *Journal of Alloys and Compounds*, 724, 2017, pp 267-274. ISSN: 0925-8388
- Emuze, F.E. (2017). A discourse on lean construction in Africa, using a supply chain example. ISSN: 2223-7852
- Emuze, F.E. (2017). Construction safety through housekeeping: The Hawthorne Effect. ISSN: 2223-7852
- Emuze, F.E. and Kadangwe, S.R. (2017). Value creation and inherent constraints in the Malawian Construction Industry. ISSN: 1179-0776
- Gericke, O.J. and Smithers, J.C. (2017). Direct estimation of catchment response time parameters in medium to large catchments using observed streamflow data. ISSN: 0885-6087

- Kazantseva, N., Krakhmalev, P., Yadroitsev, I., Fefelov, A., Merkushev, A., Ilyinikh, M., Vinogradova, N., Ezhov, I. and Kurennykh, T. (2017). Oxygen and nitrogen concentrations in the Ti-6Al-4V Alloy manufactured by direct metal laser sintering (DMLS) process. *Materials Letters*, 209, pp 311-314. ISSN: 0167-577X
- Kazantseva, N., Krakhmalev, P., Yadroitsev, I., Fefelov, A., Vinogradova, N., Ezhov, I. and Kurennykh, T. (2017). Texture and Twinning in Selective Laser Melting Ti-6Al-4V Alloys. World Academy of Science, Engineering and Technology. *International Journal of Materials and Metallurgical Engineering*, 11(11), pp 745-748. ISSN: 1307-6892
- Koko, S.P., Kusakana, K. and Vermaak, H.J. (2017). Optimal energy management of a grid-connected micro-hydrokinetic with pumped hydro storage system, *Journal of Energy Storage*, Volume 14, Part 1, December 2017. pp 8-15.
- Krakhmalev, P., Yadroitsev, I. and Yadroitsava, I. (2017). Functionalization of biomedical Ti6Al4V via in-situ alloying by Cu during DMLS manufacturing. *Materials* 10(10), 1154. doi:10.3390/ma10101154. ISSN: 1996-1944
- Krakhmalev, P., Yadroitsava, I., Fredriksson, G. and Yadroitsev, I. (2017). Microstructural and thermal stability of selected laser melted 316L stainless steel single tracks. *South African Journal of Industrial Engineering*, 28(1), 12 – 19. ISSN: 1012-277X
- Kusakana, K., Siecker, J. and Numbi, B.P. (2017). A review of solar photovoltaic systems cooling technologies. *Journal of Renewable and Sustainable Energy Reviews*. ISSN: 1364-0321
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- Masinde, E.M., Shoman, A. and Mostafa, M.M.H. (2017). Internet of Things Based Framework for Public Transportation Fleet Management in Free State, South Africa. ISSN: 18678211
- Masinde, E.M., Bashingi, N. and Mostafa, M.M.H. (2017). Possible Challenges of Integrating ICTs into the Public Transportation System in the Free State Province, South Africa. ISSN: 18678211
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- Mollo, L.G. and Emuze, F.E. (2017). Casualization of work in construction and the plight of workers in Bloemfontein. ISSN: 2223-7852
- Mollo, L.G. and Emuze, F.E. (2017). Concrete Decision Analysis in South Africa. ISSN: 1994-7402
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- Theron, E. (2017). Estimation of shrink/swell potential and variability of clays by small-scale suction tests. ISSN: 0046-5828
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The background of the entire image is a photograph of a laboratory. In the foreground, there are several glass bottles on a shelf, some containing liquids. In the background, a person in a white lab coat is visible, working with equipment. A large blue rectangular overlay covers the upper two-thirds of the image. The number '06' is written in a large, white, outlined font in the upper right corner of the blue area.

06

Faculty of Health and Environmental Sciences



A message from the Dean Professor S.S. Mashele

I am struck by the passion that our faculty and students have for discovery and problem solving; and the dedication of our hard-working staff in keeping the faculty on the cutting edge of research. We must address the most pressing problems facing society – problems with water, food, health and the environment – and we must do so in a sustainable, ethical, and humane way.

One of the noteworthy achievements of the year under review was the significant increase of postgraduate students and the registration of new patents. In fact, the Faculty of Health and Environmental Sciences has the highest number of fulltime postgraduate students. We will continue to expand our research enterprise to address our nation's most difficult and pressing technological problems. The challenge is to continue creating an enabling environment that inspires researchers to achieve their ambitions and attracts the most talented academics and scholars. I am certainly proud of our achievements in 2017 and wish to thank all researchers, managers and staff for their support, dedication and hard work.



Prof. S.S. Mashele
Dean: Faculty Health and
Environmental Sciences

A message from the Assistant Dean: Research, Innovation & Engagement Professor C. van Westhuizen

Since the objective of universities of technology is to conduct applied research, it is pleasing to witness that most of the key focus areas of research in the faculty seek to address issues and challenges that affect our communities both directly and indirectly. It is also important to note that some of the research outputs, as contributed by both postgraduate students, academic staff and fulltime researchers, were published in high impact journals. These achievements were made possible mainly by the Unit for Drug Discovery Research led by Prof. S.S. Mashele and the Centre for Applied Food Safety and Biotechnology (CAFSaB) led by Prof. Ryk Lues.

The large number of articles published in popular magazines also brings valuable information to the community and industry. It is encouraging to see a growing number of our academics obtaining master's and doctoral degrees, thus enlarging our pool of staff that, potentially, can effectively supervise postgraduate students. We are also elated by the ever-increasing external financial support, mostly from the NRF and DHET, but also other from third stream income obtained from industry.

The faculty remains committed to recruiting good quality, innovative students and to giving them the best possible learning experience. We ensure quality through vigorous quality control measures within the faculty, warranting that the research we produce is not only of good quality but also adheres to high ethical standards and is endorsed by good research conduct. Various staff members and postgraduate students attended local and international conferences where they shared their research findings with peers and created new partnerships with other institutions in line with the university's internationalisation strategy. A renewed effort was also made to promote and stimulate innovation by staff and students and to assist these individuals in registering patents and developing the new products.

This report represents the culmination of many hours of hard work by staff and we would like to acknowledge everyone in the Faculty of Health and Environmental Sciences who has contributed to the faculty achievements and to encourage others to learn from these achievements.



Prof. C. van Westhuizen
Assistant Dean: Faculty Health
and Environmental Sciences

Proposal and article writing workshops

In order to enable staff to provide effective and efficient supervision to postgraduate students, to be able to write articles and publish in accredited scientific journals, as well as to support students with specialised research skills, the faculty either organised proposal and article writing workshops or supported staff and students to attend such on- and off-campus workshops and short courses.

From 20 to 23 November 2017 the academics and prospective master's degree students from the Department of Clinical Sciences participated in a four-day workshop session. The purpose of the workshop was twofold, namely proposal writing for the master's degree students and finalisation of prepared articles with the scientific and language editor. An average of 25 persons attended the sessions.

The proposal writing programme was structured around the needs of the sixteen new master's degree students in the Radiography programme. The assistance during the workshop allowed at least three students to have a feasible and well-defined research project in order to be able to formally register for a master's degree, with the remaining course participants finalising their proposals during 2018.

In May 2017, Dr Struwig, a scientific and language editor presented an article writing workshop in the Department of Clinical Sciences. Colleagues who attended the workshop had the opportunity to draft their articles and forward these to Dr Struwig by October 2017. On day one of the article writing workshop, Dr Struwig gave feedback to the colleagues on the articles submitted. Colleagues then had time to address the feedback and finalise the articles at the workshop. They then resubmitted the drafts to Dr Struwig and submitted the articles for publication on day two of the article writing workshop, after final checks were done. Six articles were submitted for publication, while two articles were submitted to the scientific editor for feedback.

Similarly, staff of the faculty attended a workshop on writing for academic publication on 27 and 28 February 2017 in Kempton Park, Gauteng. Staff and students also attended numerous one-day workshops presented by the CUT's Institutional Research Office.

Staff of the Department of Clinical Sciences attending the article writing workshop presented by Dr Struwig





Staff of the Department of Agriculture attending to the prickly pear plantation on the CUT experimental farm.



The Advisory Committee of the Department of Agriculture observing some of the animals on the CUT experimental farm. Several research projects will be implemented on this farm.

Experimental Agricultural Farm

The Department of Agriculture within the Faculty of Health and Environmental Sciences was assisted to purchase a small farm nearby Bloemfontein. This production unit will be used for training of students and also for research purposes. The available infrastructure and resources will allow staff and postgraduate students to run long-term research projects. A multi-disciplinary approach will be followed according to which other departments will also be involved on the farm, e.g. engineering students will assist in developing monitoring equipment for water levels in boreholes, reservoirs and in the soil profile in different fields. Many innovative projects have also been lined up, one example of which is the processing of prickly pears.

