UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG

OFFICE OF THE DVC: RESEARCH AND INNOVATION

WITS Strategic Plan for Innovation

2022 – 2026

Compiled by a Task Team of the
University Research and Innovation Committee
(URIC) led by DVC: Research & Innovation
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And
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Document History

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WITS UNIVERSITY

Purpose

The **Strategic Plan for Innovation** is a Wits University plan approved by the University Research and Innovation Committee (URIC). It provides leadership and guidance with respect to growing innovation across the University as a whole and influences all five Faculties, inter-Faculty entities and members of the Wits Group.

This Plan builds on "**Wits 2033: The leading edge of the Global South**", the University's strategic framework as approved by Council in November 2021. The vision that underpins this Strategic Plan is responsive to the evolving context of the University, its staff and students, as key drivers of innovation in South Africa, Africa and the world. It prepares Wits to continue in its pivotal role in society and the economy as it enters its second century.

Task Team Members

The process to create this Plan was led by the Deputy Vice-Chancellor: Research and Innovation and the Director: Innovation Strategy, working with a broadly representative task team drawn from URIC. Additional members were invited to join the task team based on their specific area of expertise. Extensive consultation was also conducted with relevant stakeholders both within and outside the University.

The following are members of the task team responsible for drafting this Strategic Plan:

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Executive Summary

Innovation lies at the heart of Wits University's vision as it enters its second century as one of the leading academic institutions in the Global South. The recently approved strategic framework of the University lays down a set of commitments which the University undertakes to achieve by 2033. This **Strategic Plan for Innovation** builds on the institutional strategic framework. It describes how those commitments related to innovation will be achieved.

This document begins by providing an overview of the context for innovation within our region, our country, and our university. The outputs of five stakeholder workshops are summarised. These workshops elicited views on how innovation is currently perceived at Wits.

Before setting out a strategic plan for innovation we define important terms and concepts, one of which is "innovation" itself. We provide a Wits-specific definition for "innovation" as follows:

Innovation is the successful deployment of new ideas or methods to benefit society.

More specifically, innovation should:

- involve collaboration across disciplines
- cover interactions between industry, government, academia, society and/or the environment ("the quintuple helix")
- have outputs that are either tangible (products or "things") or intangible (processes, services, policies, or ideas)
- be supported by methodologies that can be taught and learnt
- be conducted in an ethical manner.

The following Vision, Mission and Values in relation to Innovation are defined for Wits:

Vision:

Wits will be at the leading edge of innovation that serves society.
Wits will play a key role as a hub that links innovation ecosystems at universities in the Global North to those in the Global South.

Mission:

Wits strives to meet society's needs by turning knowledge into impactful solutions.

Values:

Innovation is what drives us forward. We enable a space to create, collaborate, and engage in impactful innovation, across disciplines and boundaries.

We are committed to using our knowledge for the advancement of our community, city, country, continent, and the globe.

We then describe the proposed innovation ecosystem that will support research-led, researcher-led and student-led innovation at Wits. This ecosystem consists of institutional arrangements whereby the newly created Wits Innovation Centre (WIC) provides an enabling interface between innovators located in Schools and research groups, and innovation-support entities. Via this ecosystem innovators and academic entrepreneurs will receive access to training, funding, mentorship, advice, and other resources.

One of the most important objectives of the WIC is to create an innovation mindset at Wits.

This Plan touches on the question of how innovation is to be measured at Wits. Some general guidelines are provided. The actual task of devising, piloting and refining a measurement framework for innovation will be undertaken as an activity within this strategic plan.

We make the following recommendations for implementation in the 5-year timeframe of this "**Strategic Plan for Innovation - 2022-2026**".

