DURBAN UNIVERSITY OF TECHNOLOGY
INYUVESI YASETHEKWINI YEZOBUCHWEPHESHE

DUT Research and Innovation Blueprint 2021-2030
DURBAN UNIVERSITY OF TECHNOLOGY, SOUTH AFRICA

In 2021, DUT Ranked 43rd (WURI Ranking)

FOREWORD

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It gives me great pleasure to share this Research and Innovation Blueprint 2030, which provides us with the areas that we will continue focusing on, in terms of our research and innovation (R&I) agenda, as aligned to ENVISION2030. The Blueprint 2030 has been developed considering inputs from our internal and external Stakeholders as well as other quad-helix partners, following a Research, Innovation and Engagement forum held on 28th November 2020. I therefore, thank all our Executives, Faculties, Directorates, Support staff and our quad-helix partners who have contributed to this Blueprint. It will continue to evolve and adjust where relevant, taking into account, rapid changes in our region and world. It will also inform annual deliverables in terms of research, innovation and engagement areas within the University.

On a strategic level, research and innovation (R&I) forms a major characteristic of universities which are expected to transform lives and communities through the pursuit for knowledge, training of graduates (both students and community members), production of products, solutions and spin-offs. Graduates, for instance, if actively involved in the economy can contribute to local and regional socio- and economic development. This is directly linked to Sustainable Development Goal (SDG) 1, that deals with ensuring zero poverty. At the time of writing this R&I Blueprint in 2020, South Africa was still ranked highly in terms of the Genie coefficient, that is, the measure of the gap between the rich and the poor. DUT, through its strategy, ENVISION2030, aims to contribute to societal impact and socio-economic development which in turn can help reduce this gap.

The R&I Blueprint identifies 10 key Focus Areas that will help scale up and increase impact in the R&I space, thus contributing to relevant solutions locally, regionally, nationally and internationally. The intersection with teaching and learning (T&L), Internationalisation and Staff Capacity building are key elements of the Blueprint. We hope that the University Community will find the R&I Blueprint as a useful tool to develop Divisional plans and implementable initiatives that will contribute to ensuring we deliver on the R&I agenda as aligned to ENVISION2030!

INTRODUCTION

In 2019, the Durban University of Technology adopted a new strategic direction aptly named ENVISION2030. The strategic map seeks, inter alia, to position DUT as the leader in cutting-edge research and innovation that is aimed at supporting industry advancements and societal improvement while contributing to knowledge. At its core, the plan places DUT's people as engines and catalysts of creativity, innovation and entrepreneurship so they can contribute meaningfully and productively to this changing world. The R&I Blueprint underpins Envision 2030 and supports the transition towards a people-centered approach to research productivity and innovation thereby positioning DUT as a key contributor to local, regional and global developmental agenda.

This blueprint finds expression in the global Sustainable Development Goals 2030 (SDGs); Africa's Agenda 2063; the National Development Plan 2030 (NDP) and the KwaZulu-Natal Provincial Growth and Development Strategy (KZN-PDGS). In order to contribute to the transformative socio-economic imperatives, set out in each of these local, regional and global plans, the R&I blueprint has identified 10 Key Focus Areas (KFA) as guiding instruments for DUT. A logical framework for each of these KFA has been created to clearly outline target, output, outcome and indicators at both outcome and output level. The aim is to centre these as guiding instruments for DUT in planning and executing Research and Development (R&D), innovation and commercialization activities.

Furthermore, the Blueprint is firmly anchored on the value and principles of ENVISION 2030 which already identifies research and innovation as primary drivers of change.

PURPOSE OF THE BLUEPRINT

A breakfast session was held on the 23rd of November 2020 to co-produce this R&I blueprint. This blueprint identifies and sets out a roadmap for 10 Key Focus Areas in Research and Innovation at DUT for the next 10 years. It is an outcome of a collaborative process between various key stakeholders outside, and those within DUT. Its purpose is to give baseline guiding principals and direction on how DUT people must engage in R&I areas and how different units of analysis at individual, departmental, institutional centers and institutes, research focus areas must plan and set R&I plans aligned to ENVISION2030 and the Blueprint to ensure we are all contributing effectively to the institutional priorities and our regional and national objectives.

HOW RESEARCH AND INNOVATION ARE DEFINED AT DUT?

Research

For the purposes of this Blueprint, DUT's definition of research will be adopted from the South African White Paper on Science and Technology (Department of Science and Innovation, 2019) as the "creative and systematic work undertaken to increase the stock of knowledge – including knowledge of humankind, culture and society – and to devise new applications of available knowledge".

This definition is aligned to that of the National Research Foundation (NRF) which is articulated as

follows: "an original investigation undertaken to gain knowledge and/or enhance understanding". Within these definitions, there are clear inclusions and exclusions.

This blueprint considers the following activities as key inclusions:

- The creation and systemic work to increase stock of knowledge (e.g. through dictionaries, scholarly editions, catalogues and contributions to major research databases);
- the invention or generation of ideas, images, performances and artefacts, proof of concepts, which manifestly embody new or substantially developed insights;
- building on existing knowledge to produce new or substantially improved materials, devices, products, policies, or processes, patents etc.

Innovation

In its basic form, innovation is defined as the process of introducing new ideas to the firm/organisation which result in increased firm/organisation performance. The National Advisory Council on Innovation (NACI) defines innovation as "…the process of transforming an idea, generally generated through research and development, into a new or improved service, product, process or approach that relates to the real needs of society and involves scientific, technological, organisational or commercial activities". The key to this definition is the fact that the innovation process is only complete once a defined product, process or system with some tangible benefit has been implemented"[1]. DUT adopts this definition for the purposes of this blueprint. It is also aligned to the definition of innovation in the White Paper on Science, Technology and Innovation (Department of Science and Innovation, 2019).

DUT acknowledges that innovation is key to scientific and technological progress. More importantly it sees innovation as a catalyst in resolving society's deep and pressing socio-economic challenges while also supporting commercialization. This blueprint further recognizes that innovation can emerge from scientific, technological and creative activities. It further recognizes that all the DUT "people" – staff, students, alumni and community members can contribute to innovation. It must also be pointed out that the blueprint recognizes that entrepreneurship (which is about opportunity identification, business development, self-employment, venture creation and growth) forms the core of our DNA as part of the innovative and entrepreneurial strand. We expect our researchers and innovators to have the entrepreneurial and innovative mindset and seize opportunities that will help contribute to knowledge creation, generation and design of new products and services as well as contribute to our regional socio- economic transformation[2].

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[1] National Advisory Council on Innovation Act of 1997, Section 1 (vi)

[2] The DUT Spin-Off policy, Policy for Maximizing and Diversifying Income Streams: A focus on 3rd stream Income, Fundraising Policy and the DUT Student Entrepreneurship Policy are all positioned to create an enabling environment for our people.

The Current Status Quo

Through various government policy and legislation, research and innovation has been elevated as a key catalyst for addressing South Africa's and global pressing socio-economic challenges. There is a global consensus that governments must play a pivotal role in creating a conducive environment for research and innovation to thrive through developing appropriate policy and legislative frameworks and making strategic investments. Under conducive conditions, academia and industry are well positioned to establish partnerships for research and innovation driven by the need to address socio- economic and environmental challenges.

At national level, DUT acknowledges that currently, research and innovation is faced with numerous challenges. Some of these challenges are well articulated in South Africa's Ten-Year Innovation Plan 2008-2018 (Department of Science and Technology, 2008). These include the following:

- Failure to convert ideas into economic growth
- lack of investment in the entire innovation value chain
- low investment in areas of the highest socio-economic return
- Insufficient critical mass investing in research and innovation
- Inconsistency in research and development (R&D) scaling up process.
- Inadequate life-cycle planning for R&D infrastructure.