Indigenous knowledge systems research: Application of an eco-store model based on Basotho indigenous plant knowledge

The research team consist of Dr I.T. Manduna (Principal Investigator), Ntate T. Ntjane (Traditional healer and Co-investigator), Mme Mofammere (Traditional healer and Co-investigator) and Mr LJ Kobo (Farmer and Co-investigator).Through a multilateral and multidisciplinary partnership between academics and various indigenous knowledge practitioners, this project aims to establish a replicable biocultural eco-store model based on indigenous plant knowledge of the Basotho people of the Free State, South Africa. Rather than merely integrating knowledge systems, the eco-store model builds a synergy and complementary relationship between indigenous knowledge (IK) and modern science. The pilot products of this eco-store model are mainly traditional healing plants. Indigenous vegetables, because of their multifunctional characteristics, are also kept.

Several activities have been carried out towards the establishment of the eco-store. Ethnobotanical surveys done in the study area have allowed the documentation of several plants that are used routinely by traditional healers in their practice. This information is being compiled in a catalogue that will be published in Sesotho to ensure accessibility to the people who use these plant resources.

Left: Picture of a tincture made from a medicinal plant named khoara (*Pelagonium* sp)

Right: Pictures of bath salts made from Eucalyptus oil and Maringa (tropical plant used to enhance the colour and antioxidant properties of the salt)



Workshops were held with students and staff of the CUT and traditional healers of the Kopanang Dingaka Association of Thaba 'Nchu, to give examples of beneficiation through the production of tinctures and bath salts from medicinal plants. This is important as beneficiation helps to keep medicinal plants relevant for contemporary life and can promote income generation from traditional medical practice. The workshop also emphasised important issues such as the maintenance of good hygiene, use of consistent measurements, and also good plant collection practices. The eco-store will source some products from the traditional healers.

A number of postgraduate students are involved in the study. Students have projects that evaluate the bioactivity of the plants and their potential in:

- drug development as antimicrobials etc. for human and veterinary applications,
- development of biopesticides, and
- development of new phyto-preservatives for food (e.g. fruit juices).

Other student projects investigate preservation methods for indigenous vegetables and their safety. The students were also involved in tincture and bath salts making.



Ntate Kobo presenting on the Economic Benefit of Indigenous Plant Knowledge to students and staff at the Product Development Workshop Part 1 (October 2017)



Food industry effluent characterisation

Dr De Smidt has been active in the Centre for Applied Food Security and Biotechnology (CAFSaB) as a contract researcher since 2011. She conceptualised and spearheads the “Food industry effluent characterisation” research initiative. This focus area has three core interests: effluent traceability (or source tracking), exploring bioremediation opportunities and indigenous microbial consortia application for treatment of food industry effluents and establishing a microbial culture collection from different effluents. The research team consists of postgraduate students and academic collaborators, as well as partners from local industries.

Projects require extensive research operations in both the field and the laboratory. To date, Dr De Smidt and her team have demonstrated the usefulness of microbial diversity as fingerprints for poultry abattoir effluent and traceability of effluents to the recipient wastewater treatment works when using denaturing gradient gel electrophoresis (DGGE) as fingerprinting tool. Successful lowering of contaminant levels in red meat abattoir effluent has been demonstrated when treated in sequencing batch reactors (SBRs) custom designed for the project. Furthermore, the microbial culture collection is expanding rapidly and contains over 1 000 bacterial and yeast isolates from the effluents of various food industries including beverage manufacturers and abattoirs.

Other projects that Dr De Smidt is actively involved in include bioaerosols in the food industry environment, yeast diversity and associated antimicrobial resistance in beverage production facilities, and antimicrobial properties of metal alloys used for printing medical implants.

Dr De Smidt received funding for 2017 from the NRF under the Thuthuka instrument. Two postgraduate students received research travel grants from Whitehead Scientific and TestIt LAB to attend an international conference.

Dr De Smidt hosted four NRF final year student assistants from the Environmental Health programme who were involved in the food industry effluent characterisation focus area. Three postgraduate students were given the opportunity to present their research at the 4th International Conference on Microbial Diversity held in Bari, Italy during October.

Ms KM Corbett completed her research on yeast diversity and rapid detection of spoiler yeasts in a beverage production facility and was awarded a master's degree in Health Sciences in Environmental Health (*cum laude*) in March 2017.

Dr De Smidt collaborated with researchers from the University of the Free State, Stellenbosch University, Cape Peninsula University of Technology and University of Ljubljana. Several partners from local food industries also participate in food industry effluent characterisation research projects. She has a shared equipment agreement with Van Rensburg-Lancet Pathologists. They are currently the only private sector lab in the Free State that owns and operates a matrix-assisted laser desorption/ionization-time of flight mass spectrometer (MALDI-TOF MS) with both a clinically relevant (IVD) and environmental isolate database (SARAMIS RUO) exclusively used for rapid microbial identification.

Inter institutional collaboration included partnerships with Dr L Esterhuizen (Life Sciences), Dr N Luwes (Electrical Engineering) and Prof. I Yadroitsau (SARChI research chair – CRPM).



4th International Conference on Microbial Diversity held in Bari, Italy. Attended by Francois le Roux, Olga de Smidt, Morakane Keswa, Leana Esterhuizen and Edrick van der Merwe. Edrick and Morakane participated in the student research poster competition.



Fostering strategic partnerships

Institution	Nature of partnership
Glen, UFS, ARC, SA Studbook and the Grootfontein Development Institute.	Research collaboration
UFS and SAPPA	Pecan nut research project
NWU	Maize insects
Dorper and Nguni Breeders' Society	Research collaboration
National Institute of the Deaf (NID)	Assist in training and employment of deaf people in Agriculture
UNISA	Research collaboration
University of Illinois	Research collaboration
Department of Cardiothoracic Surgery, University of the Free State.	Research and academic collaboration
Coca-Cola	Research collaboration
University of Kimpa Vita in Angola	On-going collaboration
University of Kimpa Vita in Angola	On-going collaboration funded by NRF

Completed master's degrees

- Adukpo, D.L. (2017). Designing a strategy for construction of human P450 expression library in *Escherichia coli*. Master's in Health Sciences in Biomedical Technology. Central University of Technology, Free State.
- Katikati, A. (2017). Assessment of production practices of emerging cattle farmers in selected districts of the Eastern Cape Province, South Africa. Master's in Agriculture. Central University of Technology, Free State.
- Mariri, N.G. (2017). *In vitro* evaluation of the bioactivity of *Gnidia polycephala* and *Senecio serratuloides*. Master's in Health Sciences in Biomedical Health. Central University of Technology, Free State.
- Matowane, R.G. (2017). P450s of skin infectious fungus *Sporothrix schenckii*: *In silico* characterisation of azole drug target P450 CYP51. Master's in Health Sciences in Biomedical Technology. Central University of Technology, Free State.
- Moabi, N.A. (2017). Microbial quality of communal hand-washing water at African funerals in the Mangaung region. Master's in Health Sciences in Environmental Health. Central University of Technology, Free State.
- Mokgawa, S.D. (2017). Toxicology of *Asparagus laricin* extracts in rats. Master's in Health Sciences in Biomedical Health. Central University of Technology, Free State.
- Nhabe, T. (2017). Antimicrobial properties of essential oils against bulk-tank isolated bacteria. Master's in Health Sciences in Environmental Health. Central University of Technology, Free State.
- Perkins, J.J. (2017). Evaluation of accurate tidal volume as displayed on the Avea™ ventilator using predetermined neonatal ventilator settings. Master's in Health Sciences in Clinical Technology. Central University of Technology, Free State.
- Pretorius, F.J. (2017). Impact of peak intraoperative lactate levels on post-operative outcomes in congenital cardiac surgery. Master's in Health Sciences in Clinical Technology. Central University of Technology, Free State.
- Richards, M.T. (2017). Analysis of cytochrome P450 monooxygenases and their redox partner ratios in the genus *Mycobacterium*. Master's in Health Sciences in Biomedical Technology. Central University of Technology, Free State.
- Senyatsi, K.L. (2017). A descriptive analysis of smallholder pig production in Kwazulu-Natal Province, Republic of South Africa. Master's in Agriculture. Central University of Technology, Free State.
- Thompson-Jooste, L. (2017). Comparison of heart valve flow dynamic assessment between echocardiography and pulse duplication. Master's of Health Sciences in Clinical Technology. Central University of Technology, Free State.
- Van Wyk, R. (2017). *In silico* analysis of cholesterol catabolic genes/proteins in the genus *Mycobacterium*. Master's in Health Sciences in Biomedical Technology. Central University of Technology, Free State.