1. Create a common vision for Innovation at Wits and provide focus and coordination in its implementation.
2. Strengthen the level of attention to Innovation across all Faculties, Schools and research entities.
3. Develop a suitable measurement framework for Innovation. Pilot and refine it.
4. Provide incentives, rewards and support mechanisms for students and staff engaged in Innovation. Ensure that incentives are transparent and equitable.
5. Strengthen links with companies, civil society, public sector and other universities in support of Innovation.
6. Integrate training in Innovation and Entrepreneurship into all study programmes, both undergraduate and postgraduate.
7. Deepen commitment to interdisciplinarity in research, teaching and Innovation.
8. Encourage closer alignment with global frameworks such as the UN Sustainable Development Goals (SDGs)

“Wits Definitions” of Terms Used in the Document

Phrase or Term	Wits Definition
Accelerator	A business-friendly physical space. It’s often the first work address for a new company and/or a first production facility for new products. It might be set up to share resources and facilities between businesses with similar needs, but the focus is on helping new ventures to grow.
Commercialisation	The introduction into a market (economic or social) of new or improved products, services or processes.
Company	An institution comprising a group of people that cooperate so that they may accomplish something collectively that they could not accomplish separately. It is formed as a juristic person under the Companies Act, which provides for registration and requires a specific form of governance. A company can be for-profit, non-profit, or state-owned.
Entrepreneurship	The ability to identify an opportunity to provide society with something it needs or wants, and create a pathway to mitigate the risks that go with bringing a new solution into use.
External Engagement	Bringing external entities (companies (for profit, non-profit and state-owned) and government, NGOs) and academic research together for mutual benefit.
Hub	A physical space that is conducive to meeting people. It encourages interaction, co-creation, collaboration, and team formation and facilitates chance encounters. A hub is about connecting people as well as nurturing ideas.
Incubator	A space that supports the refinement of a solution or concept – often from an idea into the form/prototype of a new product or service to be delivered to society. Since the idea brought into the incubator is typically not yet fully formed, some hub-like activities are still beneficial. An incubator is typically a dedicated physical space, however virtual incubation may occur using other spaces such as research laboratories, or might be entirely online using digital collaboration platforms such as Teams of Zoom
Innovation	**The successful deployment of new ideas or methods to benefit society.** More specifically, innovation should: • involve collaboration across disciplines • cover interactions between industry, government, academia, society and/or the environment (“the quintuple helix”) • have outputs that are either tangible (products or “things”) or intangible (processes, services, policies, or ideas) • be supported by methodologies that can be taught and learnt • be conducted in an ethical manner.
Innovation Support Process	Activities that support the development of research outputs towards innovation.
Intellectual Property / IP	A creation of the mind – being an idea, invention, creative output, etc., - that can be protected by law from being used or copied by someone else. IP is knowledge that is sufficiently codified so that it may be protected for the benefit of supporting achievement of outcomes. It is also a tool to facilitate External Engagement agreements which require codified IP as the asset to which rights and obligations pertain in the agreement.

	Where the intended outcome is the result of commercialisation, IP is a tool in achieving a commercialisation strategy, and may include the need for statutory protection (where viable and appropriate).
Invention	Is an idea or concept that is novel (unique). Some inventions may meet the criteria to be statutorily protectable, i.e. registered as designs, patents, plant breeder's rights, etc. Inventions can stem from a range of activities, including Research Outputs. Inventions are often the starting point of Research Led Innovation.
Research (noun) / Research Outputs	The noun "research" is "new knowledge" synthesised via a Research Process. In some contexts this new knowledge can be an Invention.
Research (verb) / Research Process	The verb "research" refers to a methodology that answers a question (the "research question") by drawing on existing knowledge to synthesise new knowledge. Also called the "Research Process".
Research Impact	The effect research has beyond academia; that is when the knowledge generated by the Research Process contributes to benefits to, and influences, society, culture, policy, the environment, and the economy. Impact can be created at any stage of the Research Process and is usually the result of effective knowledge exchange with an external partner. The outcome of Research Led Innovation is one form of Research Impact.
Research Process	See "Research (v)"
Research Question	A question that has not been answered. In some cases the origin of the research question is simply curiosity. In other cases the problem to be solved represents an unmet societal need.
Society	A large group of people who live together in an organised way, making decisions about how to do things and sharing the work that needs to be done. "Industry", "the economy", "communities" "the university" and "government" are all part of Society.,

