Cape Peninsula
University of Technology

CPUT RTI Blueprint 3.0

Charting the Path to 2030

FOREWORD

In developing and getting approval for its Vision 2030, it is imperative for CPUT to build and update its Research and Technology Innovation Strategy in line with the new institutional vision. In 2010, CPUT adopted an overarching 10-year plan named The Research and Technology Innovation (RTI) Blueprint, which underpinned its Vision 2020. Its strategic intent was to strengthen research and foreground innovation and best practices effectively across the institution. It also heralded a great leap forward for CPUT in its transition from a 'good' to a 'great' university of technology.

During 2023, CPUT, like other South African universities, finds itself facing a myriad of challenges to its viability and sustainability in fulfilling its academic agenda of learning and teaching, research, internationalisation, and community engagement. Financial constraints, wrought by a marked decline in public and private funding, have put pressure on universities, not only to drive socially relevant research and appropriate training for a new global world of work but, even more importantly, to prioritise the commercialisation of technological innovations emanating from research efforts.

Furthermore, the past ten years have seen massive upheavals in the higher education sector. Such events, for better or for worse, have also affected the status of universities profoundly since the dawn of democracy in 1994. The 'Fees must Fall' movement, decolonisation of higher education, massification of higher education, and labour insourcing are part of the societal dynamics that have impacted and will continue to impact higher education in our country. They have added to the precarious financial status of most, if not all, South African universities and further contribute to the critical need for other sources of income to ensure the quality of academic offerings.

A new strategic plan named the CPUT RTI Blueprint 3.0 is being developed during a different and challenging epoch in South African higher education compared with the halcyon 2010. However, just as with the landmark RTI Blueprint document in 2010, the new blueprint, with congruency to the acclaimed V2030, will put a strong emphasis on the number and quality of CPUT academic staff in research (specifically with doctoral qualifications), postgraduate student success, and strategic value-adding national and international partnerships. Furthermore, it will build on or strengthen successful CPUT RTI initiatives, promoting transdisciplinary research activities to address pressing societal needs, and a renewed focus on entrepreneurship to support the socio-economic development of the Western Cape and the rest of the country.

All these initiatives cannot, however, happen in a vacuum. They will require: Firstly, an enabling environment for our researchers to conduct world-class research with appropriate state-of-the-art infrastructure and training and skills development. Secondly, empathetic, informed and empowered support staff as well as the purposeful recruitment, support and retention of productive global scholars and postdoctoral fellows. Furthermore, we will put a particular focus on knowledge-retention through succession planning and mentorship programs. Thirdly, policies need to be developed and implemented to ensure an engaged workforce in the domains of research and technology innovation. These policies should emphasise the role and value of soft-funded staff in line with CPUT's 'oneness' ambition.

Furthermore, the aspiration to double the number of postgraduate students by 2030 will require the proactive marketing of CPUT as a preferred destination to attract motivated postgraduate students from across South Africa and beyond. Systems, processes and

resources are to be developed and deployed to ensure these students enjoy a positive and fruitful experience during their time at the university. Within our ranks, developing a pipeline of high-potential undergraduate students to fill our graduate programmes is to also be a priority from now on. The drive to increase the number of postgraduate students must give due consideration to the demographic profile of the country as well as gender equity, the lynchpin of our transformation agenda as an institution and indeed as a country.

Another critical lever to enhance our research and innovation agenda, as vividly illustrated over the past ten years, is the establishment of Research Chairs, leveraging the internal capabilities and expertise within CPUT. In addition, another highly effective treadle in this endeavour is the establishment of financially sustainable research centres and institutes to drive inter-, multi- and trans-disciplinary initiatives within the university. The office of DVC: RTIP will prioritise all of these initiatives, working with the Executive Management, Deans of faculties, and relevant Directors of entities across CPUT.

Besides the alignment with V2030, the updated blueprint also seeks to build on the landmark work and vision exhibited over the past ten years in implementing the second transition of research and innovation at CPUT. To that end, the RTI Blueprint 3.0 is aligned with the revamped CPUT Research Focus Areas in:

- The Environment, Climate Change and Sustainability
- Bioeconomy and Biotechnology
- Space Science, Engineering and Technology
- Smart Energy
- Human, Health and Social Dynamics
- The Digital Society

We are interested in building on the successes and learnings of the past ten years to drive the ambitious RTI Agenda for 2030. The opportunities and challenges faced by the broader society place a moral obligation on all of us to work together in the greater national interest.

Regards,
David Phaho
Deputy Vice-Chancellor: Research, Technology Innovation & Partnerships

“The real difficulty in changing the course of any enterprise lies not in developing new ideas but in escaping from old ones.”

John Maynard Keynes

TABLE OF CONTENTS

1. Introduction

1.1. Context

As the only university of technology in the Western Cape, CPUT has, since its establishment in 2005, positioned itself to promote and inculcate an applied focus on learning and teaching, research and community engagement in its institutional DNA. With five campuses, six faculties and over 35 000 students, CPUT is also the region's largest institution of higher learning.