Completed doctoral degrees

- Bamal, H. (2017). Phylogenetic, structural and functional analysis of cytochrome P450 monooxygenase CYP5619A1 from *Saprolegnia declina*. Doctorate in Health Sciences in Biomedical Technology. Central University of Technology, Free State.
- Fadeyi, O.A. (2017). Sectoral impacts of global financial crises and high food prices: A Computable General Equilibrium (CGE) analysis for South African agriculture. Doctor Technologiae: Agriculture. Central University of Technology, Free State.
- Gleimius, H.C.L. (2017). Blood parameter responses in mice (*Mus musculus*) exposed to an electromagnetic field. Doctorate in Environmental Health. Central University of Technology, Free State.
- Igene, L. (2017). Innovative methods for identifying training needs of Shea butter processors in North Central Agro-ecological zone of Nigeria. Doctor Technologiae: Agriculture. Central University of Technology, Free State.
- Nwigwe, C.S. (2017). Root-enhancing properties of rhizospheric bacteria on Eucalyptus hybrid cuttings. Doctorate in Environmental Health. Central University of Technology, Free State.
- Setlhare, G.G. (2017). An investigation of essential oils as antimicrobial agents against antibiotic-resistant bacteria isolated at South African Hospices. Doctorate in Environmental Health. Central University of Technology, Free State.

List of conference posters

- Keswa, A.M. and De Smidt, O. (2017). Bacterial diversity in poultry abattoir effluent. Poster presented at the 4th International Conference on Microbial Diversity in Bari, Italy from 24 - 26 October 2017.
- Khetsha, Z.P. and Teele, T. (2017). Teaching multidisciplinary agricultural disciplines in a university of technology. Poster presented at HELTASA in November 2017, Durban University of Technology.
- Nkhebenyane, J. (2017). Development of antimicrobial susceptibility amongst microbiota from hospices in South Africa. Poster presented at IAFP in Florida, USA in July 2017.
- Raphela, S.F. (2017). A review of interactive teaching practices in Anatomy and Physiology and the impact on student performance. Poster presentation at SAAHE, 6 – 8 July 2017, North West University, Potchefstroom campus.
- Slabbert, R. and Friedrich-Nel, H. (2017). Extended curriculum programme evolution: A road map to academic success? Poster presented at the International Conference on Education. 4 – 7 June 2017. Stockholm, Sweden.
- Van Der Merwe, F.C., De Smidt, O. and Theisinger, S.M. (2017). Coliform diversity in abattoir effluent. Poster presented at the 4th International Conference on Microbial Diversity in Bari, Italy from 24 – 26 October 2017.

List of conference papers

- Bamal, H., Mashele, S.S., Tuszyński, J. and Syed, K. (2017). *In silico* structural and functional characterisation of a novel cytochrome P450 CYP5619A1 from *Saprolegniadiclina*. Paper presented at an international conference.
- Chandrashekhar, K., Vishwapathi, V.K. Moinuddin, Z., Agarwal, Y. and Kendrekar, P. (2017). Self-Assembly, Recognition, and Applications (SARA) 2017. Paper presentation at Institute of Physics (IOP) Conference, 14th December 2017, University of Lincoln, Joseph Banks Laboratories, Lincoln, United Kingdom.
- De Smidt, O., Van Der Merwe, F.C., Le Roux, F.P., Erasmus, H. and Keller, M. (2017). Bacterial community shift in aerobic abattoir effluent bioreactors. 4th International Conference on Microbial Diversity: Bari, Italy from 24 – 26 October 2017.
- Du Plessis, J. (2017). Deliberation of student qualitative commentaries to improve work-integrated learning in a health sciences programme. Paper presented at International Conference on Education. 4 – 7 June 2017. Stockholm, Sweden.
- Du Plessis, J. (2017). Stakeholders' viewpoints on work-integrated learning practices in radiography training in South Africa: Towards improvement of practice. Paper presented at SoTL conference 25 – 27 October 2017. CUT.
- Friedrich-Nel, H. and Munro, H. (2017). Ethics presentations at CPD events: will the patient benefit? Paper presented at SORSA RSSA conference 3 – 5 November 2017. ICC Durban.
- Friedrich-Nel, H. (2017). The perceptions of the doctoral supervisor on the quality of postgraduate supervision. Paper presented at SoTL conference CUT 25 – 27 October 2017. CUT.
- Friedrich-Nel, H. and Mac Kinnon, J. (2017). The culture of quality in doctoral education: The role of the doctoral student supervisor. Paper presented at 6th Postgraduate Supervision conference, Spier, Stellenbosch. 28 – 31 March 2017.
- Jonker, J. (2017). Time flies: Are somatology students prepared 'pilots'? Paper presented at 4th international conference of Scholarship of Teaching and Learning (SoTL) in Higher Education, 25 – 26 October 2017, Central University of Technology, Free State, South Africa.
- Khetsha, Z.P. and Teele, T. (2017). Pedagogical preparedness amongst student-teachers: Agricultural graduate perspective. Paper presented at 3rd Annual International Conference on Scholarship of Teaching and Learning (SoTL) in Higher Education, Central University of Technology, Free State, Bloemfontein. October 2017.
- Khetsha, Z.P. (2017). Criticality, reflexivity and praxis: Case of teaching and learning approach to Agricultural Management Discipline, CUT. Paper presented at 21st International Conference on Teaching, Education & Learning, Voila-Bagatelle Hotel, Mauritius. July 2017.
- Khetsha, Z.P. (2017). Criticality, reflexivity and praxis: Case of teaching and learning approach to Agricultural Management Discipline, Central University of Technology, Free State. Paper presented at 4th Innovation in Learning and Teaching Conference, 1 – 2 June 2017, Central University of Technology, Free State.
- Le Roux, F., Botes, E., De Smidt, O. and Esterhuizen, L. (2017). Coliform diversity in a drinking water distribution system. Paper presented at the 4th International Conference on Microbial Diversity, Bari, Italy. 26 – 26 October, University of Bari Aldo Moro.

- Madamombe-Manduna, I.T. and Mabote, S. (2017). Herbal mixtures sold for the treatment of bromhidrosis in Bloemfontein, South Africa. Paper presented at the 2nd International Conference of the Society for Medicinal Plants and Economic Development (SOMPED). 27 – 30 August 2017. Johannesburg, South Africa.
- Muller, H. and Friedrich-Nel, H. (2017). Bachelor of Radiography in Diagnostics: Central University of Technology, Free State. Paper presented at SORSA RSSA conference 3 – 5 November 2017. ICC Durban.
- Muller H. (2017). Radiation safety training. Paper presented at Radiation Safety colloquium. Faculty of Health Sciences, UFS. 5 – 6 December 2017
- Nkhebenyane, J. (2017). International Health Regulations and Requirements to Build Epidemiology Capacity in South Africa. Paper presented at the PHASA workshop during September 2017 at Indaba Hotel Fourways, Gauteng.
- Oosthuysen, J. (2017). Safe water, safe dentistry, safe kids; What's new on infection control for dental handpieces; and How big is our infection control compliance elephant? A global best practice perspective. Papers presented at the Country Branch, South African Dental Association Western Province at Ashanto Estate in Paarl. 14 June 2017.
- Phahlamohlaka N. (2017). Psychosexual experiences of prostate cancer following radiotherapy. Paper presented at SASCRO SASMO conference 4 – 6 August 2017. Sandton Convention Centre Johannesburg.
- Pudumo, K., Monyaki, R., Mashele, S.S. and Syed, K (2017) Gene-cluster analysis of CYP121 and CYP125 genes in the genus *Mycobacterium*. Paper presented at international conference.
- Raphela S.F. (2017). Prevalence of musculoskeletal disorders among employees in a welding company within Mangaung Metropolitan Municipality. Paper presented at PSSA 2017 conference at the University of Pretoria from the 28 – 30th August 2017.
- Roberts, H. (2017). Paper presented at the ISWA World Congress & WASTECON 2017 conference in Baltimore, Maryland, USA from 25 – 27 September 2017. She also attended a mobile, industrial training session on 28 September to Freshkills Landfill/Park in Staten Island, New York City.
- Sebelego, I-K. (2017). Investigating the utilisation of radiographic criteria in radiography by means of mixed methods. Paper presented at Applying mixed methods to move disciplines forward conference, organised by Mixed Methods International Research Association. Saint George Hotel & Conference Centre, Irene, Pretoria, South Africa. 30 August – 01 September 2017.
- Van Der Linde, B. (2017). Enhancement of postgraduate skills through an educational programme. Paper presented at International Conference on Education. 4 – 7 June 2017. Stockholm, Sweden.
- Van Der Merwe, B. (2017). Are we armed to keep Africa safe? Paper presented at SORSA RSSA 3 – 5 November 2017.
- Van Der Merwe, B. (2017). Catch me if you can. Paper presented at SAAHE. 6 – 8 July 2017, North West University, Potchefstroom campus.
- Van Der Merwe, B. (2017). Flexible learning. Paper presented at SORSA RSSA Durban ICC. 3 – 5 November 2017.
- Van Der Merwe, B. (2017). Radiation safety colloquium. Paper presented at Faculty of Health Sciences, UFS. 5 – 6 December 2017.
- Van Der Merwe, B. (2017). The amazing Roentgen race. Invited speaker at the Biennial Association for Peri-operative Practitioners in South Africa (APPSA) congress, Sand du Plessis theatre, Bloemfontein, 21 April 2017.