At institutional level, DUT acknowledges that despite some significant improvements towards achieving goals set out in the Research and Innovation Strategy 2014-2020 and achieving DUT's entry into the Times Higher Education (THE) World University Rankings 2021, there are still areas that require intervention and alignment with ENVISION2030 in ensuring there is adequate focus on the four perspectives of the strategy and greater impact on Society. In 2021, DUT has been ranked in position 401 (in the top 500) by the THE World University Rankings, and in the Top 90 in the World University Rankings "Emerging Economies". Additionally, in terms of World Universities with Real Impact (WURI) rankings, DUT ranked 35th. In all of these, the University has performed above excellence and needs to continue growing from this baseline and participate in the Times Higher Education Impact Rankings that will help measure impact on localised SDGs and how the University contributes to addressing these.

Research Performance: Key Performance Indicators

Sustainability of research and outputs: As things stand in 2020, DUT is ranked first amongst University of Technologies and is in the top 401-500 globally. However, through previous DUT Bibliometric studies done through the Centre for Research on Evaluation, Science and Technology (CREST), the data shows that due to the ageing profile of productive researchers, low percentage of staff with doctorates and low gender balance, sustainability of outputs is at risk. Unless the University implements a rigorous recruitment and retention plan of highly qualified talent and puts in place approved successions plans, it will be challenging to maintain or exceed the current research productivity levels. Human Capital Development has to therefore be seen as a priority area.

Attracting and retaining high quality researchers: sustainability of research outputs is also largely dependent on DUT's ability to attract and retain highly talented researchers. The low representation of Black South Africans in the Science, Technology and Innovation areas also poses potential risk in terms of meeting the institution's transformation agenda to ensure that it makes considerable contributions to its regional socio and economic transformation as an anchor institution. The current status is the resignation of young NRF Rated scientists leaving the institution for other research intensive South African institutions after a significant investment in their development by DUT. Here again the University needs to put in place a policy that would incentivize such talent to stay on rather than for DUT to wait until they are recruited to start negotiating their stay. This is coupled with having excellent R&I infrastructure and an enabling environment that will allow for both Teaching and Learning (T&L) and R&I to thrive, attract and retain the best talent

Publication citations and impact: there is significant progress made in this area. However, the ratio of publications with international co-authors has decreased and the Field Weighted Citation Impact has stagnated. To maintain DUT status as the leading University of Technology, these factors will need to drastically improve. The DUT internationalization strategy/framework has to ensure that there is a drive to form joint collaborations and joint degree programmes that would help drive co- publications amongst partnering institutions.

Commercialization of research: whilst there is the intention of DUT to commercialize its R&D outputs, there has not been much evidence of this except for the few pockets of excellence in this area. In order to contribute to social economic development and addressing both local and regional needs, concerted effort has to be put into working with researchers, innovators and entrepreneurs in partnership with industry to commercialize different products emanating from R&D. Profiling and understanding the impact of these will be critical for measuring progress in alignment with ENVISION2030.

Qualifications of academic staff: Currently, DUT's percentage of academic staff with doctorates is at 30% (2020 statistics) PhDs which is a very low in comparison to the national average. This ultimately impacts negatively on productivity. This rate needs to get to 40%-45% in short to medium term in order to ensure that DUT can competitively contribute to research and innovation productivity.

Quality of research output, NRF Ratings and impact factor: while DUT's output are in accordance with national policy there is still an imbalance between output and impact. DUT acknowledges that to increase NRF ratings of academic staff, there has to be a push for publication in high impact journals. Even though DUT ranks 10th globally on publication citations, impact on society in terms of local and regional solutions and products also needs to be considered and measured in alignment with ENVISION2030. One of the ways will be the alignment of the Research and Innovation (R&I) focus areas with the Sustainable Development Goals (SDGs), localizing these and measuring the impact in terms of the DUT contribution to the SDGs and getting feedback from the community partners we engage with.

Postgraduate component of student body: Currently, postgraduate component of students has increased from 2% (in 2012) to 5% in 2019/2020. This rate is lower than where DUT aspires to be in terms of its enrolments. It is acknowledged that an acceptable rate will be to achieve a 10% growth in the next 10 years. Without a significant percentage of postgraduate students, driving the research and innovation agenda will be at risk as there will be a limited pool of researchers – both emerging and established. Hence, the Blueprint acknowledges the need to grow the pool of postgraduate students as part of the high-end skills training agenda.

R&I support systems: It is acknowledged that while the University has invested in R&I support systems, these are insufficient, especially at Faculty level to support the R&I enterprise. The structure designed before merger does not integrate R&I administration, and especially that of postgraduate students holistically. A review of the Faculty structures in terms of research administrative support will help to ensure that there is an increase in PG uptake and improvement in PG success rates. Support systems need drastic improvement in order to support research productivity and innovation. Faculties need to ensure that there is basic support infrastructure – both in terms of physical resources and human capital to support the R&I enterprise of the Faculties and University at large. Similarly, the centralised University structures like the Research and Postgraduate Support Directorate also need to be strengthened and capacitated to deliver at a higher level of service required by ENVISION2030.

Postgraduate student research and publication: Postgraduate research and publication output has seen steady growth, but this needs to be enhanced to support overall DUT research and innovation productivity. As part of ENVISION2030, DUT aims to foster creativity and innovation by introducing research as well at Undergraduate level through its programme launched in 2020 on Supporting Undergraduate Research Excellence (SURE). This will help create a culture of research earlier within the pipeline and encourage publications as well amongst undergraduate students. Similar initiatives are well established in the global north to promote undergraduate research. In addition, joint curriculum in entrepreneurship and innovation will contribute to other creative and innovative outputs by students.

Maximizing and diversifying income Streams: A focus on 3rd stream income: There is over-reliance on research and innovation income from the NRF and Department of Higher Education and Training (DHET). With the current phaseout of the BTech, the Government subsidy is expected to decrease as this cohort did attract a significant amount of NRF block grants as well as income from teaching inputs and outputs via DHET. There is room to improve 3rd stream income and contract research and innovation income by focusing on grant writing and support for researchers and innovators who are able to compete for grants. We also have to create a culture of entrepreneurial and innovative mindset amongst our staff and students which requires a change in attitude to search for and find opportunities for grants rather than depending solely on the University.

Research driven teaching and learning: There are inefficiencies in driving research-focused teaching and learning at undergraduate level. Another challenge in this area is the lack of mechanisms to measure the impact. Programmes such as Supporting Undergraduate Research Excellence (SURE) are aimed at driving research at undergraduate level and we aim to continue advancing this area within the University and amongst our staff. We will continue identifying and supporting pockets of excellence with an overall aim of creating a conference track for Undergraduate Students to

participate in and opportunities for participation in research processes, e.g., data collection, article writing, conducting interviews, starting up a student journal and reading club etc. as part the SURE programme.

Student entrepreneurship and innovation: While there has been significant progress in supporting students in their entrepreneurial and innovation education and creativity that allows them to create their start-ups and enterprises, there are issues of sustainability and the need to deepen the socio-economic impact. The planned infrastructure will deal with the issues of sustainability and provide a conducive physical space for student entrepreneurship and innovation to strive. The University has approved an entrepreneurship policy which focuses on supporting students and staff both in entrepreneurial education and exposure as well as practical support to start up their own enterprises. We will add a bouquet of policies and procedures to create a sustainable and enabling environment based on our values as articulated in ENVISION2030. The newly approved Innobiz DUT Centre for Entrepreneurship and Innovation will assist the University in driving this agenda. At the time of writing this Blueprint, the University had approved a Spin Off Policy to support commercialisation.