CPUT is unwavering in its commitment to becoming a 'great' university of technology. It continues to strive to generate relevant and responsive research and innovation aligned to the needs of the province, the country, the continent and the world. This is accomplished through knowledge discovery, excellence in learning and teaching and community engagement, and has borne fruit for the institution as well as the broader society.

The prevailing challenges and needs of the country to address the triple threats of poverty, unemployment, and inequality have come into sharp focus over the past few years. Publicly funded institutions, such as CPUT, are being increasingly relied upon to ensure that their research, learning and teaching, and community engagement initiatives are relevant, responsive, and aligned to societal needs.

To its credit, and as articulated in the RTI Blueprint 2020, CPUT made a public declaration to go beyond the Humboldt University Model of 'Knowledge for its own sake' by also focusing on knowledge generation that addresses specific problems and challenges that confront society [1]. Furthermore, the unwavering advocacy by the leadership over the past ten years has seen a recognised pivot towards innovation and commercialisation of identified research outputs.

RTI 2020 has yielded notable outputs for the institution. Emanating from the V2020, CPUT has, over the past ten years, developed world-class competition and expertise in Space Sciences through its first-of-its-kind continental *Nanosatellite Programme*, innovations in food sciences such as *Bambara Groundnut Food Portfolio*, cutting-edge *Rooibos Research*, as well as advances in *Teacher Education* through its world-renowned Centre for International Teacher Education (CITE). In terms of human resources development, key indicators such as a marked increase in the *number of NRF-rated scholars*, *research*, *creative and innovation outputs*, as well as an increase in the number of *academic staff members obtaining doctoral qualifications,* point to an institution on a growth trajectory in its RTI endeavours during the period under review. However, there is a recognition that more work needs to be done, especially in translating innovations for the public good.

The CPUT RTI Blueprint 3.0, though forward-looking, aims not to reinvent the wheel but to build on past successes and expand our RTI agenda in line with emerging regional, national, and international 'Societal Grand Challenges'. Therefore, this document will use the 2020 Blueprint as a base to provide 'swim lanes' for CPUT as an engaged public institution to contribute to the sustainable growth and competitiveness of the Western Cape and the country, considering the ever-changing and increasingly challenging socio-economic landscape.

;

1.2. Basis for CPUT's RTI Blueprint 3.0

Notwithstanding the country's challenges, CPUT in 2023, as part of a nascent innovation ecosystem, must also support legislative imperatives of sustainable economic growth and competitiveness. Therefore, the basis for the RTI Blueprint 2030 is an abiding commitment to focus our RTI agenda on the pressing socio-economic needs of society. Furthermore, the everchanging world of work, informed in no small measure by the emergence of the fourth and, inevitably other future industrial revolutions, warrants an RTI strategy that is agile, foresighted, and impactful.

1.3. Alignment with regional, national, continental, and global developmental imperatives

This blueprint, as indicated earlier, is underpinned by cross-cutting issues that resonate at regional, national, continental, and global levels. These include **climate change**, **poverty**, **inequality**, **unemployment**, **food (in)security**, **water**, **sanitation**, **good health and well-being, clean renewable energy**, **open science,** and **open data** as codified in developmental imperatives such as the National Development Plan 2030, Africa Agenda 2063, and the United Nations' Sustainable Development Goals. This legion of global concerns warrants inter-, multi- and trans-disciplinary efforts by universities and other research institutions to urgently yield solutions as these challenges threaten the safety and security of all people in both the developing and the developed world. Their deleterious impact on society has been vividly illustrated in South Africa as well as in other parts of the globe in recent days. For example, the unseasonal flooding in Kwazulu-Natal Province (KZN)and other regions of the country has wrought untold damage and hardship to our citizens. On the other hand, drought has threatened and continues to threaten food security in major regions of the world including South Africa.

Access to an affordable, reliable, and clean energy supply is another challenge with which the country is grappling. Some of the adverse consequences wrought by power outages ('load shedding'), due to a plethora of issues have led to, amongst others, compromised water and sanitation infrastructure, resulting in sewage spillage into sensitive ecosystems. The economic impact is felt far and wide where major cities such as Durban and Cape Town had to close some of the popular beaches during peak holidays for health and safety concerns at the end of 2022. The ripple effect on the economy was significant with the lucrative tourism sector reporting a marked decline in the number of local and international tourists in both regions during that period.

In the Northern Cape, according to recent press reports, sewage pollution from eleven towns along the Orange River and the Vaal River threatens the ten billion rand per year agricultural produce industry in the province. Besides the negative economic impact on much-needed export revenue and jobs, these challenges also carry serious health risks, as untreated sewage flowing into drinking water sources could result in the breakout of diseases such as cholera and typhoid.

These crises will require universities, such as CPUT, to play an active role by working with the government to produce innovative and implementable solutions and recommendations. These could be in the supply of critical skills and public awareness campaigns, as well as innovative technology and knowledge exchanges. Our stated intent as an institution to promote inter-, multi- and trans-disciplinary research,

;

innovation and community development initiatives could go a long way in providing solutions for the region, province and country. Our faculties, including Applied Sciences, Health & Wellness Sciences, Education and Business & Management Sciences, have sufficient expertise to contribute to high impact solutions to arrest this decline in service delivery as part of the RTI agenda for 2030.