- Van Wyk, M., Nelson, D.R., Mashele, S.S., Chen, W. and Syed, K (2017) *In silico* analysis of cytochrome P450 monooxygenases in the genus *Mycobacterium tuberculosis*. Paper presented at international conference.
- Vishwapathi, V.K., Moinuddin, Z., Agarwal, Y., Kulkarni, Chandrashekhar V. and Kendrekar, P. (2017). Towards improving the biocompatibility of carbon nanomaterials using lipid self-assemblies. Paper presentation at the Institute of Physics (IOP) Conference "Self-Assembly, Recognition, and Applications (SARA) 2017", 14 December 2017, University of Lincoln, Joseph Banks Laboratories, Lincoln, United Kingdom.
- Zeelie, L. (2017). Novel approaches to teaching research methodology at universities of technology: A South African perspective. Paper presented at International Conference on Education. 4 – 7 June 2017. Stockholm, Sweden.

List of conference proceedings (DHET accredited output)

- Theisinger, S.M. and De Smidt, O. (2017). Bioaerosols in the food and beverage industry in: Ideas and applications toward sample preparation in food and beverage analysis. Ed. Stauffer M. INTECH; ISBN 978-953-51-3686-6. pp 51-75. DOI: 10.5772/intechopen.69978

List of other conference proceedings

- De Smidt, O. (2017). Bacterial community shift in aerobic abattoir effluent bioreactors. Conference: Microbial Diversity: drivers of microbial diversity. Publisher: SIMTREA. ISBN Number 978-88-943010-0-7
- Du Plessis, J. (2017). Deliberation of student qualitative commentaries to improve work-integrated learning in a health sciences programme. International Conference on Education. 4 – 7 June 2017. Stockholm, Sweden. Publisher: Clute Institute. ISBN Number ISSN 2157-9660
- Kotzé, B., Friedrich-Nel, H.S. and Van Der Merwe, B. (2017). Enhancement of postgraduate skills through an educational programme. Conference: International Conference on Education. Publisher: Clute Institute. ISBN Number ISSN 2157-9660
- Slabbert, R. and Friedrich-Nel, H. (2017). Enhancement of postgraduate skills through an educational programme. International Conference on Education. 4 to 7 June 2017. Stockholm, Sweden. Publisher: Clute Institute. ISBN Number ISSN 2157-9660
- Slabbert, R.S. and Friedrich-Nel, H. (2017). Extended Curricula Development at the Faculty of Health and Environmental Sciences, Central University of Technology, Free State, South Africa: A success story. Conference: International Conference on Education, Stockholm 4 – 8 June 2017. Publisher: Clute Institute. ISBN Number ISSN 2157-9660 (Online)
- Theisinger, S.M. and De Smidt, O. (2017) Bioaerosols in the food and beverage industry in: Ideas and applications toward sample preparation in food and beverage analysis. Ed. Stauffer M. INTECH; ISBN 978-953-51-3686-6. pp 51-75. DOI: 10.5772/intechopen.69978

List of journals/articles (DHET subsidised)

- Achilonu, M., Sedibe, M. and Shale, K. (2017). Bioactive Phytochemicals: 2. Efficient Synthesis of Optically Active Substituted Flav-3-enes and the Flav-3-en-3-O-derivatives. *Journal of Chemistry*. DOI:10.1155/2017/3971253.
- Alabaraoye, E., Achilonu, M. and Roberts, H.A. (2017). Biopolymer (Chitin) from various marine seashell wastes: Isolation and characterization. *Journal of Polymers and the Environment*, 2017: 1572-8900.

- Badenhorst, J., Fourie, P.J. and Vosloo, M. (2017). The effects of Swedish massage on performance horses in the Bloemfontein area. *Journal of New Generation Sciences*. Vol 15 (no2).
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07

Faculty of Humanities



A message from the Dean

Professor N.N. Feza

I feel honoured and privileged to present this overview of research activities and development of the Faculty of Humanities. Generally, the faculty demonstrated its potential to become a creative and innovative research environment with relevant support provided. I therefore would like to convey my words of appreciation to the staff members for their perseverance and dedication towards research development and growth.

Research in the Humanities is growing and becoming strengthened as evidenced by the 17 articles published in DHET accredited journals, giving us 13.8 credit output points, together with a book counting 5 credit output points, therefore totalling 18.8 credits. The 18.8 credits attained in 2017 indicates a strength compared to 19.8 credit outputs of journal articles in 2016, and 13.8 in 2015. Growth that occurred in 2016 has stabilised in 2017. Predatory journals however continue to be a challenge in the faculty, as without these the credit total would have been above the current status. This indicates potential for growth as the credit outputs in accredited journals show much resilience. The master's and doctoral graduations also indicate similar patterns to those of 2017. The faculty graduated 11 master's and 3 doctoral graduates. These numbers again indicate stability as in 2015 the numbers were 10 master's and 2 doctoral graduates while in 2016 10 master's and 4 doctoral degrees were conferred.

The faculty is research active, as also demonstrated by the strong attendance of conferences by staff members. Hosting of international and national research seminars exhibits visionary research leadership, and this is evident at the CUT and in the faculty.



Prof. N.N. Feza
Dean: Faculty of
Humanities

A message from the Assistant Dean: Research, Innovation & Engagement Professor M.K. Mhlolo

It is that time of the year once again, when I have to present the Faculty of Humanities' Research, Innovation and Engagement Report for 2017. A number of milestones were reached in the faculty during the year under review. We have been without a Dean ever since Prof. Ngidi was promoted to the post of Deputy Vice-Chancellor (DVC) Teaching and Learning. Prof. Ngidi therefore last presented as Dean of the Faculty in the 2015 Research Report. In the 2016 Research Report, Prof. Van Schalkwyk presented her overview as the Acting Dean of the faculty. We now have a new Dean, Prof. Feza, who will be presenting her overview for the faculty for the first time in this 2017 Report. Let me take this opportunity to do two honourable things: Firstly, I would like to thank both Prof. Ngidi and Prof. Van Schalkwyk for their excellent leadership of the faculty during their term of office – I wish you well in your new portfolios. Secondly, I would like to welcome Prof. Feza as the new Dean to the faculty and assure her that we will give her unwavering support during her time with us.

I would now like to take you through the faculty's research activities for the period under review.



Prof. M.K. Mhlolo
Assistant Dean: Faculty
of Humanities





A message from Emeritus Professor I.M. Ntshoe

Centre for Innovation in Learning and Teaching and Faculty of Humanities

Professor Ntshoe is the leader of a research project on the scholarship of teaching and learning (SoTL) in universities of technology in particular, and in higher education in general. The main purpose of the project is to build capacity amongst staff at the Central University of Technology (CUT) in order for all to understand the centrality of teaching and learning in a university of technology (UoT) and in the higher education context both nationally and globally.

There are two innovations in the SoTL project at CUT that are of particular importance. First, there is the mentor-mentee strategy, where more experienced academic staff members support upcoming staff members to develop and improve their own practice. Second, there is the Group of Communities of Practice (GCPs), each focusing on specific domains of teaching and learning.

The research seeks to contribute to knowledge in general on the relationship between curricula of fields of practice offered in UoTs, and pedagogies of teaching and learning in specific fields and disciplines. The research project therefore advances knowledge on curriculum and pedagogies (teaching and learning) of specific disciplines, highlighting the nature and distinctiveness of curricula of the different fields of practice, and how these features shape teaching and learning of different disciplines.