Industry partnerships and stakeholder engagement: DUT has made strides in driving external engagement and industry partnerships with the aim of contributing to capacity development at local and national level. There is still a significant improvement required in order to increase collaboration and mutual partnerships that are aimed at addressing socio-economic issues at both local and national level.

The current status quo indicates that there are areas of improvement that need to be addressed through deliberate programming directed at improving Research and Innovation at DUT, aimed at strengthening the role of the University as the leader in R&I amongst Universities of Technology.

R&I Vision, Objectives and Values

DUT Statement of intent states that by 2030;

Our people will be creative, innovative, entrepreneurial and adaptive to changes in the world; Our people will participate productively in the development of our region, country and the world; Our state-of-the-art infrastructure and systems will enhance an ecosystem to achieve this vision.

To ensure our staff and student body are creative, innovative, entrepreneurial and adaptive to changes in the world; that they will participate productively in the development of the region, country and the world and; that the University will establish the state-of-the-art infrastructure and systems that will enhance an ecosystem for achieving this vision.

Therefore, in line with ENVISION2030, the DUT R&I Blueprint aims:

"To position DUT as a Centre of Excellence and as a Leading Institution in Research and Innovation that addresses socio-economic challenges in its local, national, regional and global context".

The objective of this document is to identify key focus areas for enhancing research and innovation at DUT, set clear principles and the roadmap for aligning the research and innovation activities with DUT's ENVISION2030. Achieving the vision and objectives of this blueprint will be underpinned by the following value system captured in the ENVISION2030, that is,

- Integrity
- Respect
- Accountability
- Fairness
- Honesty
- Professionalism
- Commitment
- Compassion
- Excellence

BASELINE STATISTICAL TRENDS (2016-2021)

SURVEY OF RESEARCH AND INNOVATION IN NUMBERS

In terms of overall performance in research and innovation, our size and shape can be summarized in the following charts:

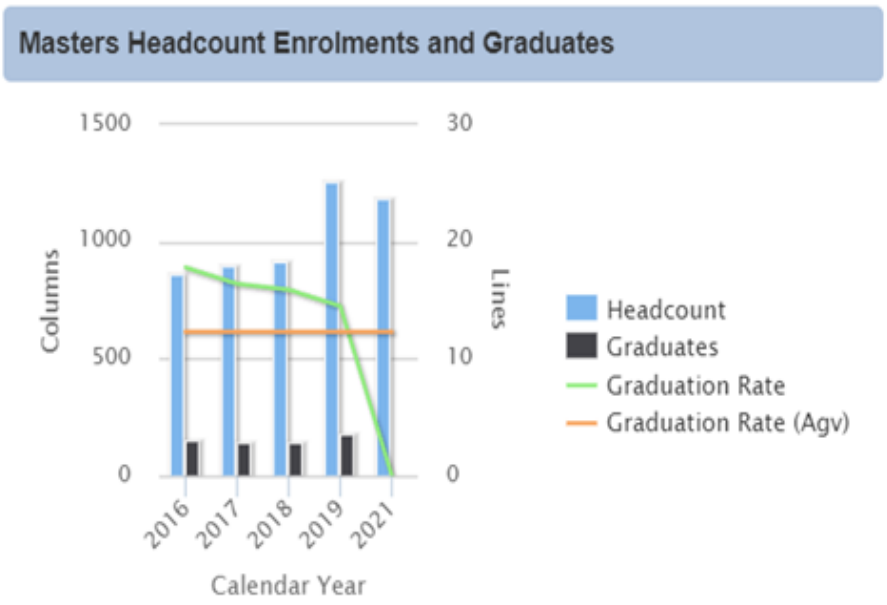

Figure 1. Masters Headcount Enrolments and Graduates (2016 – 2021).

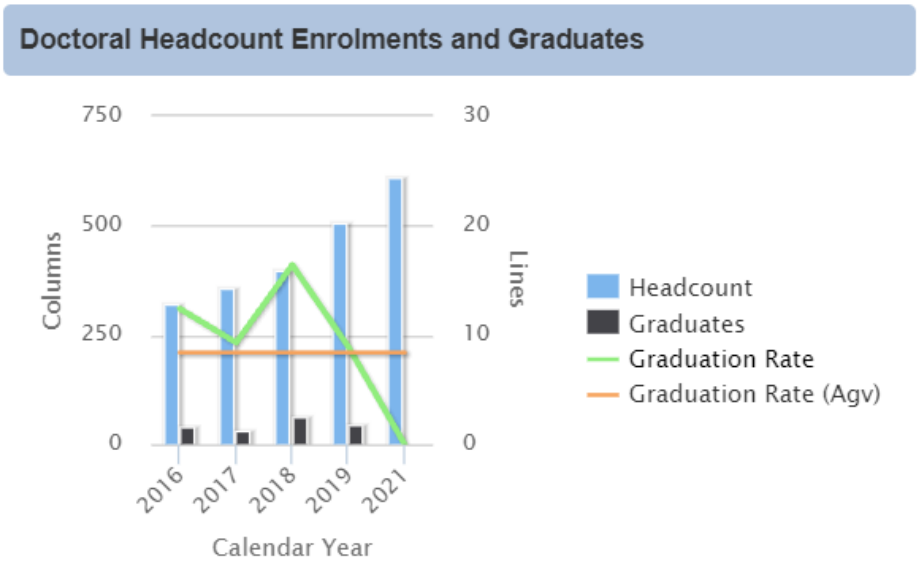

Figure 2. Doctoral Headcount Enrolments and Graduates (2016 – 2021).

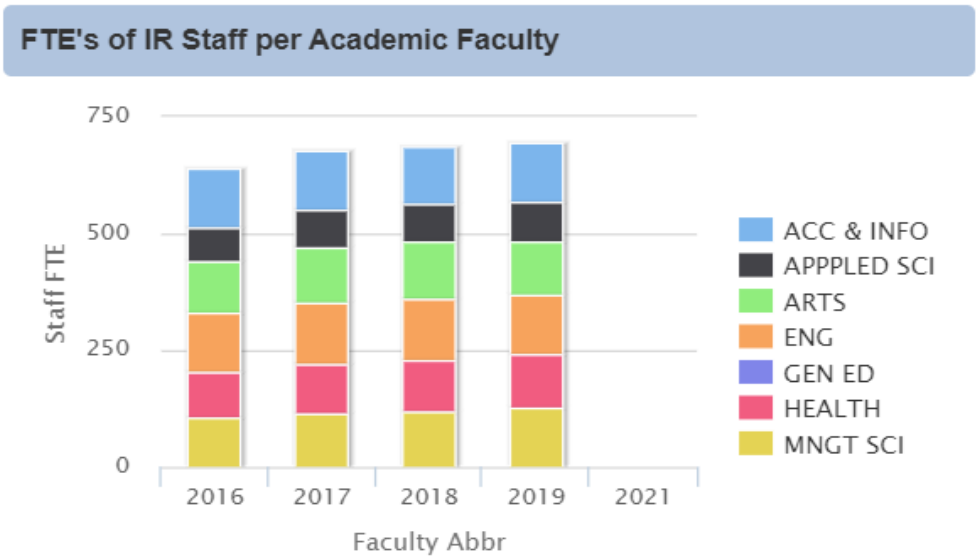

Figure 3. FTE's of IR[3] Staff per Academic Faculty (2016 - 2021).

[3] IR- Institutional Research Staff (Researchers/Academics).