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1 Context

1.1 Innovation as a Driver for Global and Regional Development

Innovation has become an important priority for universities around the world. Innovation complements and extends the impact of research. Publicly funded research-intensive universities, such as Wits, are expected by society to develop new knowledge, find answers to key challenges and contribute to the common good. As one of Africa's top academic institutions, Wits University is in a unique position to become the driving force behind a new generation of African researchers, scientists, engineers, innovators and entrepreneurs. Wits is increasingly seen as the university of choice for Africa's top students. Through inter-university networks such as the "African Research Universities Alliance" (ARUA) network, co-founded by Wits, some of Africa's top research universities are developing powerful research collaborations. Wits also has an extensive network of collaborative relationships with researchers and academic institutions beyond Africa. The University's strategic framework, as articulated in "**Wits 2033: The leading edge of the Global South**", sees Wits as playing a key role as "a hub that connects universities in the Global South to those in the Global North".

1.2 Innovation as a national priority in South Africa

Promotion of innovation has been an increasing priority of the South African government since the "Science and Technology White Paper" of 1996, and the subsequent "National Research and Development Strategy" in 2002. These steered the creation of technology-led innovation support structures, such as the NRF-managed Innovation Fund, a number of Biotechnology Research and Innovation Centres (BRICs), and others. These instruments were consolidated into the Technology Innovation Agency (TIA) (through the "Technology Innovation Agency Act", 2008). Mechanisms were also established to ensure optimal use of intellectual property that has been developed utilising taxpayer's money (Intellectual Property Rights from Publicly Financed Research and Development Act, 2008), for the benefit of South Africa's citizens.

In March 2019 the South African Cabinet approved the White Paper on "Science, Technology and Innovation". It sees Science, Technology and Innovation (STI) as important enablers to address many of South Africa's socio-economic challenges. It notes that previous STI policy initiatives have failed to achieve the desired results and sets out several policy shifts. These include (p. iii in the White Paper):

- Increasing the focus on inclusivity, transformation, and linkages in the National System of Innovation (NSI).
- Enhancing the innovation culture in society and government.
- Improving policy coherence and budget coordination across government.
- Developing a more enabling environment for innovation.
- Developing local innovation systems.
- Supporting social and grassroots innovation.
- Expanding the research system.
- Developing human capabilities.
- Accelerating the implementation of the pan-African STI agenda.
- Increasing investment in the NSI

The White Paper refers to "Centres of Competence" as distinct from "Centres of Excellence". It defines these entities as follows:

> *A Centre of Competence (CoC) is envisaged as a collaborative entity or instrument, preferably led by industry, that is resourced by highly qualified researchers associated with Public Research Institutions who are empowered to undertake market-focused strategic research and technology development for the benefit of industry and the economy at large. CoCs are therefore intended to provide a formal, and as far as possible contractually secure, physical or virtual platform upon which to establish collaborative*

technology innovation and commercialisation partnerships between government, industry, universities and Public Research Institutions, with the explicit aim of technology commercialisation.

Industry led entities are envisaged as being established by drawing in researchers from "Public Research Institutions" (such as universities, the CSIR, MRC, ARC etc), and through their collaborative nature they provide a useful vehicle for collaborative research with industry by research universities, leading to innovation.