Notably, the description above contributes to the continuing project which investigates the distinctiveness of curricula of universities of technology and their pedagogies.



Prof. I.M Ntshoe
Emeritus Professor
Faculty of Humanities

Prestige Research Day

The Annual Faculty Prestige Research Seminar is a fundamental part of our scholarly activities in the faculty. By bringing our faculty staff together with their postgraduate students, these seminars do not only provide a formal structure for their interaction but also provide a distinctive opportunity for them to showcase their research. The Research Seminar also serves to encourage students to synthesize the evidence they have gathered thus far, thereby helping them to refine their research as it proceeds.

The Faculty of Humanities held its Prestige Research Seminar 2017 on Friday, 10 November 2017, in the Japie Van Lill Auditorium. Dr Kevin Teise and Dr June Palmer from University of the Free State were our invited speakers. Their theme for the research seminar discussion was: *On becoming a scholar*.



Participants
at the Annual
Faculty Prestige
Research Seminar

Community engagement – Lesson Study workshop by Professor Maitree Inprasitha

International assessments in Mathematics and Science reveal consistently high performance by students from Japan and other Asia Pacific countries. The question is, how has Japan achieved this consistent standing, and what might other countries learn from the Japanese experience? One of the topics receiving worldwide attention is the Japanese Lesson Study, which is recognised as an engine for above-average achievement of Japanese students. Globally there has been growing interest in, and government support for, Lesson Study as a powerful form of professional development. In January 2017 the Faculty of Humanities hosted the SAARMSTE. The CUT took advantage of the MOU signed with Khon Kaen University in Thailand, to invite an expert on the Lesson Study approach to run a workshop for teachers in Bloemfontein.



Prof. Maitree and Dr Narumol Inprasitha conducting the Lesson Study workshop.

Prof. Dr Maitree Inprasitha is Dean for the Faculty of Education, Khon Kaen University, Thailand. He is a professor for the Mathematics Education Programme at the Faculty of Education, Khon Kaen University. He holds a PhD in Mathematics Education from the University of Tsukuba, Japan, and has extensive experience in studying Japanese Lesson Study for more than 15 years. His main research focus and publications are related to Mathematics education, and teaching styles of the Lesson Study and Open Approach. He has been overseeing the APEC Lesson Study series since 2006. A total of 19 Asian-Pacific Economic Cooperation (APEC) member countries have participated in this project, and Prof. Dr Maitree Inprasitha has advanced the Lesson Study community in APEC. On 20 January 2017, a Lesson Study workshop was held in the Artec Hall, Central University of Technology. A total of 72 participants were representatives from various constituencies, such as the Faculty of Humanities, Central University of Technology, Teacher unions, the Free State Department of Education, non-government organisations, the University of the Free State, the University of Witwatersrand, Sol Plaatje University, and Foundation phase educators from selected schools in the Motheo educational district.

A grade 3 class, consisting of 15 learners (from Heide primary school), was used for the practical demonstration of the Lesson Study approach during the Open Class session. The grade 3 teacher, Ms D. Iannore from Heide primary school, presented a lesson to the learners, on division. All attending participants observed the lesson, and made notes on the above mentioned questions as well.

The CUT-KKU delegation also visited Eunice Primary and High Schools. Eunice High School is regarded as the top Maths and Science school in the Free State province. Eunice was also awarded as the Top Performing Public School in South Africa at the 2016 Education Awards Ceremony.

From left, Dr Kalobo (CUT), Prof. Van Schalkwyk (Acting Dean Humanities), Prof. Ngowi (DVC Research), Prof. Maitree Inprasitha (Thailand) and Prof. Alexander (CUT)





Standing from left to right: Mrs Magwa, Mr Marumo, Mrs Nyoni and Ms Thejane.

Seated from left to right: Mrs van Wyk, Prof. Mhlolo and Ms Mohokare

Activities of the Research Unit for Giftedness in Mathematics

In 2013, the CUT Senate and Council approved a University Research and Development Plan. The objectives of this plan are directed at building a critical mass in research and optimising opportunities to grow research outputs. The Plan identified the approved Research Clusters and Programmes as a meaningful vehicle to meet the outputs of the Plan by 2020. Strategy 2 of the Plan suggests meaningful structural support to achieve the desired outputs. One such mechanism is research performed by a critical mass organised in Research Centres/Units/Groups. In line with this strategy, STEM education was identified as important to the CUT's vision. Our Unit for Giftedness in Mathematics responds to the Central University of Technology, Free State's vision and mission. More specifically, research on gifted students is aligned with the university's "Youth into Science" strategy. According to the policy, in relation to innovation, the "Youth into Science" strategy seeks to nurture young talent to support a stronger national system of innovation, by developing the next generation of productive and representative researchers.

This project is also funded by the NRF on a Thuthuka Rating Category. There are currently 5 master's and 2 doctoral students who are all researching different aspects of education for the gifted.

Our work is guided mainly by François Gagné, a Canadian psychologist who has done a lot of research on gifted students. Gagné has devoted his 50+ years' career toward research on the education of the gifted. He was given the Distinguished Scholar Award from the National Association for Gifted Children for significant contributions to the field of knowledge regarding the education of gifted individuals. Gagné began imagining a logical follow-up to his first set of principles on gifted education and as he began working on the second list of principles, the idea of stating them as commandments sprang to mind, no doubt influenced by God's 10 commandments. In developing his 10 commandments, Gagné's aim was to extract from the existing literature on gifted students, a series of principles that would be sufficiently basic and solidly grounded to enable both interpretation and implementation as well as to withstand the test of time. His fifth commandment says: *Thou shalt intervene earliest*. His main argument is that the longer we wait to attend to the gifted students' needs for an appropriate learning environment, the more we risk exacerbating their boredom and ennui. We found this to be resonating with what we are trying to achieve in our project and so this is what is embroidered on both our jackets and our golf shirts.

Attending the DAAD DIES ProGRANT 2017 Course

In September 2017, the German Academic Exchange Service (DAAD), the DIES ProGRANT Coordination Centre at the University of Cologne, and proWISS put up a call for the DIES ProGRANT Alumni Workshop 2017. Potential participants were DIES ProGRANT Alumni from all four DIES regions (Latin America, Africa, the Middle East, and Southeast Asia) where the proposal writing courses for research grants had been run from 2014 – 2016. Most of the costs for participants of the DIES ProGRANT Alumni Workshop 2017 were to be covered by funds from the DAAD provided by the German Federal Ministry for Economic Cooperation and Development (BMZ). Because this was a highly competitive financial support programme, only 28 participants were selected according to the quality of their Letter of Motivation and also based on regional and institutional profiles. Prof. Mhlolo was once more successful in his application and was therefore invited to participate in this high-level course.

Broad aim of DAAD DIES ProGRANTS:

The aim of the training course “Proposal Writing for Research Grants” (ProGRANTS) is to support upcoming academics from Africa, Latin America, the Middle East and Southeast Asia to perfect their proposal writing skills according to international standards, and to design, write and budget a competitive proposal for national and international research funding.

Specific aim of December 2017 alumni workshop

Through this workshop the University of Cologne (UoC) coordination centre aimed at strengthening the alumni’s skills in teaching in higher education. The assumption was that the members of the DIES ProGRANT Alumni Network had successfully completed each of the three ProGRANT phases and are, thus, advanced in proposal writing. Therefore, this group of individuals represents a high-potential pool of professionals that are crucial multipliers for proposal writing and subject specific knowledge. It was hoped that the participants of this higher-level workshop would take on the role of trainers in their own institutions.



Professor
Michael Mhlolo
at the DAAD
DIES ProGRANTS
workshop in
Germany



Completed master's degrees

- Alberts, M.J. (2017). Investigating the role of school management teams in the implementation of inclusive education at schools in the Mangaung Metropolitan municipal area in the Free State. Central University of Technology, Free State.
- Faber, H.A. (2017). 2-D and 3-D Design at a university of technology: A retrospective outcome. Central University of Technology, Free State.
- Havenga, S.P. (2017). Customized finishing techniques on entry level FDM 3D printed artefacts in visual arts: An explanatory sequential study. Central University of Technology, Free State.
- Holmes, E.L. (2017). Commercial jewellery techniques: innovating selected contemporary manufacturing techniques. Central University of Technology, Free State.
- Lethena, M.S. (2017). Re-examining curriculum knowledge and pedagogy of Grade 12 Physical Science teachers. Central University of Technology, Free State.
- Louw, J.S. (2017). The development of a framework for the use of Information Communication Technology in the classroom. Central University of Technology, Free State.
- Magumela, M.M. (2017). Teachers' perceptions of support given by subject education specialists: A case study of 3 selected high schools in the Maluti Education District. Central University of Technology, Free State.
- May, Y.M. (2017). Challenges faced by women primary school principals from the ZF Mcgawu District of the Northern Cape Province. Central University of Technology, Free State.
- Mopeli, N.A. (2017). Curriculum and Assessment Policy Statement: Challenges and Dilemmas facing Senior Phase Social Sciences Teachers in Lejweleputswa District. Central University of Technology, Free State.
- Motsoere, P.A. (2017). Investigating school effectiveness in rural Setsoto Municipality Area: A strategy for school improvement. Central University of Technology, Free State.
- Ngobeni, W.P. (2017). The effect of sign language barriers amongst deaf learners: A case study of a special school in Motheo District – South Africa. Central University of Technology, Free State.