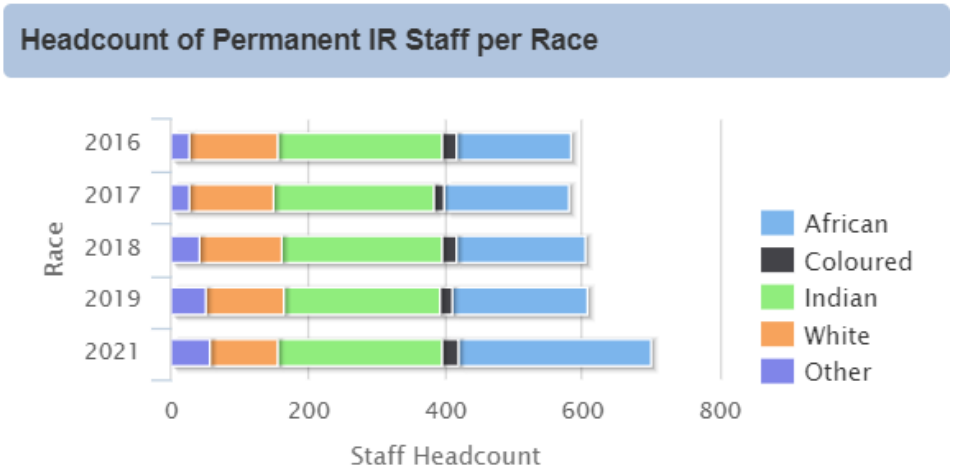

Figure 4. Headcounts of Permanent IR[3] Staff per Race (2016 -2021).

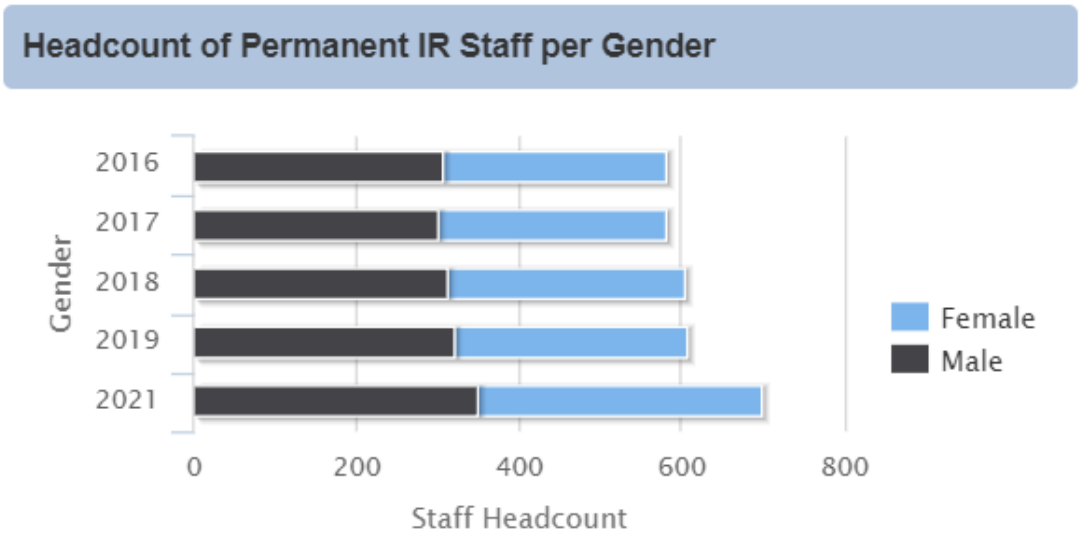

Figure 5. Headcounts of Permanent Institutional Research Staff per Gender (2016 -2021).

[3] IR- Institutional Research Staff (Researchers/Academics).

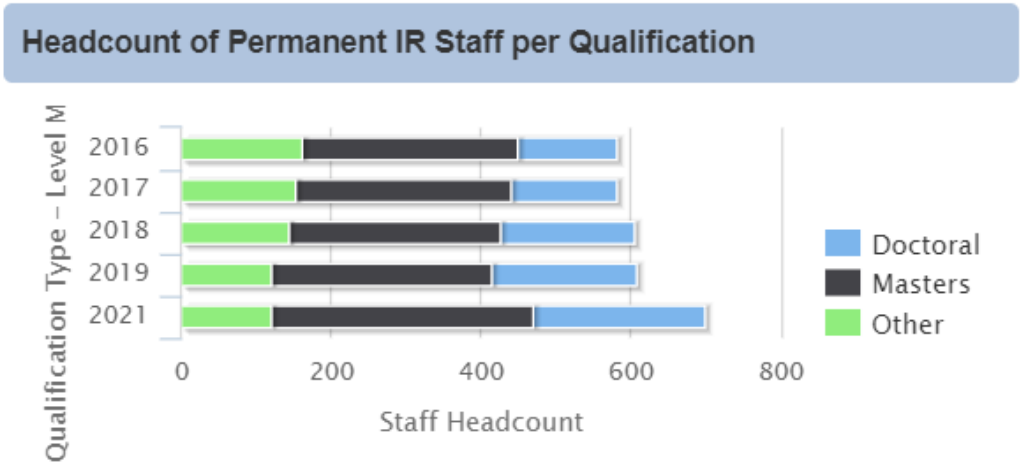

Figure 6. Headcount of Permanent Institutional Research Staff per Qualification.

Table 1. Actual vs Planned enrolments (2018 – 2025) for Masters and Doctoral

Actual vs Planned Enrolments

	2018			2019		
	Actual	Target	Progress	Actual	Target	Progress
Masters	917	1 010	90.8%	1 261	1 067	118.2%
Doctors	397	267	148.7%	506	288	175.7%
TOTAL	**1 314**	**1 277**	**102.9%**	**1 767**	**1 355**	**130.4%**

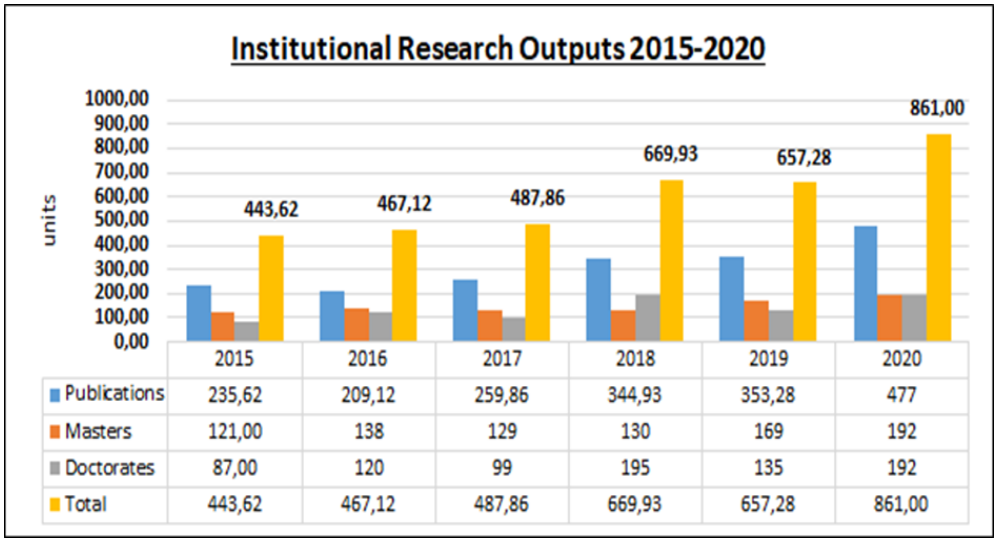

Figure 7. DUT Institutional Research Outputs (2015 - 2020).

Table 2. Planned University Research Outputs (2020 – 2025).