1.3 Innovation as a focus for Wits in its Second Century

When he was installed as Wits University's 16th Vice-Chancellor on 29th April 2021, Professor Zeblon Vilakazi, placed great emphasis on the importance of innovation. He spoke about "*plans to reinvigorate Braamfontein* [the inner-city area of Johannesburg in which the University has its main campus]*, with the help of public and private sector partners, in order to develop an ecosystem of knowledge generation, innovation, and entrepreneurship, and an innovation hub which could soon spawn Africa's own tech companies, which will grow and multiply to scale*." He also said that "*We must create an enabling environment for the flourishing of great ideas that will herald this continent into an era of innovation, change, and growth."*

In 2021 the University launched a consultative process that resulted in the drafting of a new strategic framework for the institution. This framework is set out in the document "**Wits 2033: The leading edge of the Global South**", which was formally approved by Council in November 2021. This strategic framework sets the direction for Wits as it celebrates its centenary in 2022 and enters its second century. "Innovation" is one of the key factors in this strategic framework.

"Wits 2033" sees the University as being at "the 'leading edge' as the foremost research-intensive university in the Global South bridging the world's divides using our location in Johannesburg to act as an interlocutor between the Global South and North". It lists 5 key goals for Wits, one of which is to "lead in innovating and pioneering knowledge".

"Wits 2033" articulates a **Vision** for Wits. Quoted in full, it reads:

> *By driving innovation throughout the University, embracing the diversity of our people, disciplines and ideas, Wits will be a place where our students and staff thrive.*
>
> *We will strive to empower our graduates to be socially-responsive and adaptive to an ever-changing world.*
>
> *We will build on Wits' 100 years of academic scholarship and research excellence, and use our abundance of knowledge, talent, and innovation to find solutions to the challenges of the 21st Century.*
>
> *Our locale will enable us to lead from the Global South, to serve as a hub of knowledge on the continent to advance inclusive and sustainable futures for all.*
>
> *We will be at the leading edge of innovation and academic excellence in the Global South.*

Each of these statements in the University's Vision refers directly or indirectly to "Innovation", i.e. turning knowledge into societal impact.

The Deputy Vice Chancellor: Research and Innovation (DVC) has been tasked to work on developing a detailed strategy to create a coherent plan to encourage innovation at Wits. This strategy has the overall aim of supporting, managing, measuring, and growing innovation at the University. This strategy will underpin the implementation of the "Wits 2033" vision referred to above.

This strategy is set out in the document you are now reading.

1.4 How 'Innovation' is perceived at Wits

Five stakeholder workshops were held to elicit perceptions at Wits on key aspects related to "innovation". See Appendix for more details. The key findings are set out in the following table:

Table 1: Outputs from Stakeholder workshops – perceptions on Innovation

What is "innovation"?	▪ Innovation is broad requiring collaboration across disciplines ▪ Innovation implies improvements – doing things "better" ▪ Innovation can be taught and learnt ▪ Innovation is a collaborative activity focusing both on the individual beneficiary and on the innovative team ▪ Innovation is inevitable – "we have to keep innovating" ▪ Innovation has a social context ▪ Innovation is not always "good"
What can be done to grow innovation at Wits?	▪ Create an "innovation mindset" ▪ Create "institutional space" for innovation at Wits ▪ Incentivise innovation ▪ Identify opportunities for innovation
What are the benefits of promoting innovation at Wits?	▪ Contribute to building a better society ▪ Raise the quality of Wits research ▪ Raise Wits University's reputation ▪ Generate income
What can go wrong?	▪ Innovation strategy might result in unintended consequences ▪ Innovation strategy fails to deliver on high expectations ▪ Insufficient appetite and support for risk-taking ▪ Failure to move forward at the right pace – doing too much too soon or moving too slowly ▪ Lack of institutional coordination ▪ Thinking too narrowly about innovation ▪ Lack of positive role models at Wits
How do Wits people feel about innovation and the innovation strategy?	**Negative sentiments** ▪ Provoking jealousy and resentment ▪ Fear of "thinking outside of the box" ▪ Innovation becomes too widespread and disruptive at Wits ▪ Wits will become too business-oriented ▪ Fear that "research will be taken away from researchers and commercialised by 'The University' " ▪ Uncertain roles and responsibilities ▪ Added workload **Positive sentiments** ▪ Wits will become more accommodative towards entrepreneurship ▪ Opens up exciting new opportunities ▪ Creates an environment that rewards "new thinking" ▪ Greater opportunities for social impact