CPUT will, as in the past, ensure that it strengthens collaborations and participates in all the relevant Western Cape Government initiatives to ensure the success of the Regional System of Innovation. Specifically, contributions to City–Region initiatives in education, private sector growth, health and access to basic needs such as water and sanitation, will be a particular focus of the university in the future.

At a national level, CPUT will continue to work with the government to contribute to identified imperatives to enhance the National Innovation Ecosystem. Since its establishment, CPUT has benefited immensely from government initiatives, including the establishment of the world-class Technology Innovation Agency (TIA) funded Technology Stations, generous research funding by the National Research Foundation (NRF), as well as a myriad of other funding instruments from the national Departments of Science and Innovation and Higher Education and Training.

1.4. RTI 2030 Blueprint directional framework

This document aims to set high-impact RTI objectives and activities for CPUT for the next decade. In terms of critical navigational markers to ensure the RTI Blueprint agenda has the desired and measurable societal impact, the following aspects of research will be prioritised:

- **Researcher-focused** – Staff development, mainstreaming soft-funded researchers, postgraduate success, research infrastructure investment;
- **Innovative** – More significant societal benefits accruing by deepening the culture of innovation, data sharing and knowledge exchange, entrepreneurship and community engagement;
- **Inter-/multi-/transdisciplinary** – Prioritise and promote collaborations and initiatives dealing with mega-societal challenges, e.g. health, climate change, poverty, etc.;
- **Anticipatory** – Research that speaks to global socio-economic trends, e.g. emerging and future industrial revolutions, artificial intelligence, etc.;
- **Relevant and responsive** – Proactively address the needs of society;
- **‘Glo-cal’ Partnerships** – Industry, communities, government, municipalities, research institutions; and
- **Mutuality** – Mutually beneficial partnerships are rooted in reciprocal relationships among stakeholders. The themes of mutuality and reciprocity emphasise that all stakeholders in a specific partnership benefit from the alliance in a way that is meaningful and beneficial to each of them as well as to the larger shared goals.

;

2. Vision and Objectives

2.1. CPUT's vision, mission and values

Vision
CPUT is Africa's leading Smart University of Technology, globally renowned for innovation with graduates that shape a better world for humanity

Mission
CPUT transforms its students through world-class researchers who inspire knowledge production and innovation that are cutting edge

Values
CPUT agrees to 'oneness' and 'smartness' by:

- Embracing a culture of **Ethics** and **Integrity**;
- Seeking **Kindness** and showing compassion (human heartedness) for the well-being of all our students, staff, stakeholders and the CPUT community, as expressed in *ubuntu* as a way of living;
- Embracing **Restoration** as we deal with the legacy of our past and as we redress issues of equality, gender-based violence and any form of discrimination;
- Being a testimony of **Unity** (*ubunye*) while embracing diversity (*ukungafani*) in all its forms, by being honest, transparent, credible and respectful;
- Showing **Passion** and demonstrating enthusiasm, devotion, intensity, tenacity and total commitment to everything that we undertake as a university of technology; delivering uncompromising quality of service and always searching for better ways of doing things;
- Taking **Accountability** and accepting responsibility for all our actions and the actions to which we commit; and
- Being **Technologically Astute** and understanding that as CPUT staff members or students, we will embrace and take ownership of and experiment with the possibilities technology offers. These attributes facilitate the novel application of modern technology, enhancing productivity and efficiency, while always focusing on innovation for a better world.

2.2. Defining Research, Technology, and Innovation

The following definitions are based on research, technology, and innovation descriptors captured in the RTI Blueprint 2020 and are still in use throughout the institution [2]:

Research is an original investigation undertaken to gain knowledge and/or enhance

;

understanding.

Technology refers to the specific methods, materials, and devices used to solve practical problems or "the branch of knowledge that deals with the creation and use of technical means and their interrelation with life, society, and the environment".

Innovation, based on the National Advisory Council on Innovation (NACI) definition, is taken to mean the process of transforming an idea, generally generated through Research and Development, into a new or improved service, product, process or approach, which relates to the real needs of society and involves scientific, technological, organisational or commercial activities. Stated differently and based on its Latin origin, **innovation** refers to the introduction of something new to the existing realm.

Considering the emerging **social** and **community engagement** dimensions regarding **innovation**, the most appropriate and all-encompassing definition as proposed by *The Economist* would be "new thinking that enhances shareholder (in case of entrepreneurship) or stakeholder (in case of the broader society) value".

2.3. Towards an innovative, regionally engaged entrepreneurial university

As mentioned, a marked decline in traditional funding streams at universities worldwide has spurred a renewed focus on alternative income sources to ensure the long-term sustainability of universities. This has resulted in the institutionalisation of 3rd stream income activities alongside learning, teaching, and research. To this end, universities in the Global South and North are adopting a decidedly innovative and entrepreneurial posture to support their overall academic offering amidst crippling financial constraints.