Completed doctoral degrees

- Ndamani, P.L. (2017). Leadership efficacy of secondary school principals in the Free State Province and its effect on their leadership practices and the school climate. Central University of Technology, Free State.
- Senekal, S.L. (2017). School governing body members' perceptions about their role in the governance of Secondary Schools in Lesotho. Central University of Technology, Free State.
- Tshatshu, U.J. (2017). Strategies to deal with poor learner safety in the North West Province township schools: Towards the development of a safety strategy. Central University of Technology, Free State.

List of conference proceedings

- Alberts, M.J. and Setlalentoa, W.N. (2017). The role of School Management Teams in implementing Inclusive Education in the Mangaung area in South Africa. In Proceedings of the EDC 2017, held on 3 – 5 March 2017, Bangkok, Thailand. pp 465-482. ISBN: 978-86-87043-42-8
- Alexander, G. and Mpisi, A. (2017). What do learners think of the organizational culture of historically white multicultural schools in South Africa ? In ANISSH (Eds.). Proceedings at the International Conference on Recent Developments in Social Sciences and Business Studies (RDSSB), Aqueen Hotel, Singapore, 7 – 8 December, 2017. pp 12-17. ISBN 978-602-6427-25-0
- Alexander, G. and Masoabi, C. (2017). Reflections on the state of pedagogy and perceived related challenges in Technical, Vocational, Education and Training (TVET) Engineering Studies of South Africa. In F. Uslu et al. (Eds.). Proceedings of the ADVED 2017, 3rd International Conference on Advances in Education and Social Sciences, 9 – 11 October 2017, Istanbul, Turkey. pp 1008-1017. ISBN: 978-605-82433-0-9
- Alexander, G. and Kalobo L. (2017). Lecturers' observations of a lesson study approach and open class workshop held at the Central University of Technology in South Africa. In K. Ariyaporn, R. On-anong, T. Prin, B. Siribhong, T. Pattamaporn, T. Jakkrapong and P. Witthawat (Eds.). Proceedings of the 10th International Conference on Educational Research, Faculty of Education, Khon Kaen University, Thailand, 9 – 12 September 2017. pp 253-260. ISBN: 978-616-438-066-0
- Alexander, G. (2017). White teachers' development needs in integrated school settings of South Africa: An exploratory study. In F. Uslu et al (Eds). Proceedings of the 4th SOCIONT Conference, Dubai, United Arab Emirates, 2 – 3 July 2017. pp 1167-1173. ISBN: 978-605-82433-1-6
- Bhagwandeem, R. and Rambuda, A.M. (2017). The perceptions of physical sciences learners on teacher implementation of participative learning in the classroom. In K. Ariyaporn, R. On-anong, T. Prin, B. Siribhong, T. Pattamaporn, T. Jakkrapong and P. Witthawat (Eds.). Proceedings of the 10th International Conference on Educational Research Conference, Khon Kaen University, 9 – 12 September 2017. Khon Kaen, Thailand. pp 140-149. ISBN 978-616-438-066-0
- Delport, M. (2017). Academic writing skills of doctoral candidates at the Central University of Technology, Free State (CUT): The bad, the ugly and the innovative. In A. Kuroda (Ed.). Proceedings of the 10th International Conference on Educational Research (ICER), Khon Kaen University, 9 – 10 September 2017. Thailand, Khon Kaen University, pp 387-397. ISBN: 978-616-438-066-0
- Kalobo, L. and Alexander G. (2017). Lecturers' reflections on a lesson study open class session held at a South African university: Considerations for the teaching of division in primary school mathematics. In K. Ariyaporn, R. On-anong, T. Prin, B. Siribhong, T. Pattamaporn, T. Jakkrapong and P. Witthawat. Proceedings of the 10th International Conference on Educational Research, Faculty of Education, Khon Kaen University, Thailand, 9 – 12 September 2017. pp 379-386. ISBN: 978-616-438-066-0
- Leepo, S.R. and Rambuda, A.M. (2017). Strategies to deal with academic underperformance of Grade 12 learners in the Free State, South Africa. In K. Ariyaporn, R. On-anong, T. Prin, B. Siribhong, T. Pattamaporn, T. Jakkrapong and P. Witthawat (Eds.). Proceedings of the 10th International Conference on Educational Research Conference, Khon Kaen University, 9 – 12 September 2017. Khon Kaen, Thailand. pp 650-661. ISBN: 978-616-438-066-0

- Lekhu, MA. (2017). Pre-service Science Teachers' Beliefs of Effective Physical Science Teaching. In F. Uslu (Ed.) Proceedings of the 4th International Conference on Education, Social Sciences and Humanities (SOCIOINT), Dubai, 11 – 12 July 2017. Istanbul, Turkey: Ocerint. pp 946-953. ISBN: 978-605-82433-1-6
- Marumo, J. and Mhlolo, M.K. (2017). Strategies used by teachers for supporting mathematically gifted learners in Bloemfontein high schools. In D. Pitta-Patazi (Ed.) Proceedings of the 10th International Mathematical Creativity and Giftedness (MCG) Conference, University of Cyprus, 24 – 26 April 2017. Nicosia, University of Cyprus. pp 57-61. ISBN: 978-9963-700-99-8
- Marumo, J. and Mhlolo, M.K. (2017). Grouping mathematically gifted learners: An analysis of teachers' practices in Free State High Schools. In T. Penlington and C. Chikiwa (Eds). Proceedings of the 23rd Annual National Congress of the Association for Mathematics Education of South (AMESA), 3 – 7 July 2017, Johannesburg, AMESA. pp 194-202. ISBN: 978-0-620-75954-0
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- Matoti, S.N. (2017): A comparative study of students' perceptions of their classroom environments. In Tomorrow People Organisation. Peer reviewed Conference Proceedings of the 12th Annual Education and Development Conference, Bangkok, Thailand 5 – 7 March 2017. Belgrade, Serbia: Tomorrow People Organisation. pp 9-19. ISBN: 978-86-87043-42-8
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- De Jager, H., Monnapula-Mapesela, M.L.E. and Ntshoe, I.M. (2017). Scholarship of teaching and learning in the context of a university of technology: A case of the Central University of Technology (CUT). *JNGS*, 15(91): 253-259. ISSN 1684-4998
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- Mhlolo, M.K. (2017). Regular classroom teachers' recognition and support of the creative potential of mildly gifted mathematics learners. *(ZDM) - International Journal on Mathematics Education*, 49(1): 81–94. ISSN 1863-9690
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Ntshoe, I.M. 2017. Resegregation and recreation of racism in education in a post-apartheid setting. *SARE South African Review of Education*. 23 (1): 70-90. ISSN 1563-4418

Ojo, O.A. and Ntshoe, I.M. (2017). Efficacy of collaboration in improving learning outcomes of graphic design in higher education. *South African Journal of Education*, Vol 31 no. 3. 172-192. ISSN 1011-3487

Phage, I.B., Lemmer M. and Hitge, M. (2017). Probing factors influencing students' graph comprehension regarding four operations in kinematics graphs. *African Journal of Research in Mathematics, Science and Technology Education*, 21(2): 200-210. ISSN: 1811-7295