1.5 Towards a Broad and Inclusive Approach to Innovation at Wits

How does Wits Humanities Faculty see Innovation

The Humanities has always been innovative insofar as much of our intellectual and applied labours continue to address pertinent questions of social change affecting humanity, and contributions to societal change in the service of the public good. The Humanities responds to issues of climate change, race, gender, labour, class, health, education, migration, food and water security, and inequality, amongst others, and has been able to communicate understandings and responses to such issues to multiple publics through creative, artistic and public-intellectual modes, but also by having an influence on social policies and programmes. A definition of innovation must of necessity therefore be inclusive, and not restricted to digital transformation, technological developments, commercialisation and entrepreneurship. In the Humanities, we envisage digital transformation and technological evolution as a part of innovation, but this is only one of many components. Others include policy creation and influence, interdisciplinary interventions to address the 'wicked' problems of our time through a Global Humanities, creative and/or artistic research, public science and social science communication, critical thinking, advancing citizen participation in all forms of social life, and the enhancement of the functioning of public institutions and organisations for societal development. Our knowledge project must serve society through advancing knowledge and improving all aspects of lives and livelihoods. As such, 'measurement' of innovation at the institution should include enhanced societal flourishing, learning, thought, social benefit and the application of Humanities scholarship to the development of more equitable societies.

Nicole De Wet-Billings
Assistant Dean (Research), Faculty of Humanities

Wits University is a richly diverse community of researchers, students and staff. The strength of this community lies in its potential to draw on this diversity to tackle some of the most challenging problems faced by society in the 21st Century. In its first 100 years Wits has on several occasions successfully risen to specific societal challenges. The most recent of these has been the COVID-19 pandemic. Wits medical researchers, social scientists, engineers, data scientists, legal experts, ethicists and others have played an important role in dealing with society's response to the pandemic both locally and globally. The disciplinary breadth of the community of researchers and social activists that have come together at Wits in response to COVID-19 has resulted in significant impact and creativity.

Innovation thrives on diversity. Innovation at Wits will be best served by ensuring that this Wits Strategic Plan for Innovation is as multi- and trans-disciplinary as possible. Equal opportunities for engagement from everyone at Wits must be ensured. **The erroneous view that innovation is limited to scientists and engineers developing and commercialising widgets must be challenged**.

1.6 Comparison between Wits and Other Academic Institutions

Within the context of an innovation strategy there are many comparisons that can be made between Wits University and other academic institutions in South Africa and throughout the world, both in the Global South and the Global North. While our Strategic Plan for Innovation is cognizant of information gleaned from other institutions, we see our situation as unique. The Strategic Plan is specifically tailored for the Wits situation focussed on local and African issues. However, we include here a short summary of a recent survey on European universities conducted by the European University Association (EUA)[1].

The report notes that there is a growing focus on innovation at European universities. This focus is "outpacing the availability of incentive and other support mechanisms, as well as requiring them to adjust their own institutional approaches for a more disruptive role as innovators". The report goes on to say that "aligning these support mechanisms and approaches with universities' innovation capacities and ambitions will be crucial to fostering a more sustainable and digitally connected society [in Europe]". The EUA conducted a survey to capture the different levels of innovation capacity at European universities. They also aimed to understand how these levels contribute to a wide range of impacts and social outcomes. Data was collected from 166 academic institutions in 28 European countries.