Innovation economists, starting with the pioneering work of Joseph Schumpeter, believe that what drives economic growth in today's knowledge-based world is not capital accumulation, as neoclassical economists assert, but innovation capacity spurred by appropriable knowledge and technological externalities [3]. Schumpeter stressed the importance of both innovation and entrepreneurship in the economy and society by articulating that entrepreneurial activities, based on innovation, need to change. He further argued that evolving institutions, including universities and enterprises powered by technological changes, were at the heart of economic growth [4]. The 'Capitalisation of Knowledge' has thus gained currency in both the developing and developed world where Science is seen as an alternative engine for economic growth to the troika of land, labour, and capital, which were the traditional sources of wealth [5].

Entrepreneurship is classically defined as creating new ventures and organisations [6]. On the other hand, an entrepreneurial university integrates economic development into the university as an academic endeavour alongside learning and teaching, and research. Hence entrepreneurial activities are primarily undertaken to enhance regional or national economic performance while also improving a university's financial status through the generation of 3rd stream income [7]. Therefore, the imperative to become an entrepreneurial university is due to pressures to access additional funding sources, government 3rd mission policies, and emerging collaboration between universities and external stakeholders [8].

Furthermore, policymakers see universities worldwide as anchor institutions in an innovation ecosystem expected to contribute to regional and national development. Therefore, governments the world over, through policy "like to ensure using funding mechanisms that universities are positively engaged in regional and national development through the pursuit of research and development, leading to innovation, knowledge exchange, and technology transfer" [10]. Hence, governments are encouraging and incentivising entrepreneurial universities to drive the

;

commercialisation of research outputs. It is noteworthy that one of the earliest proponents of the entrepreneurial university concept was American Senator Birch Bayh, after whom the landmark Bayh Dole Act was named. He implored his United States Congress colleagues that the billions of dollars spent on government-supported research should benefit the broader society. He further asserted that universities should become more entrepreneurial to facilitate knowledge spillovers to commercialise innovations out of universities [1].

Due to several structural challenges, the effective and efficient transformation towards an entrepreneurial university is a complex evolutionary process and can take several years to achieve. These challenges include but are not restricted to:

- Tensions and contradictions are likely to emerge between different universities' missions and activities;
- The institutional ability and capacity to balance a broader range of responsibilities over and above the traditional core missions of teaching and research;
- Resistance from academics to shift from a 'publish or perish' paradigm to a dual cognitive mode, where researchers focus on knowledge advancements and identifying inventions that can be patented and marketed for the more significant economic benefit of society;
- Academics could fail to recognise or exploit the commercialisation opportunities in their research outputs;
- Lack of knowledge from university researchers about the market or demand side, which is critical to successful commercialisation activities;
- Requisite core competencies to develop and sustain an integrated approach to entrepreneurship across the institution; and
- Optimal functioning of technology transfer offices as innovation intermediaries to exploit research outputs and facilitate the knowledge and technology transfer to the private sector.

"The entrepreneurial posture" alluded to here, speaks to CPUT pursuing activities that could enhance 3rd stream income. As stated earlier, this is a practical response to significant cuts in public funding for higher education sector. Stated differently, it calls for a decidedly business mindset to seek other sources of revenue without compromising CPUT's stated purpose of pursuing smart learning and teaching, research, innovation as well as community engagement. As articulated by Hannon (2013), in this context CPUT will prioritise and promote the notions of enterprise, innovation, commercialisation, new venture creation and employability of its graduates. So, this entrepreneurship push will be buttressed by every aspect of our academic agenda as vividly articulated in V2030 [13]. Ropke (1998) also assert that the entrepreneurial university can in turn guide industry towards more efficient innovations by the creation, application and diffusion of knowledge both beneficial to industry and the broader society.

Surveying the broader South African higher education environment, this posture is not unique to CPUT. The Entrepreneurship Development in Higher Education (EDHE) Programme within Universities South Africa (USAf) proclaims and promotes this entrepreneurial orientation as a fulcrum through which universities should pursue 3rd stream income initiatives.

Therefore, EDHE's foundational mandate is in positioning universities for their envisaged role in entrepreneurship, innovation, commercialisation, and policy development by focusing on:

- **Student entrepreneurship**, i.e. mobilising the national student and graduate resources to create successful enterprises that will ultimately lead to both wealth and job creation;
- **Entrepreneurship development in academia**, i.e. support academics in instilling an entrepreneurial mindset within all students and graduates through the offering of relevant knowledge, transferral of practical skills, and the application of business principles, not only to a specific discipline but across disciplines; and

;

- **Creating a conducive environment** that will enable universities to adapt strategically and embark on projects whereby 3rd stream income can be generated through innovative business ideas.

Hence the entrepreneurial posture advocated here goes beyond just the quest for 3rd stream income for the respective universities. It also seeks to promote the concept of universities as fertile ground to implant entrepreneurship skills in every student and staff member inclusive of postdoctoral fellows, support staff, and academics.

There is wide consensus among Universities working with EDHE that the concept of an entrepreneurial university should not be seen as replacing the core university strategy but as an integral part of the strategic agenda of the respective universities. Without adequate funding, any enterprise's growth ambition will be stunted.

Within CPUT, the entrepreneurial focus for students at both undergraduate and postgraduate levels will be prioritised. Best practices in the sector as well as the support and thought leadership from EDHE will be valuable as we inculcate entrepreneurship, not only at an institutional level, but also amongst students. Furthermore, the development and subsequent implementation of formal and informal Curricula at CPUT, focusing on undergraduate and postgraduate training in Entrepreneurship, will be spotlighted in consultation with the office of the DVC: Learning and Teaching.