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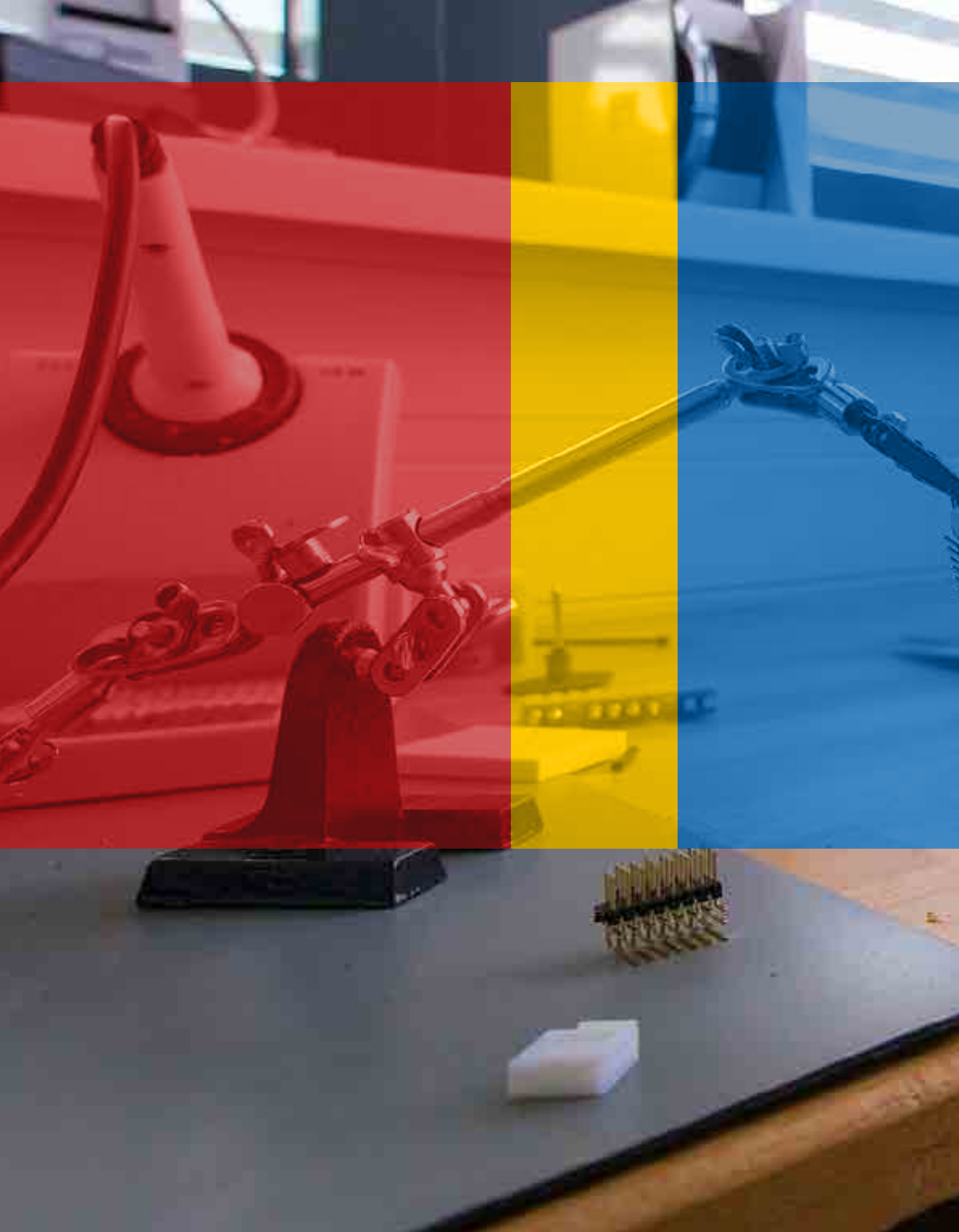
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Tondi, T.P.E. (2017). The Role of African Organic Intellectuals in (Re)-Centering of African Cultural Values and Practices: Towards the Sankofa Paradigm. *Gender and Behaviour*, 15(2): 8606-8617. ISSN: 1596-9231

Tondi, T.P.E and Nelani, N.B. (2017). Issues of Morality and Student Leadership in South African Higher Institutions. *Gender and Behaviour* 15(2): 8687-8700. ISSN: 1596-9231

List of books published

Makola S. (2017). *Pimp the pain: Purpose Inspired Dialogues*. Pretoria, UNISA Press. ISBN 978-1-8688-797-2



The background image shows a desk setup with a computer monitor, a keyboard, and a small circuit board (likely a Raspberry Pi) on the left. The image is overlaid with a blue gradient. The number '08' is displayed in large, white, outlined digits on the right side of the image.

08

Faculty of
Management Sciences



A message from the Dean Professor A.J. Strydom

The Faculty of Management Sciences is fully committed to reaching the targets set out in CUT's Research and Development Plan 2014 to 2020. The year 2017 was a stable one in terms of research performance. Although we could not manage to reach the set targets in terms of publications in accredited journals, we still recorded a growth in outputs compared to 2016. We managed to exceed the target by far in terms of the production of master's and doctorate graduates. In fact, we have been the leading faculty in terms of the last mentioned category for the past two years!

Despite this, the faculty is still facing challenges in terms of broadening its research participation base, increasing the number of full-time postgraduate students, internationalisation in research, improvement in staff qualifications and filling of vacant professor positions. A major step in the right direction was the signing of two Memorandums of Understanding with the following counterparts in Africa:

- HO Technical University in Ghana, and
- Great Zimbabwe University

A direct result of these MoUs is the fact that more than 30 staff members of those universities want to enrol as postgraduate students at the CUT.

We will continue to address all challenges in an attempt to position the faculty as a role-player to be reckoned with in the international arena.

My sincere appreciation goes to the Assistant Dean: Research, Innovation and Engagement and all contributors to a successful 2017!



Prof. A.J. Strydom
Dean: Faculty of
Management Sciences

A message from the Assistant Dean: Research, Innovation & Engagement Professor C.C. Chipunza

Various research -related development and achievements took place in the year 2017. Three master's postgraduate students were awarded NRF funding: one each in Accounting, Human Resource Management, and Marketing. Two doctoral students were awarded the NRF Scarce Skills Doctoral Scholarship and the Thuthuka Grant. Three full-time master's students travelled *to Germany and France on an exchange programme to the Corporate State University in Ravensburg. FRIC approved 14 postgraduate student proposals. Four post-docs were appointed by the faculty to spearhead research publications, and help with the supervision of students. With regard to staff qualifications, four and two (black female) staff members obtained doctoral and master's degrees, respectively. Nine staff members were registered for doctoral programmes, and four for master's degrees, at various institutions, including the CUT.*

The faculty successfully launched and hosted the 1st International Conference on Entrepreneurship Development (ICED 2017), which will be held bi-annually going forward. The Assistant Dean, Research Innovation and Engagement travelled to the Great Zimbabwe University (GZU) to explore possible areas of immediate implementation of the signed MoU between the two universities (Great Zimbabwe University and CUT, Free State). As a result of this visit, the Deputy Dean of Commerce from GZU visited CUT from 1 to 31 August 2017, as part of his contact leave, and a delegation from the CUT also went to GZU to facilitate a proposal writing workshop. The workshop resulted in three (3) staff members from GZU identifying supervisors; they are working toward registering for their doctoral studies and submission of journal articles for a joint special publication. The implementation of the MoU between CUT and Ho Technical University (HTU) was done through the enrolment of 26 staff members from HTU to study towards doctoral degrees in the faculty. The official launching of the HTU-CUT doctoral programme was held at HTU in September 2017.

The faculty was allocated a total amount of R470000 as part of DHET funding for different capacity building programmes. As a result, three data analysis workshops took place, one on *Atlas ti* and the other two on data analysis using SPSS. A total of 20 staff members participated in each workshop. Several other workshops were held for students during the course of the year.



Professor C.C. Chipunza
Assistant Dean: Faculty of
Management Sciences





The faculty's Associate Research Professor, Professor P Rambe, facilitating a proposal writing workshop

Research workshops, seminars and entrepreneurial lecture

Seven proposal writing workshops were held for staff and postgraduate students. The workshops were held at both the Welkom and Bloemfontein campuses every two weeks.

The Annual Prestige Research Seminar for the faculty was held in October 2017. The guest speaker was Professor Callie Theron, from Stellenbosch University. Postgraduate students, as well as junior and senior staff members, presented a total of ten papers at the seminar.

The Herman Mashaba Entrepreneurship Lecture is an annual event in the Faculty of Management Sciences, to promote entrepreneurship in and outside the university.



Delegates at the Herman Mashaba Entrepreneurship lecture, including the Vice-Chancellor, Professor Henk De Jager.

From left to right: Prof. C. Chipunza (Assistant Dean), Prof. C. Theron (Stellenbosch University) and Prof. A.J. Strydom (Dean) at the Prestige Seminar





SETA Project

This project is housed in the Department of Business Support Studies. It is a two-year project and was launched in 2017 with 700 students for the degree of BTech Project Management and BTech Business Administration. It is a 3p project involving CUT, Services SETA and IJ Technologies. The students are from the public sector. It is modular in nature and held on Saturdays on a fortnightly basis, with the venues located in 7 different provinces: Free State, Northern Cape, Eastern Cape, North West, Gauteng, Limpopo and Mpumalanga.