Planned Research Outputs

	2020	2021	2022	2023	2024	2025
	Target	Target	Target	Target	Target	Target
Publication units	260	270	280	290	300	310
Research masters graduates	160	177	197	211	229	258
Doctoral graduates	37	41	46	49	53	57
WEIGHTED TOTAL	531	570	615	648	688	739

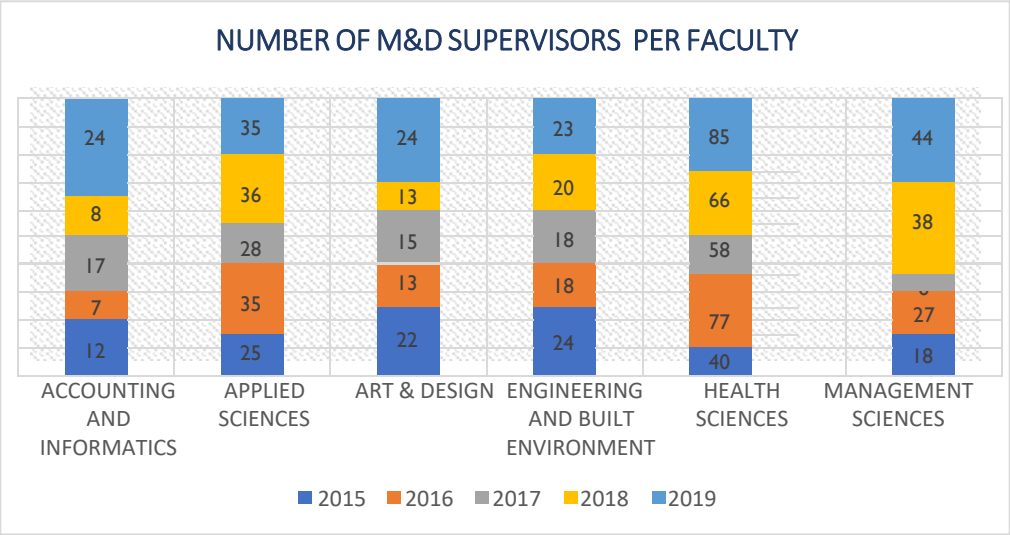

Figure 8. Numbers of Masters & Doctoral student supervisors per Faculty (2015 – 2019).

Table 3. NRF Rated Researchers (2016 – 2021).

Year	2016	2017	2018	2019	2020	2021
Females	9	10	10	11	11	12
Males	18	20	22	26	29	30
TOTAL	27	30	32	37	40	42

Key Strategic Alignments

This R&I blueprint is strategically aligned to all 12 strategic objectives of DUT's ENVISION2030 and to local, national, regional and global strategic imperatives. DUT positions itself as a global University of Technology and sees its role as critical in achieving socio-economic prosperity at local, national, regional and global level.

At provincial level, the R&I aligns itself to at least five strategic objectives and 14 sub-objectives of the KZN Growth and Development Strategy[4]. These are detailed on the Table 4. At national level, the R&I is aligned to three principal objectives of the National Development Plan 2030[5].

At regional level, DUT views its role as key in achieving the Africa Agenda 2063[6] by supporting initiatives that contribute towards achieving Aspiration 1 of Agenda 2063, which is, "a prosperous Africa based on inclusive growth and sustainable development". This aspiration is underpinned by clear actions that are centred around education, research and innovation technology, as pillars for achieving strategic objectives of Agenda 2063. DUT recognizes that its success, on the global stage, is firmly rooted in its ability to influence Africa's trajectory towards socio-economic and environmental prosperity.

At the global level, R&I aligns to all the 17 United Nations Sustainable Development Goals (SDGs) as shown below and in the subsequent sections of the Blueprint:

Figure 9. United Nations17 Sustainable Development Goals (SDGs).

4 http://www.kznppc.gov.za/images/downloads/PGDP%202019%20v4%20Final.pdf, accessed 5th October 2020.

5 https://www.gov.za/issues/national-development-plan-2030, accessed 5th October 2020.

6 https://au.int/agenda2063/aspirations, accessed 5th October 2020

Table 4. Alignment of DUT thematic areas with global, national, local and regional strategic objectives

LOCAL	NATIONAL	REGIONAL	DUT's ENVISION 2030	GLOBAL
KZN Growth and Development Strategy	***NDP***	***Africa Agenda 2063*** ***ASPIRATION 1. A prosperous Africa based on inclusive growth and sustainable development:***	***Alignment to ENVISION 2030 and Research Focus Areas (RFAs)***	***Alignment to Sustainable Development Goals (SDGs)***
Strategic Objectives *1.1 Develop and Promote the agricultural potential of KZN* *1.2: Enhance Industrial Development through Trade, Investment and Exports*	Uniting South Africans of all races and classesaround a common programme to eliminate poverty and reduce inequality	By 2063, African countries will be amongst the best performers in global quality of life measures. This will be attained through strategies of inclusive growth, job creation, increasing agricultural production;investments in science, technology***, research and innovation;*** gender equality, youth empowerment andthe provision of basic services including health, nutrition, education, shelter, water and sanitation.	**PERSPECTIVES:** Society and Sustainability **STRATEGIC OBJECTIVES:** 1. Financial Sustainability 2. A distinctive Education 3. Innovation and Entrepreneurship 4. Adaptive graduates **THEMATIC AREAS:** 1. Strengthen DUT Research and Innovation focus areas and identify new relevant ones e.g. Agribusiness, Additive Manufacturing, ICT and Society, Public Health research. 2. Entrepreneurship business development for student start-ups.	

			3. Gender Justice, Health and Human Development Research Focus Area 4. Commercialisation through Spin-Off Companies 5. Technology Transfer & Innovation	
1.5: Promoting SMME, Entrepreneurial and Youth Development	Encourage citizens to be active in their own development, in strengthening democracy and in holding their government accountable	Africa's human capital will be fully developed as its most precious resource, through sustained investments based on universal early childhood development and basic education, and sustained investments in higher education, science, technology, ***research and innovation***, and the elimination of gender disparities at all levels of education. Access to post-graduate education will be expanded and strengthened to ensure world-class infrastructure for learning and research and support scientific reforms that underpin the transformation of the continent.	**PERSPECTIVES:** Stewardship; Systems and Processes; Society and Sustainability **STRATEGIC OBJECTIVES:** 1.Creativity 2.Innovative curricula and Research 3. Financial Sustainability 4.A distinctive Education 5.Innovation and Entrepreneurship 6.Adaptive graduates 7.An engaged University 8.Green ecosystem **THEMATIC AREAS:** 1. Entrepreneurship and Innovation Education through modern Curricula 2. Student SMME mentorship and support 3. Co-designed Short Learning Programs in Entrepreneurship, Innovation and Commercialization 4. Spin-Off Companies. 5. Enhanced and applied postgraduate programmes that include creative thinking and project based learning 6. Enhancing and improving postgraduate support systems.	  

1.6: Enhance the Knowledge Economy	Raising economic growth, promoting exports and making the economy more labour absorbing	By 2063, the necessary infrastructure will be in place to support Africa's accelerated integration and growth, technological transformation, trade and development. This will include high-speed railway networks, roads, shipping lines, sea and air transport, as well as well-developed ICT and the digital economy. A Pan-African High-Speed Train Network will connect all the major cities/capitals of the continent, with adjacent highways and pipelines for gas, oil, water, as well as ICT Broadband cables and other infrastructure. This will be a catalyst for manufacturing, skills development, technology, research and development, integration and intra-African trade, investments and tourism.	**PERSPECTIVES:** Stewardship; Systems and Processes; Society and Sustainability **STRATEGIC OBJECTIVES:** 1. Creativity 2. Innovative Curricula and Research 3. Financial Sustainability 4. Green Ecosystem 5. An engaged University **THEMATIC AREAS:** 1. ICT and Society 2. Tourism and Hospitality 3. Biotechnology 4. Water and Wastewater Technology 5. Additive Manufacturing 6. Nanocomposite Research 7. Green Engineering 8. Renewable Energy 9. Smart Grids 10. Urban Futures and Resilient Cities	 