It is worth emphasising that entrepreneurship at universities should not just be the preserve of the engineering, health and physical sciences disciplines. As noted by Etzkowitz [5], entrepreneurship follows a non-linear progression as it can also be generated from the learning and teaching mission of the university as well as humanistic knowledge. This is despite the assertations of some scholars in this field that the phenomenon of the entrepreneurial university is much more accepted and supported by academics in the disciplines of engineering, science, and medicine compared to those in social sciences, arts, and business [9].

CPUT, having pivoted towards its mission as an engaged university to address noted societal challenges, is well positioned to fully evolve into an entrepreneurial university to benefit the broader society. The RTI Blueprint 3.0 hence serves as a basis for CPUT not just to adopt an entrepreneurial posture focusing on the commercialisation of activities (patents, licenses, spin-offs, etc.) but also to continue to play a proactive role as prioritising regional activities such as collaborative industry research, R & D contracts, technical/consultative services (especially for small to medium-sized enterprises or SMEs) as well as community development.

Considering the challenges mentioned above, which could adversely affect the RTI agenda as we advance, it is envisaged that CPUT will need to adopt an integrated approach to coordinate, promote and manage entrepreneurial activities via the office of the DVC: RTIP. To that end, seed funding to establish an Economic Activation Office has been secured from EDHE, which is positioned within Universities South Africa (USAf), for implementation during 2023.

2.4. CPUT's Competitive Advantage

The following RTI flagship initiatives have been identified, prioritised, and marked for specific support as they have given CPUT a **Sustainable Competitive Advantage** in the broader higher education sector in South Africa over the past decade or so. Sustainable competitive advantage in this context is created or enhanced by perceiving or discovering new and better ways to compete in a particular sector and bringing benefits (e.g. innovations) to society in ways that escape competing similar organisations. Underpinning these are *core (distinctive) competencies*.

These refer to the harmonised combination of unique, multiple resources (e.g. research and innovation infrastructure and skills) that distinguish an organisation in the marketplace [11]. Core competencies speak to a resource-based view of strategy where economic rents accrue to organisations that hold resources that are:

- **Inimitable**: It should be hard for competitors to copy competencies, e.g. proprietary technologies;
- **Durable**: There should be the ability to maintain in-house resources and capabilities before they depreciate or become obsolete;
- **Not easily replicable**: The processes should involve highly complex routines which are not easily replicable by competitors; and
- **Not easily transferable**: It should be difficult to transfer the resources and capabilities and upend the incumbent organisation.

Informed by this insight and the prestige and renown CPUT has accrued nationally and internationally, the following flagships are identified as giving CPUT a competitive edge. They have the potential to further enhance the institution's stature and RTI agenda well into the future.

Flagship	CPUT Research Focus Area(s)	Alignment with Developmental Imperatives	Enablers
Nanosatellites	Space Science, Engineering and Technology	• White Paper on Science, Technology and Innovation • NDP 2030 • Industry, Innovation and Infrastructure (SDG 9) • National Space Strategy	World class engineers, academics, and researchers; French–South African Institute of Technology (F'SATI); Africa Space Innovation Centre (ASIC); Strategic industry and government linkages
Green Clean Energy	Smart Energy The Environment, Climate Change & Sustainability	• South African Response Strategy on Climate Change • National Integrated Resource Plan (NIRP) • White Paper on Renewable Energy • Affordable & Clean Energy (SDG 7) • Climate Action (SDG 13)	CPUT Research Chair: Energy Energy Institute at CPUT; SARETEC; Strategic industry and government linkages
Food and Nutritional Research	Human, Health & Social Dynamics Bio-economy & Biotechnology	• National Integrated Food Security Strategy (IFSS) • NDP 2030 • Zero Hunger (SDG 2) • Good Health & Well-being (SDG 3)	World-class infrastructure (e.g. Agri-Tech Station); Leading Researchers in Food and Nutrition; Agricultural Expertise and Resources (Wellington Campus); and envisaged Biotech Corridor

;

Water and Sanitation	The Environment, Climate Change & Sustainability Human, Health & Social Dynamics	• Water Supply and Sanitation Policy White Paper • Zero Hunger (SDG 2) • Clean Water & Sanitation (SDG 6) • Sustainable Cities & Communities (SDG 11)	NRF SARChI Chair in Governance & Economics of Water Sanitation Sector Institutions; Centre for Water & Sanitation Research
Education Research	Human, Health & Social Dynamics	• White Paper for Post-School Education and Training • Quality Education (SDG 4) • NDP Chapter 9	2x NRF SARChI Research Chairs in Education and Work-Integrated Learning; Leading Researchers in Teacher Education; Curriculum Development; visible trans-disciplinarity drive

2.5. RTI 2030 Strategic Objectives

The need to ensure that the new Blueprint is relevant and responsive to the overall strategic direction of CPUT is paramount. The implementation of this Blueprint in alignment to V2030 and the activities are already being implemented as per V2030. Stated differently, the RTI Blueprint provides the requisite implementation and monitoring swim lanes for V2030. To that end, the following six over-arching RTI objectives are informed entirely or in part by the focus areas codified in V2030:

Focus Area 1: A Smart ITC environment and ITC workforce
Focus Area 2: Smart teaching and learning and smart learning environments
Focus Area 3: Smart RTIP that is relevant and has an impact
Focus Area 4: Smart human capital and talent
Focus Area 5: Smart internationalisation
Focus Area 6: Smart engagement and strong links with quintuple helix partners
Focus Area 7: Smart student engagements and learning experiences

Focus Area 3: Smart RTIP that is relevant and has an impact

Objective 3.1: Develop the research capacity of a future generation of researchers/ scholars, and innovators, putting CPUT at the forefront of innovation in its broadest sense.
3.1a: Invest in the development and growth of research leadership on all academic levels through a supportive research culture, creating academic career paths by providing opportunities for the development of Mode 2 and Mode 3 knowledge production.
i. Support and promote initiatives to increase the number of CPUT academics with doctoral qualifications in line with NDP 2030; ii. Purposeful recruitment of reputable, productive and experienced academics (including adjunct professors), support staff and postdoctoral fellows; iii. Retain productive researchers after the age of 65 as adjunct professors and research fellows; iv. Annual recognition of research and innovation excellence at CPUT; v. Continuous training and support for the university's emerging and established researchers; vi. Support and encourage CPUT academics to obtain and maintain NRF rating; vii. Optimal, fair and equitable workshare model for academics to enhance research

;

outputs;

viii. Coordinate the development of industry-standard research, technology and innovation facilities, including laboratories, trials, prototyping and demonstration facilities; and

ix. Policies developed and implemented to ensure an engaged workforce in the domains of research and technology innovation. These policies should emphasise the role and value of soft-funded staff in line with the 'oneness' ambition.

3.1b Identify students on undergraduate level that will make a success of postgraduate studies, based on their performance, curiosity and research capabilities

3.2 Develop relevant research focus areas and strengths with continuing emphasis on research uptake in mode 2 and 3, and some mode 1 where relevant.

3.2a Invest in CPUT research capability and state-of-the-art infrastructure to ensure that we have the skills, capacity, systems and approaches to generate positive impact in industries and communities through our research and Modes 2 and 3 knowledge production.

i. Assess, document and publicise (e.g. on the CPUT website) accessible research and innovation infrastructure located at CPUT or at our external partners;

ii. Develop e-Research unit/facility to provide high-performance computing and enhanced data processing and visualisation; and

iii. Facilitate empathetic, informed and empowered support staff as well as resourced support facilities.

3.2b Add a research component in the undergraduate curriculum as from first-year level to build a strong awareness of research and scholarly inquiry.

i. Where possible, introduce training of students in areas such as innovation, intellectual property (IP) management, and business management in master's and doctoral programmes (to create entrepreneurial scientists/scholars).

3.2c Increase a new and innovative focus on building our unique integrated and perspective of humanities and social sciences (HASS) with science, technology, engineering and mathematics (STEM), across our teaching and research practice.

i. Engage local, provincial and national government to address development challenges with a specific South African context, e.g., water and sanitation, electricity shortages, waste management, food security, climate change and other sustainability challenges;

ii. Increase in CPUT collaborative trans-disciplinary/transnational and cross-border research outputs;

iii. Enhance collaboration between researchers across faculties and departments and promote data sharing; and

iv. Engage industry, science councils and non-governmental entities in funding cross-faculty research and innovation projects for socio-economic impact.

3.2d Use leading-edge platform technologies and facilities to harness opportunities across key areas, including health, data science and sustainability in a multi-disciplinary approach.

i. Link state and private sector entities to support key institutional research and innovation high impact initiatives;

ii. Strengthen the link between research focus areas with research initiatives across CPUT faculties, centres and institutes to enhance collaborations with strategic

;

local and international partners; and iii. Develop e-Research unit/facility to provide high-performance computing and enhanced data processing and visualisation.
3.2e Create new opportunities for all CPUT researchers from research students to Distinguished/visiting Professors to work in collaboration with industry, business and communities, and develop commercialisation or other pathways for research impact.
i. Strengthened mechanisms to maximise the benefit of intellectual property and the promotion of entrepreneurship and business acceleration to benefit the broader economy and society; ii. Promote technology and knowledge transfer through the Technology Transfer Office across the institution; iii. Establish an Economic Activation office to centralise all entrepreneurship and innovation activities at CPUT; iv. Venture fundraising to ensure spin-off companies are sustainable; and v. Enhanced commercialisation and IP support, including: • Support with registering patents, trademarks, designs, copyright, and know-how • Licence agreements • Support for business incubation and development of spin-off companies.
3.2f Increase the diversity and scale of our research income by supporting our researchers to secure large, external research contracts, enhancing the academic profiles/standing of our staff, and creating and leveraging strategic partnerships and collaborations that provide funding solutions on multiple fronts.
i. Purposeful identification of new business and societal opportunities and challenges to undertake research on a contract basis.
3.3 Strengthen the link between research focus areas, programme development/ development of future looking qualifications in postgraduate programme offering.
Regular reviews of work trends and, subsequently design programmes that will be high in demand in an increasing technology-driven world, e.g., Artificial intelligence (AI) Block Chain Applications, Quantum computing technologies, Virtual Reality Development, Simulation Sciences, Robotics and Manufacturing, Cyberpsychology, Cyber Consumer Sciences, E-Commerce, Energy capturing, storage and transmissions.