The following is a selection of the key results of the EUA survey:

- Most institutions have a strategy or mission statement that reflects their innovation agenda. Most of these strategies address the broad sense of innovation, including the universities' contribution to building a sustainable society through all types of innovation including social innovation. The respondents also reported an increased focus on knowledge transfer and commercialisation processes;;
- There is widely shared optimism that Europe's research and innovation capabilities will allow it to achieve its innovation objectives;
- Resources, in particular funding, staff and space for co-creation, play a key role in meeting university ambitions in the area of innovation. Many institutions feel that they lack sufficient funding, and staff resources to fulfil their university's innovation mission. They also feel that there is no official recognition of innovation activities in career assessment. These are important aspects hindering university innovation capacity.
- Efficient institutional governance structures and institutional autonomy are crucial prerequisites for enhancing university innovation capacity. Most respondents consider that efficient institutional governance structures and institutional autonomy are necessary to allow them to develop innovative and evidence-based solutions to societal challenges, act as honest brokers in innovation ecosystems and engage with society.
- While there are many ways in which universities measure their innovation success, the number of partnerships is the most widely used indicator.
- Collaboration in the innovation ecosystem is important. While collaboration with other universities and public sector departments and institutions is the dominant form of collaboration, the most successful universities collaborate primarily with companies and civil society organisations.
- Universities measure their success as innovators in terms of nurturing the start-up sector.
- There is room for further improvement in the development of student entrepreneurial mindsets. Relatively few students benefit from entrepreneurship training. Such courses are often not embedded in the curriculum. In many cases, they are offered as an extra-curriculum activity, but the participation rate is low, as many students do not consider them relevant for their future career paths.

The report also makes some recommendations. The following is a selection of those that are relevant to the Wits situation:

[1] European University Association (EUA), "Innovation Ecosystems for a sustainable Europe: How to enhance the contributions of Universities – Based on the results of the EUA survey on universities and innovation", November 2021. Available for free download at https://eua.eu/resources/publications/

- Strengthen strategic attention to innovation across all departments, faculties and services. A common institutional innovation vision and strategy, as well as effective coordination, will contribute to enhancing the institution's innovation capacity.
- Provide incentives, rewards and support mechanisms for academic staff innovation activities. Notably, expand career development and recognise a wide range of academic staff contributions in career assessment, including innovation activities. Such activities should be considered in a broader sense, including its economic, social, cultural, ethical and environmental impacts.
- Strengthen links with companies and civil society organisations as part of long-term partnerships to better respond to societal challenges.
- Increase integration of entrepreneurship training into all study programmes. This should address a broad range of entrepreneurial and transversal skills, including in interdisciplinary contexts. Such training will contribute to the development of innovative mindsets, thus bringing added value for a wide range of career paths.
- Deepen commitment to interdisciplinarity as a driver of research, education and innovation. Encourage closer alignment with comprehensive frameworks like the UN Sustainable Development Goals.

2 Definitions

2.1 Defining "Innovation"

Developing the University's "Strategic Plan for Innovation" begins with the definition of the word "**innovation**". We believe that this definition should be made as broad as possible. Before putting forward a broad "Wits Definition" of "innovation" we need to explain why having a suitable definition is crucial. Some of the reasons are:

- Unless the Wits leadership structures (eg. SET, Council, Senate) are at one regarding a definition of "innovation", it is unlikely that anyone else – both internal to Wits and outside – will understand what we are doing in relation to innovation.
- Unless we define what "innovation" is, it is impossible to measure it.
- Unless Wits leadership structures measure "innovation" it won't get done.

The 2019 South African White Paper on Science, Technology and Innovation uses the OECD definition of Innovation: "*An innovation is the implementation of a new or significantly improved product (good or service) or process, or a new marketing method, or a new organisational model in business practice, workplace organisation or external relations*."

It should be noted that the OECD definition is based on what it intends to measure and is focussed on measuring innovation in the economy. The OECD acknowledges that it's definition does not cover the public sector. It also does not cover other forms of innovative outputs and outcomes originating from a university such as Wits.

In defining "innovation" it is useful to distinguish between "Inputs", "Outputs" and "Outcomes". **Figure 1** represents the relationship between these.

Figure 1: The Innovation process has inputs, outputs and outcomes (or impact).