2.2: Support Skills Development to Economic Growth	Growth and jobs, education and skills, and a capable and developmental state	Catalyse education and skills revolution and actively promote science, technology, research and innovation, to build knowledge, human capital, capabilities and skills to drive innovations and for the African century: - Build and expand an African knowledge society through transformation and investments in universities, science, technology, research and innovation; and through the harmonization of education standards and mutual recognition of academic and professional qualifications; - Harness universities and their networks and other options to enable high quality university education.	**PERSPECTIVES:** Stewardship; Systems and Processes; Society and Sustainability **STRATEGIC OBJECTIVES:** 1. Creativity 2. Innovative Curricula and Research 3. A distinctive Education 4. Financial Sustainability 5. Green Ecosystem 6. An engaged University 7. Innovation and Entrepreneurship 8. Adaptive graduates **THEMATIC AREAS:** 1. Short Learning Programs in Research Translation to Products 2. Short Learning Program (Waste-to-Profit) to reinforce Green Ecosystem 3. Entrepreneurship desk and Centre 4. Short Learning Program for municipalities	  
3.1: Poverty Alleviation & Social Welfare	Promoting health	Healthy and well-nourished citizens.	**PERSPECTIVES:** Sustainability and society **STRATEGIC OBJECTIVES:**	

			1. A distinctive Education 2. Financial Sustainability 3. Green Ecosystem 4. An engaged University 5. Innovation and Entrepreneurship 6. Adaptive graduates **THEMATIC AREAS:** 1. African Indigenous Knowledge Systems 2. Biotechnology and Enzyme Technology 3. Food and Nutrition Security 4. ICT and Society 5. Peace Programme (ICON) 6. Water and Wastewater Technology 7. Maternal Health 8. Urban Futures and Resilient Cities	  

3.2: Enhancing Health of Communities and Citizens	Promoting Health	A high standard of living, quality of life and well-being for all citizens.	**PERSPECTIVES:** Sustainability and Society **STRATEGIC OBJECTIVES:** 1. A distinctive Education 2. Financial Sustainability 3. An engaged University 4. Innovation and Entrepreneurship 5. Adaptive graduates **THEMATIC AREAS:** 1. African Indigenous Knowledge Systems 2. Food and Nutrition Security 3. ICT and Society 4. Institute for System Science 5. Institute for Water and Wastewater Technology (IWWT) 6. Maternal Health 7. The Urban Futures Centre (UFC) 8. Short Learning Program in African Indigenous Knowledge Systems	

3.4: Sustainable Human Settlements and improved quality of household life	Transforming human settlement and the National space economy	Environmentally sustainable and climate resilient economies and communities.	**PERSPECTIVES:** Sustainability and Society **STRATEGIC OBJECTIVES:** 1. Green ecosystem **THEMATIC AREAS:** 1. African Indigenous Knowledge Systems 2. Energy Group 3. Food and Nutrition Security 4. International Centre of Nonviolence (ICON) 5. Institute for Water and Wastewater Technology (IWWT) 6. Maternal Health 7. The Urban Futures Centre (UFC)	 
4.3: Development of Information & Communications Technology	Improving education, training and innovation	Well educated citizens and skills revolution underpinned by science, technology and innovation.	**PERSPECTIVES:** Systems and Processes **STRATEGIC OBJECTIVES:** 1. Digital Environment **THEMATIC AREAS:** 1. ICT and Society 2. Institute for System Science	All the 17 sustainable development goals 

4.4: Enhance Water Resource Management	Ensuring environmental sustainability and equitable transition to a low-carbon economy	Environmentally sustainable and climate resilient economies and communities.	**PERSPECTIVES: Sustainability** **STRATEGIC OBJECTIVES:** 1. Green ecosystem **THEMATIC AREAS:** 1. Water and WastewaterTechnology 2. Biotechnology	 
5.2: To Investigate and develop viable alternative energy generation options	Ensuring environmental sustainability & an equitable transition to a low carbon economy.	Environmentally sustainable and climate resilient economies and communities.	**PERSPECTIVES: Sustainability** **STRATEGIC OBJECTIVES:** 1. Green ecosystem **THEMATIC AREAS:** 1. Water and WastewaterTechnology 2. Renewable Energy 3. Smart Grids 4. Green Engineering	  

5.4: Disaster Management	Social protection	A high standard of living, quality of life and well-being for all citizens.	**PERSPECTIVES: Society** **STRATEGIC OBJECTIVES:** 1. An engaged University **THEMATIC AREAS:** 1. Public Health 2. Peace Programmes (ICON) 3. Urban Future Center Interventions	

Unpacking R&I Emerging Themes and Key projects

There are 8 emerging R&I themes upon which this blueprint is centred. They are as follows:

1. World class research and innovation infrastructure
    a. DUT's state-of-the-art innovative hub
2. Increased research and innovation capacity across all sectors
    a. Increase a number of academics with PhDs
    b. Increase a number of PG students
3. Linking research and innovation to strategic societal needs
4. Multidisciplinary and collaborative research
5. Enhanced quad-helix engagement and partnerships
    a. Community engagement
    b. Industry engagement
    c. Government and civil society partnerships
6. Optimizing research commercialization
7. Building internal and external capacity research capacity
8. Green Economy and infrastructure
    a. Contributing towards a sustainable green industry

Table 5. Research and innovation thematic areas and projects.

R&I Thematic Areas and Projects		
NAME OF PROJECT	**Objectives**	**Responsible Faculty/Stakeholder**
Thematic Area 1: World class R&I Infrastructure		
Project 1: DUT's state-of-the-art innovative hub	Innovation Hub aims to provide a **single shared facility** that serves all faculties and focuses on innovation and development through strong links with private sector, government and other academic institutions	DUT Real Estate RFA Leaders Dir TTI DVC RIE
Project 2: Create an enabling physical infrastructure and human resource capacity to provide a high-quality education experience and expand research capability of students and staff.	To offer an enabling infrastructure that fosters a culture of research and innovation at DUT.	HR Executive Deans DVC T&L DVC RIE
Project 3: DUT Industry/Business/TVET stakeholder Forum	To co-design solutions to existing real time problem with the relevant industry/business partners and stakeholder engagement to assist with designing real time project based learning projects to support T&L and to provide appropriate SMME mentorship and support coupled with commercialisation strategies. For R&D.	Executive Deans Dir. RPS Dir TTI DVC T&L DVC RIE

1. **Thematic Area 2 and 7: Building R&I Capacity Across All Sectors** **Building R&I Internal and External Capacity**		
Project 1: Increase a number of academics with PhDs	To increase the pool of academics with PhDs with the view of supporting teaching and learning and research and innovation outputs at DUT	Executive Deans RPS DVC T&L DVC RIE
Project 2: Increase a number of PG students according to the DUT enrolment plan	To increase the number of postgraduate students in order to support research and innovation outputs	Executive Deans DVC T&L DVC RIE
Project 3: Revised template of proposal writing (M&D)	To support alignment of M&D research, innovation to commercialization	Executive Deans Dir TTI DVC RIE
Project 4: Introduce efficient mechanisms that support multidisciplinary research, development of students and staff and increase effectiveness of postgraduate studies to strengthen ties with industry.	To increase multi-disciplinary research outputs linked to industry needs	Executive Deans Dir: RPS Dir: TTI DVC T&L DVC RIE