Focus Area 5: Smart Internationalisation

In addition to the Internationalisation Strategy, the RTI 2030 Blueprint will contribute to the actualisation of Focus Area 5 through the following:

i. Develop and implement an International Student Roadmap to enhance the student experience and success at CPUT;
ii. Promote Internationalisation at Home and Abroad to facilitate student and staff exchange in research, innovation and teaching;
iii. Focus on funded opportunities in Africa, Europe, Asia, and North America; and
iv. Identify new or strengthen existing funded opportunities, e.g. Erasmus+, etc.

;

Focus Area 6: Smart Engagement and Strong Links with Quintuple Helix Partners

The RTI 2030 Blueprint will contribute to the actualisation of Focus Area 6 through the following:

i. Enhanced, equitable and mutually beneficial partnerships and networks locally and internationally to deepen research, innovation, teaching and learning capabilities;
ii. 'Hitting the pavement' to promote CPUT in general and RTI initiatives in particular to the private sector, government departments and entities, foreign missions, local and international universities, and non-government entities;
iii. Adopt a 'consortia approach' with other universities and science councils, especially in areas where CPUT aspires to develop flagships but has limited capacity and resources;
iv. Establish and maintain a database of all CPUT partnerships and collaborations; and
v. Establish and implement guidelines on strategic RTI partnerships, including criteria for partnerships, partnership approaches, and scanning for prospective industry and other partners to form potential target markets for CPUT RTI outcomes.

Strategic objective above and beyond V2030

Double the number of postgraduate students

i. Enhance postgraduate supervisory capacity through innovative programmes and approaches informed by global best practices, e.g., Sisonke Supervision Mentorship Programme; cohort supervision, industry (co)supervision, etc;
ii. Implement a postgraduate marketing plan to attract motivated, high-quality postgraduate students from South Africa and beyond;
iii. Raise funding for merit-based postgraduate bursaries from government, industry, and local and international donors;
iv. Leverage the postdoctoral fellowship programme to enhance postgraduate supervision;
v. Identify high-potential undergraduate students to develop a sustainable pipeline of postgraduate students at CPUT ('grow our own timber');
vi. Communicate postgraduate student achievements to attract a new crop of students to CPUT;
vii. Enhance graduate attributes through specially designed programmes focusing on research methodology, writing, presentations and other communication training initiatives;
viii. Apply approved progression rules to ensure student success;
ix. HDC to develop guidelines in line with Bursary Policy and Rules to incentivise research outputs by Masters and Doctoral (M & D) students. These could include but are not limited:

- Fee rebates if the Masters or Doctoral qualification is completed in the minimum prescribed time;
- Waivers in the subsequent year for M and D students if the output is published during their studies; and
- Fee rebates if article(s) is published within one year after graduation

;

3. Key CPUT Challenges in Implementing RTI Blueprint 3.0

The following issues have the potential to adversely impact the implementation of the blueprint:

- Turnover and retirement, especially of key and productive academic staff, could adversely affect our research outputs, supervisory capacity and established quality partnerships;
- Socio-economic instability deepens the skills deficit in the country, e.g. the emigration of skilled professionals across all economic sectors;
- Lack of adequate funding for new research areas due to shifting government priorities – social spending increasing amidst a declining tax-paying base;
- Competition for staff and students from other universities and institutions – be they regional, national or international;
- Obsolete and outdated research and innovation infrastructure coupled with inadequate operational, servicing and maintenance expertise; and
- Misalignment with National Development Priorities causes a decline in funding by the national government and other public formations.

;

4. RTI Blueprint 3.0. Indicators to evaluate, monitor, and measure progress

Dimension	Indicator	2023 (baseline)	2025	2027	2030

Human Capital (HC)	• Percentage of staff members with PhDs
	• No. of NRF-rated scholars/researchers
	• No. of masters/doctoral students as percentage of total enrolment
	  ○ % South Africans
	  ○ % Women
	• No. of masters/doctoral graduates as percentage of postgraduate enrolment
	• No. of postdoctoral/innovation/teaching fellows
	• No. of research fellows
	• No. of adjunct/emeritus professors
	• No. of staff involved in innovation activities [a]				

Organisation Capital (OC)	• No. of invention disclosures • No. of patents granted • No. of spin-off companies • No. of license agreements • Licence revenue • No. of enterprises assisted [b] • University–industry partnerships • Accredited research outputs [c]				

Social Capital (SC)	• Partnerships
	  ○ National
	  ○ Continental Africa
	  ○ International
	  ○ Global South [d]
	  ○ Global North
	• No. of mobilities
	  ○ Students (inward/outward)
	  ○ Staff (inward/outward)
	• No. of multi-, trans- and interdisciplinary research initiatives				

[a] *Technology/knowledge transfer to industry, communities, government, etc.*

[b] *Assisted by TIA technology stations, faculties, institutes, centres*

[c] *Book chapters, books, research papers, conference attendances, creative outputs*