In considering the Inputs, and relating them to Wits, it is important to consider the various groups that make up the University's community. Broadly speaking these are:

- Students – undergraduate and postgraduate;
- Academic / Research staff – noting that all Academic staff are expected to be "research active".
- Professional staff – tasked with running the university's systems and operations.
- External stakeholders – including commerce and industry, government, external communities, etc.

Innovation can arise out of engagement between all of these communities. Hence, we can consider the following examples of innovation activities applicable to a university:

- Research-led innovation

- Researcher-led innovation
- Student-led innovation.
- Institutional innovation
- Inclusive innovation

"Institutional innovation" refers to improvements in how the institution conducts its activities with the intention of improved efficiencies and performance. "Inclusive innovation" refers to the implementation of sustainable products and services for and by those who have been excluded from the development mainstream. One finds solutions with the poor and marginalised, not for them.

In arriving at our Wits definition of "research-led" and "researcher-led" innovation, we will relate "innovation" to new ideas coming out of "research". "Research" is both a process and a result, both a verb and a noun. The verb "research" refers to a methodology that answers a question (the "research question") by drawing on existing knowledge to synthesise new knowledge. The noun "research" is this new knowledge. In some contexts, this new knowledge can also be labelled as an "invention".

The way we go about finding an answer – the verb "research" – draws on a long tradition of academic practice. The solution to the problem – the noun "research" – can be used in a variety of different ways. We cluster these outputs within two groups:

- New Knowledge: the solution is shared via academic publications, theses, dissertations, books, patents, and other forms knowledge and in the intellectual development of people who gain new insights. [Note: An application for a patent is in essence a form of open-source publication.]
- "Innovation": the new knowledge is embodied in new products, services, processes; policies; organisational practice, professional practice etc and delivered to society using mechanisms such as companies (for-profit, non-profit or state-owned, start-ups, spin-outs[2]) or other types of organisation.

Some new knowledge may not have immediate prospects for utility and may not lead to the start of an innovation process/ journey. The research question may be a key determinant of the likelihood that the research could lead to Innovation. A question such as:" Why is the radiation from that distant star varying in some specific way?" may not necessarily lead to innovation in the *immediate* future. However, it holds immediate value within the discipline and related body of knowledge and may well inform or direct an innovation in the longer term. Other questions such as: "How to validate and/or assure the accuracy of diagnostic testing for SARS-Cov-2 infection?" may lead to answers implemented within months, with consequent national and global impact. The underlying methodologies that are used/developed to answer this type of question may have immediate innovation prospects.

Note: In a university all research questions are valid and valuable.

Starting from "research" we can distinguish between "research-led innovation" and "researcher-led innovation". Consider the process depicted in the flow chart of **Figure 2**.

[2] The difference between a "start-up" and "spin-out" is that the former is a new company set-up from scratch, whereas the latter is established by an existing entity which provides some of the initial infrastructure and resources. New companies set up to commercialise university research are commonly "spin-outs".