Project 5: Improve current capacity building programmes through interventions that demonstrate excellence in scholarship, creativity, innovation, learning and service	To establish study systems that promote excellent scholarship, creativity, innovation,learning and service	Executive Deans Dir RPS DVC T&L DVC RIE
Project 6: Implementation of Online Research Management Systems for all Postgraduate Processes in Faculties	To improve PG efficiency and research and innovation outputs at the University level as well as the PG experience.	Executive Deans Dir: RPS Dir TTI DVCs T&L DVC RIE
Project 7: Improved PG enrolment targets and graduation rates and support postgraduate research	To increase PG enrolment targets and support PG research and innovative outputs	Executive Deans RFA Leaders DVC T&L DVCRIE
Project 8: Supporting Undergraduate Research Excellence (SURE)	To inculcate research and creative thinking skills from undergraduate level that will help prepare UG students for research and scholarly careers as well as increase their chances of innovating and starting up their own enterprises	All Faculties RPS TTI DVC T&L DVC RIE
Project 9: Mobility and exchange programmes for PG & UG students	To establish formal exchange programmes for our students to collaborate with Centers of Excellence both nationally and globally to enhance their skills and exposure.	All Faculties International Office DVC RIE

Project 10: Writing and Publishing retreats	To cultivate a conducive environment for research and innovation	All Faculties RPS DVC RIE
Project 11: Mentorship programmes for staff to improve NRF ratings, supervision capacity, PhD completion rate and article writing programmes	To enhance supervision and research capacity of DUT staff in order for them to contribute to research and innovation outputs.	All Faculties DVCs RIE & T&L
Project 12: Emerging Researchers Programme	To nurture and support emerging researchers at DUT	RPS RADLA DVC RIE
Project 13: Directed Exchange/Mobility Programme for all DUT staff	To expose DUT staff to international research and innovation contexts in order to enhance collaboration with leading international researchers and scholars	RPS International Office DVC T&L DVC RIE
Project 14: Supplementation of Developmental Grants for all DUT staff	To provide additional resources/support for DUT staff to complete their research and innovation projects as well as increase the pool of active researchers	RPS CELT DVC RIE DVC T&L
Project 15: Staff Research and Innovation Capacity Enhancement Programme	To enhance research and innovation capacity amongst DUT staff through Design Thinking and Project Based Learning Training initiatives amongst other R&I training programmes	RPS TTI DVC RIE

Project 16: Women in Research & Innovation Programme	To increase a pool of highly experienced female researcher and innovators at DUT. To revive and strengthen the "Women in Research and Innovation" and "Women in STEM" programmes in collaboration with our quad-helix partners.	RPS TTI DVC RIE
Project 17: Research Integrity and EthicsTraining for Academics and Researchers	To support capacitation of DUT academicsand researchers on research integrity and ethics	RPS IREC DVC RIE
Project 18: Enhanced Performance Tracking for R&I Indicators Measures	To boost the research and innovation outputs as well as incentivize these through using appropriate measures that also talk to the impact	Executive Deans DVC: T & L DVC: RIE
Project 19: Staff Credentialing e.g. PhD completions, NRF Ratings	1.To increasing the number of staff members with PhDs and to increase the number of NRF Rated researchers at DUT e.g. through RADLA - GJHHD mentorship programmes. To boost research outputs at DUT	Executive Deans DVC T&L DVC RIE
Project 20: Create a Pipeline of NextGeneration Scholars	To increase the pool of young scholars who could enter the academy at different levels.	Executive Deans DVC T&L DVC RIE Office of the VC(Hlomisa)
Thematic Area 3: Linking research and innovation to strategic societal needs		

Project 1: Faculty workshops on reconceptualization of our research and innovation 'for society', through improving the attractiveness of researchand innovation to external stakeholders	To improve the relevance and alignment of research and innovation conducted by Faculties and Research Focus Areas (RFAs) to societal Needs with a focus on Mode 2 type research.	All Faculties RPS TTI
Project 2: Bellhaven Harm-Reduction Projectand Lalela uLwandle (Listen to the Sea)	To contribute towards solving environmental and societal challenges through action research	UFC Inter-Disciplinary Research Across Faculties and RFAs
Project 3: The Sojourner Project South Africa; Art for Humanity	To participate in an international Black feminist forum of artists and scholars, initiating dialogues on blackness and anti- black violence. To advance the work done through Art for Humanity.	FAD (Faculty of Arts and Design)
Project 4: Applying mathematics to human and natural systems (Chair awarded in 2021)	To conduct high calibre research into real- world questions using multidisciplinary computational and mathematical systems methods with specific focus on the followingresearch areas: - Food security - Disease transmission and control - Human population systems - Environmental sustainability - Engineering and other physicalsystems and Mathematics outreach	ISS DVC RIE

Project 5: Food and Nutrition Security	To support global efforts for food security and nutrition and contribute to commercialization of innovative food products and new services and processes related to food and nutrition. To produce new food products and commercialisation of R&D.	Applied Sciences TTI
Project 6: Computational Modelling & Bioanalytical Chemistry	To support the use the design, modelling and fabrication of doped smart materials toimprove drug delivery systems and biosensor technologies	Applied Sciences TTI
Project 7: Indigenous Knowledge Systems, Traditional Medicine and Maternal health for Global Health	To enhance the role of IKS in economic development by identifying plant phytochemicals from indigenous plants for medicinal, cosmetic, food and nutrition and building materials use.	Health Sciences Applied Sciences TTI

Project 8: Global Health and Sustainabilitywith a Focus on the Burden of Disease andPandemics (new Chair)	Highly cited area to enhance DUT impact onburden of disease and pandemics (new) and to complement the new proposed area in public health.	Health Sciences &Inter-Faculty Collaborations. DVC RIE
Thematic Area 4: Multidisciplinary and collaborative research		
Project 1: Increasing the number of international teaching collaborations- through implementation of COIL Projects	To support collaborative research outputsthrough the implementation of COIL projects	All Faculties DVC T&L DVC RIE
Project 2: Centre for African Governance and Development	To provide transformative knowledge and leadership to the public and private sectors' enterprises and communities that enhance performance towards sustainable development excellence through partnerships and collaborations.	Management Sciences DVC RIE DVC T&L
Thematic Area 5: Enhanced engagement and partnerships		

Project 1: Create interdepartmental cooperation with industry, community, professional organization, and other stakeholders for global recognition within the economic environment	To enhance DUT's engagement with external stakeholders such as industry, community and professional organisations inorder to ensure contribution towards resolving societal challenges	All Faculties TTI DVC RIE
1. Thematic Area 6: Optimizing Research Commercialisation and 3rd Stream Income		
Project 1: Established Spin-off Companies	To improve DUT's contribution to local economy by supporting establishment ofspin-off companies from research and innovation	TTI All Faculties DVC RIE
Project 2: Development path to move innovation forward toward commercialization.	To strengthen to link between innovation and commercialization	TTI DVC RIE
Project 3: Establish Chairs in Entrepreneurship, Innovation and Commercialisation; Manufacturing; Agribusiness; Global Health and Sustainability	To mobilize local and international resources for Entrepreneurship, Innovationand Commercialisation at DUT; Manufacturing and Agribusiness, Global Health and Sustainability	TTI DVC RIE