[d] *Excluding Africa*

;

5. Creating an enabling RTI ecosystem at CPUT

The building and enhancement of the following components and services across the institution are essential for the advancement of a productive and sustainable research, technology and innovation culture within CPUT:

i. *Essential infrastructure*
   - Technology stations
   - Economic activation office
   - Institutes and centres
   - Specialised technology platforms
   - Industry-standard research, technology and innovation facilities, including laboratories
   - High-value equipment

ii. *Advisory services*
   - Mentorship and Coaching
   - Project management
   - Business warehousing
   - Expert/technical services
   - IP management
   - Commercialisation
   - Technology transfer

iii. *Business development capabilities*
   - Identifying market opportunities
   - Economic viability
   - Commercial and legal concepts
   - Entrepreneurship teaching and learning (e.g. short courses especially for industry and community members)
   - Consultancy

iv. *Process/product development (marketing testing)*
   - Prototyping and demonstration facilities
   - Laboratory testing
   - Incubation and/or piloting

6. Monitoring and Evaluation

Aligned with the V2030 reporting protocols, progress on the RTI Blueprint 3.0 will be on an annual basis through the relevant structures within the university. Specifically, once this blueprint is approved, an implementation plan will be developed, along with a monitoring plan that articulates both indicators and targets. We intend to optimally use all available information systems to monitor and evaluate progress in goal and objective attainment in addition to other traditional reporting mechanisms.

This will be complemented by an institutional M&E system, with a system of indicators as part of the Research Information Management System (RIMS), with additional information collected for strategic purposes where required. The system will focus intensely on utility for learning that facilitates planning and improvement, and accountability toward internal and external stakeholders. Data and information will thus only be collected if used at different levels. This necessitates a strong focus on good vertical and horizontal

;

information flows across the university and, where necessary, to and from external stakeholders.

7. Definition of Victory (DOV)

In developing and adopting the RTI Blueprint 3.0, CPUT will ensure the abiding relevance and responsiveness of our academic agenda to the needs of the broader society. Specifically, the following will be high-level indicators of impact over the stated period of the blueprint:

- Growth in CPUT stature and ranking in terms of research outputs, quality of learning and teaching, community engagement and commercialisation of research innovations;
- Alignment of learning and teaching, research and community engagement to current and future industrial revolutions (4IR and beyond);
- The establishment of inter-, multi- and trans-disciplinary Research Platforms across the institution to address pressing national and global challenges;
- University–Industry partnerships to ensure that research translates into societal value; and
- Real, substantive, value-adding and mutually beneficial engagements – regional, national and international partnerships and networks, in the rest of Africa as well as the Global South and the Global North.

;

References

1. Audretsch DB, 2014. From the entrepreneurial university to the university for the entrepreneurial society. *Journal of Technology Transfer*, 39: 313-321.
2. https://www.cput.ac.za/storage/research/research_directorate/RTI_Blueprint.pdf.
3. Antonelli C, 2003. *The Economics of Innovation, New Technologies, and Structural Change*. London: Routledge.
4. Schumpeter J, 1934. *The Theory of Economic Development*. Cambridge, MA: Harvard University Press.
5. Etzkowitz H, 2019. Innovation Lodestar: The entrepreneurial university in a stellar knowledge firmament. *Technological Forecasting & Social Change*, 123: 122-129. http://dx.doi.org/10.1016/j.techfore.2016.04.026
6. Etzkowitz H & Leydesdorff L, 2000. The dynamics of Innovation. From Natural Systems and Mode 2 to a Triple Helix of University–Industry–Government Relations. *Research Policy*, 29 (2): 109-123.
7. Etzkowitz H, Webster A, Gehardt, C & Terra BR, 2000. The future of the university and the university of the future: Evolution of ivory tower to entrepreneurial paradigm. *Research Policy*, 29: 313-330.
8. Sanchez-Barrioluengo M & Benneworth P, 2019. Is the entrepreneurial university also regionally engaged? *Technological Forecasting and Social Changes*, 141: 206-218.
9. Kalar B & Antoncic B, 2015. The entrepreneurial university, academic activities and technology and knowledge transfer in four European countries. *Technovation*, 36-37:1-11.
10. Frondizi R, Fantuuzzi C, Colasanti, N & Fiorani G, 2019. The evaluation of universities' third mission and intellectual capital: Theoretical analysis and application to Italy. S*ustainability*,11: 3455-3427.
11. Prahalad CK & Hamel G, 1990. The core competence of the corporation. *Harvard Business Review*, 79-91.
12. CPUT Research Focus areas. Available at https://www.cput.ac.za/research-technology-and-innovation/research-focus-areas.
13. Hannon PD, 2013. Why is the entrepreneurial university important? *Journal of Innovation Management* 1(2):10-17. DOI: 10.24840/2183-0606_001.002_0003
14. Ropke, J. (1998). The entrepreneurial university, innovation, academic knowledge creation and regional development in a globalized economy. Working Paper, Department of Economics, Philipps-Universität Marburg, Germany. Available at https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=a492feccb37145329f4c0ce25a671de2f51c1a04

;