Maccauvlei and TVET Project

This project is housed in the Department of Business Management. It was launched in 2015 with an enrolment of 36 students. The value of the project is about R3.1million. The programme is offered in a modular didactical way. Facilitators are staff from the Department of Business Management, specifically, from the Human Resources Management programme.

As one of the most critical national imperatives, i.e. the call to address dire skills shortages, a consequence of the legacy of apartheid, the Central University of Technology, Free State has deliberately prioritised collaboration with the TVET sector as one of its prime focus areas, and this has culminated in the signing of an MoU with this sector in the Free State province. Amongst the many areas of urgent need within this sector, the Department of Business Management proactively identified capacitation of the HR officials from this sector as one of its priorities. Once the idea had been adequately ventilated in the department and successfully vended to the principals of the sector and their buy-in secured, mobilisation of the formidable, competent and capable HR programme team was unleashed for the successful roll-out of the project.

Over a period of one year, six study schools are presented approximately 6 weeks apart. The group was split into two smaller groups, to ensure more personal attention during the contact week. After the contact week, the students write online tests. At the end of each study school a Portfolio of Evidence is submitted. Thus far these students have completed Adv Human Resource Management IV, Research Methodology I, Industrial Relations IV and Organisational Behaviour IV. The remaining study schools are Adv Management of Training IV and Adv Strategic Management IV. All students that have so far passed, graduated at the Spring Graduation in September 2016. The second intake of this project commenced in June 2017 and it will be winding up in June/July 2018.



VALU-E Games project

CUT adopted the philosophy of becoming a true entrepreneurial university in 2014. Due to its nature, the Faculty of Management Sciences is at the helm of entrepreneurship activities at the CUT. We feel it is our responsibility to spearhead the entrepreneurial focus and culture at the CUT.

The Faculty of Management Sciences has very close links with Aalen University of Applied Sciences in Germany. One of their professors, Ulrich Holzbaur, is also an extraordinary professor at the CUT. He took the initiative to develop an entrepreneurial game called VALU-E. The purpose of the game is to explain the mechanics of entrepreneurship in a simple and visible way to target groups. The game consists of a set of six board games to demonstrate the following sub-components of entrepreneurship:

- Elementary economics
- Basic accounting
- Marketing and sales
- Management and leadership
- Sustainability
- Business Plan development

The VALU-E game will in future be managed in partnership with CUT's I-gym. The intention is to train role-players on a wide front in the basics of entrepreneurship. They include, amongst others:

- School learners (primary and secondary)
- Students
- Community members
- Owners and prospective owners of SMMEs etc.

Completed master's degrees

- Gany, K. (2017). Visitors' perception of destination attractiveness: the case of selected Kimberly resorts. Central University of Technology, Free State.
- Makhalemele, N. (2017). The relationship between managerial competencies and performance of Internet cafés in the Free State Region. Central University of Technology, Free State.
- Moeti, E. (2017). The development of a Business Social Responsibility (BSR) model to promote the long-term sustainability of hospitality SMMEs in the Free State. Central University of Technology, Free State.
- Mothotloane, L.J. (2017). Consumer behaviour of visitors attending the Mangaung Cultural Festival (Macufe). Central University of Technology, Free State.
- Mpiti, N. (2017). The influence of private and public finance on the performance of SMMEs in Free State: A case of afro hair salons in Mangaung Metropolitan Area. Central University of Technology, Free State.

Completed doctoral degrees

- Amoakoh, E. (2017). A relationship marketing model for hair salons in the Free State Province. Central University of Technology, Free State.
- Atiase, V. (2017). Impact of credit risk management practices on micro financing the poor for poverty alleviation in Africa: Insights from Ghana. Central University of Technology, Free State.
- Ndofirepi, T.M. (2017). The impact of technological creativity and entrepreneurship education on the entrepreneurship intentions of students at particular tertiary institutions in Zimbabwe and South Africa. Central University of Technology, Free State.
- Mosweunyane, L. (2017). Free State tourism SMMEs utilisation of social media technologies for business competitiveness: A stakeholder's perspective. Central University of Technology, Free State.
- Orlu, K.N. (2017). A business model for sustainable SMME pig farming in the Central Free State Province of South Africa. Central University of Technology, Free State.

List of conference posters: FRIC funded national conferences

- Adonis, V. (2017). Developing a strategic entrepreneurship development plan in local government: the case of Matjhabeng Local Municipality, Free State Province. 1st International Conference on Entrepreneurship Development (ICED), Bloemfontein, South Africa, 4 – 7 April 2017.
- Agbobl, E. (2017). Exploring the mediated effects of entrepreneurial and market orientations and innovation on the performance of Small Agricultural Enterprises in South Africa. 1st International Conference on Entrepreneurship Development (ICED), Bloemfontein, South Africa, 4 – 7 April 2017.
- Amoakoh, E., Onojaefe, D. and Naong, N. (2017). Achieving hair salon competitiveness through a relationship marketing model. 1st International Conference on Entrepreneurship Development (ICED), Bloemfontein, South Africa, 4 – 7 April 2017.
- Amoakoh, E., Onojaefe, D. and Naong, N. (2017). Determining the attitude and rate of entrepreneurship infusion within academic programmes at CUT. 1st International Conference on Entrepreneurship Development (ICED), Bloemfontein, South Africa, 4 – 7 April 2017.

- Haarhoff, R. (2017). Destination price perceptions of departing foreigners to South Africa. 6th International Conference on Global Research Issues in Social Sciences, Management and Applied Business (GRSMAB-MARCH-2017), Radisson Blu Hotel, Waterfront, Cape Town, 2 – 3 March 2017.
- Holzbau, U., Agbobli, E. and Strydom, A.J. (2017). An educational game to foster entrepreneurship. 1st International Conference on Entrepreneurship Development (ICED), Bloemfontein, South Africa, 4 – 7 April 2017.
- Jordaan, H. and Coetzee, J. (2017). Obstacles impeding the growth potential of SMMEs and access to finance. 1st International Conference on Entrepreneurship Development (ICED), Bloemfontein, South Africa, 4 – 7 April 2017.
- Lezar, L.W.P. and Van Der Walt, F. (2017). The relationship between cultural intelligence, thriving at work and psychological well-being. National Research Conference. 7 – 8 December 2017. Mancosa: Durban.
- Maime, B. (2017). Cost cutting of web 2.0 concept in South African universities: perspectives of management accounting. 2nd Interdisciplinary Research, Innovation and Postgraduate Conference, Durban University of Technology, 13 – 15 June 2017.
- Mbeo, MA and Rambe, P. (2017). Developing research culture in the faculty of engineering and information technology at the Central University of technology, Free State. 1st International Conference on Entrepreneurship Development (ICED), Bloemfontein, South Africa, 4 – 7 April 2017.
- Mkhize, D., Van der Walt, F. and Modise, A. (2017). Improving and sustaining good practices of financial management in secondary schools in Lejweleputswa District. 44th Southern African Society for Education (SASE) Conference. 4 – 6 October 2017. Gaborone, Botswana.
- Mosweunyane, L., Rambe, P. and Dzansi, D. (2017). Tourism SMMEs extent of use of social media technologies (SMTs) to position and market brands. 1st International Conference on Entrepreneurship Development (ICED), Bloemfontein, South Africa, 4 – 7 April 2017.
- Modise, D. and Rambe, P. (2017) Locus of control of engineering workforce in a power distribution utility: Implications for job performance. 1st International Conference on Entrepreneurship Development (ICED), Bloemfontein, South Africa, 4 – 7 April 2017.
- Moeti, E., Rambe, P. and Dzansi, D. (2017) Critical stakeholders that hospitality SMMEs engage with in fulfilment of their BSR activities. 1st International Conference on Entrepreneurship Development (ICED), Bloemfontein, South Africa, 4 – 7 April 2017.
- Mokokeng, K. and Rambe, P. (2017). The Influence of creative broadcasting techniques on the social sustainability of community radio stations. 1st International Conference On Entrepreneurship Development (ICED), Bloemfontein, South Africa, 4 – 7 April 2017.
- Mpiti, N. and Rambe, P. (2017). Impact of public funding on SMMEs' acquisition of technology: A hair salon business perspective. 1st International Conference on Entrepreneurship Development (ICED), Bloemfontein, South Africa, 4 – 7 April 2017.
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