Project 4: Create favourable conditions to promote innovation and entrepreneurship for development	To position innovation and entrepreneurshipas catalysts for development; Establish a DUT Center for Entrepreneurship and Innovation	All Faculties RFAs Dir TTI DVC RIE
Project 5: Increased 3rd stream income through clinical and short-course offerings	To generate additional income for funding DUT's research and innovation programmes	Health Sciences Dir TTI All Faculties Dir. (Short CoursesUnit/CCPE)
Project 6: Supporting PG student start-ups	To enhance entrepreneurship amongst postgraduate students	RPS & TTI DVC RIE
Project 7: Short Learning Programs (SLP)/Workshops in Innovation, Entrepreneurship & Research Commercialization	To make innovation, entrepreneurship and research commercialization accessible to researchers and external stakeholders interested in these areas.	RPS Dir TTI DUT Business School/Dir. Short Courses Unit/CCPE DVC RIE
Thematic Area 8: Green Economy, Technology and Infrastructure		
Project 1: Waste Management Project in collaboration with eThekwini Municipality	To support waste management projects that respond to societal challenges within the local context	IWWT Faculties RPS UFC
Project 2: SLP/Workshops in Waste-to-Profit Development Strategies, Research, Innovation and Commercialisation Workshops	To contribute to sustainable developmentthrough designing and implementing waste to profit	RFAs

	projects with the focus, for instance, on the following bio-products: - Bioplastics - Biobricks - Biogas generation - Insulation material To establish DUT conference series e.g. a Sustainable Development; Research, Innovation and Entrepreneurial Weeks and Series. To implement the DUT Spin-off policy as part of the commercialisation strategy.	RPS RFAs All Faculties TTI
Project 3: Waste Management, Urban Informality and Climate Change: Innovative zerowaste solutions from the informal street markets of Warwick in Durban	To contribute towards waste management efforts, support urban informality and climate change responses through a collaborative process with affected communities and the municipality.	All Faculties and RFAs Urban Futures Center (UFC)
Project 4: **Enhancing the role of DUT Technology Stations**	1. To assist SMMEs and entrepreneurs with design, 3D printing, prototyping, batch runsand tooling; 2. To assist SMMEs and entrepreneurs with training and product development in the renewable energy space.	DUT Technology Stations
Project 5: Biofuels and Chemicals from Algae	To establish and implement wastewater beneficiation projects with public and private sector partners	IWWT Faculties Selected RFAs

Project 6: Advanced Oxidation using photocatalysis for waste treatment	To strengthen work on the use of photocatalytic treatment system to degrade contaminants in wastewater	EBE IWWT AS
Project 7: Desalination of Industrial Wastewater	To contribute and assist industry save costs,reduce negative environmental impact and reduce demand on freshwater	Engineering and Built Environment IWWT
Project 8: Biomass and WasteValorisation	To strengthen work on ascribing value tolocally available biomass and waste using green engineering principles for the production of biofuels and high value hydrocarbons	EBE AS IWWT
Project 9: ICT & Society	To strengthen work on the use of ICT in tackling societal problems and using ICT forinstance in waste management, Agri-farming etc.	AI ISS RPS Center for Entrepreneurship and Innovation (Innobiz)
Project 10: Biotechnology and Enzyme Technology	To develop new technologies and associated products to address the vital science-based innovation needs of the country in the health, industrial and agricultural sectors of the economy	Applied SciencesRFAs IWWT
Project 11: Nanotechnology	To enhance the development and use of nanotechnology to support global competitiveness and sustainable economic growth	Engineering and the Built Environment

Project 12: Maritime and Space Science	To train and equip human capital (students)in maritime for placement locally and internationally after graduation	Applied Sciences (Maritime); Engineering and the Built Environment (forMaritime and Space Science) – MKI & DSTsponsored

THE BLUEPRINT ENABLERS

In order to successfully achieve what is detailed in this Blueprint, the following actions need to be taken:

- An expansion in external research and innovation fundraising
- The development of a research equipment replacement plan
- The development of a strategy to attract more and higher quality postgraduate students
- The expansion of research mentoring of younger academics by more experienced researcherseither from DUT or from elsewhere (formal mentorship programme)
- The establishment of strategic and carefully placed postdoctoral fellowships in approvedUniversity R&I focus areas and retention programme for high performing researchers into research and faculty positions.
- The development of a strategic plan in consultation with the faculties to expandthe cohort of female and black researchers.
- The VC, DVCs, Executive Deans and Directors to continue facilitating possible stakeholder meetings with the quad-helix partners to form critical partnerships that assist in addressing the research and innovation initiatives and grant raising. This will in turn reduce the over reliance on the Government subsidy and NRF funds. A database of all possible funding organisations will be compiled, and the University will be pro-active in initiating possible collaborations and partnerships with the view of raising funds for research and innovation purposes. The capacity of the Research and Postgraduate Offices in Faculties and Centrally, Technology Transfer andInnovation and the Advancement and Alumni Offices will be optimized to facilitate and enhance grant and donor seeking.

MONITORING, EVALUATION AND LEARNING

This R&I blueprint will be reviewed on an annual basis to monitor and evaluate progress while capturing lessons.

Table 6. R&I blueprint progress and lessons

R&I Thematic Area	Medium-term impact or outcomes	Impact indicators	Sourcesof evidence	Short- term outcomes	Outcome indicators
World class R&I Infrastructure	Increase in the number of DUT'sR&I outputs	Increased numberof R&I outputs	R&I Annual Report	DUT students and academics have access to the World class R&I infrastructure	R&I outputs
Building R&I Capacity among student and staff ofDUT	Increased proportion of students and staff involved in R&I projects	Proportion of staffand students who successfully complete theirR&I projects	R&I Annual Report	DUT staff and students are capacitated in R&I	Number of students and staffcapacitated in R&I
Linking research to strategic societal needs	Increased numberof R&I projects responding to strategic societal needs	Number of R&I projects responding to societal needs	R&I Annual Report	DUT produces research projectsthat respond to strategic societal needs	Number of research projectslinked to responding to strategic societal problems
Multidisciplinary and collaborative research	Increased numberof multidisciplinary and collaborative projects	Number of multidisciplinary and collaborativeprojects within R&I space	R&I Annual Report	Various DUT departments and faculties collaborate across disciplines	Number of multidisciplinary and collaborative projects

R&I Thematic Area	Medium-term impact or outcomes	Impact indicators	Sourcesof evidence	Short- term outcomes	Outcome indicators
Enhanced engagement andpartnerships	Increased numberof engagements and partnerships with external stakeholders	Number of engagements and partnerships with external stakeholders	R&I Annual Report	DUT has enhanced engagement and well-developed partnerships with various stakeholders	Number of engagements and partnerships
R&I commercialization and 3rd steam income	Increased proportion of DUT's R&I budget coming from commercializationand 3rd stream income	Amount of funds generated through commercializationand 3rd stream income. No. of spin Offs, Proof of Concept,Patents generated,Deals brokered todrive innovation and commercialisation.	R&I Annual Report	DUT achieves high rates of R&I commercialization, and more funds are generated from 3rd stream income	Number of R&I projects resulting in commercialization and amount of funds generated from 3rd stream income
Green Economy, Technology and Infrastructure	DUT makes a significant contribution towards green economy, technology andgreen infrastructure	Number of green economy and infrastructure projects DUT is contributing towards	R&I Annual Report	Increased contribution towards green economy, technology and infrastructure	Number of green economy projects, number of technologies and infrastructure developed

CONCLUSION

This Blueprint should be read in conjunction with DUT's ENVISION2030. Its objectives are intrinsically aligned to those set out in the ENVISION2030. However the document will evolve at any given time based on changes in the innovation space which are quite rapid.

In its core, the Blueprint provides detailed R&I thematic areas and research focus areas that the DUT will focus on in the next 10 years. These themes and research focus areas emanate from an extensive consultation process between all sectors of DUT involved in the research and innovation space including our key stakeholders. Therefore, to achieve the objectives set out in this document requires a deliberate effort from all sectors of DUT and our partners to strengthen mutually beneficial collaborations, partnerships and co-creation engagements to solve particular real time problems.

To ensure that this blueprint contributes to greater improvement of DUT's teaching and learning, research and innovation processes and systems, a monitoring and evaluation process should be developed, and its result fed through into organizational learning and continuous improvement process. It is proposed that a detailed log frame be used along with an explicit implementation plan to monitor and evaluate progress towards the goals set out in this document. This will be supported by a data collection process from all projects detailed in this plan. It will then help measure impact and outcomes that would feed into ENVISION2030.

Finally, it is proposed that an annual review of the Blueprint be conducted at the end of each academic year to assess progress and realignment of priorities in line with changing local, regional and global imperatives. The Blueprint can be adjusted to consider new developments as the R&I space evolves rapidly with times.

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