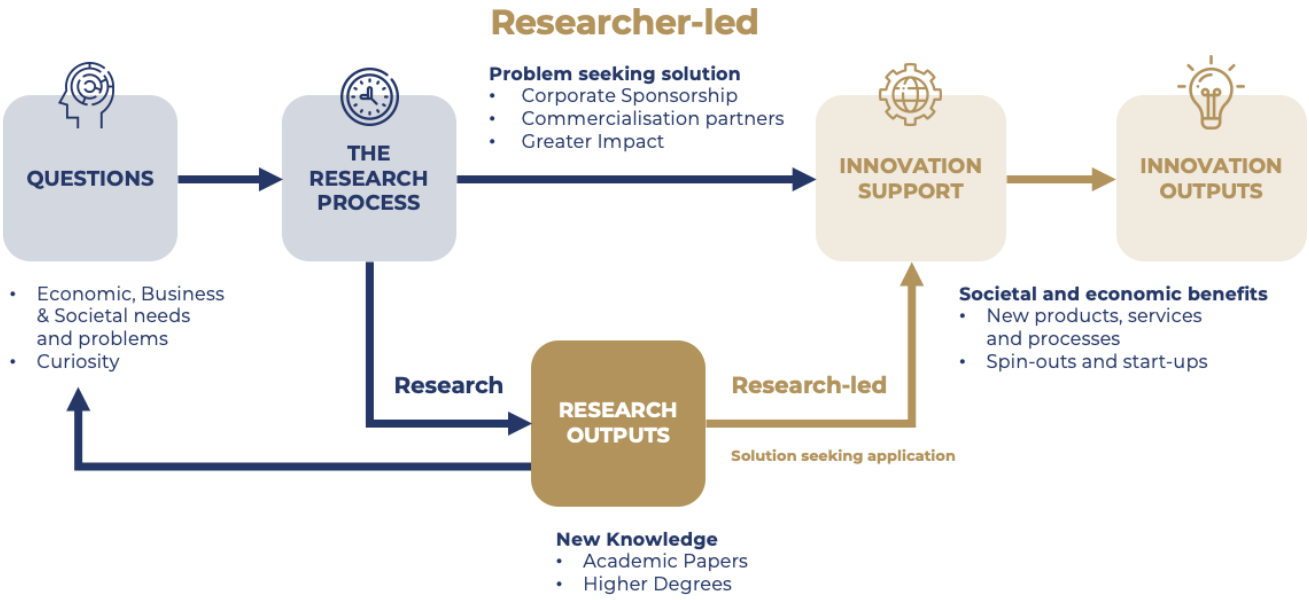


Figure 2: Research to Innovation – Research-led and Researcher-led Innovation

- Research questions can either arise from a researcher's curiosity and experience or can originate from the desire to address problems and needs in society. Such problems and needs might be identified by researchers themselves or may be brought to the researcher by others.
- Research outputs can be in the form of academic publications and/or higher degrees, and can lead to valuable outcomes in society, such as skilled graduates, new knowledge in a discipline, etc.
- Some research outputs contain the possibility of innovation.
- A researcher, or others, may use the outputs to consult and to inform further research. Where there is the possibility of innovation, a researcher can choose to further develop the ideas into products, services, processes or other outputs which can be made available to society to use. In Figure 2 this is referred to as "research-led" innovation.
- Existing companies or other stakeholders may support research by providing funding or other resources. They may choose to use research outputs as well as possibly collaborate during all steps in the process. This often requires contracts or other formal arrangements. In Figure 2 this is referred to as "researcher-led" innovation.
- In general Ideas that:
    - start in curiosity are referred to as "pushed towards users" and may be harder to move forward on the innovation journey. They can, however, have "breakthrough" or disruptive potential,
    - are directed from external stakeholders are classed as "pulled" and will typically be easier to convert to innovation outputs. They more often yield success, but may be more incremental in outcome.

This leads to the following "Wits definition":

Innovation is the successful deployment of new ideas or methods to benefit society.

More specifically, innovation should:

- involve collaboration across disciplines
- cover interactions between industry, government, academia, society and/or the environment ("the quintuple helix")
- have outputs that are either tangible (products or "things") or intangible (processes, services, policies, or ideas)
- be supported by methodologies that can be taught and learnt

- be conducted in an ethical manner.

This definition draws on the views expressed in the Stakeholder Workshops (see **Appendix**) and represents a consensus of these views.

2.2 The Relationship Between Innovation and Risk-taking

The following quote is attributed to the innovator and inventor of the electric light bulb, Thomas Edison "*I have not failed. I've just found 10,000 ways that won't work*." There is a strong correlation between innovation and a willingness to take risks. Most innovative ideas do not lead to successful outcomes. For Wits as an institution to develop and grow an "Innovative Mindset" it is essential that risk-taking is supported and encouraged. Ways will need to be developed to provide space within Wits for risk-taking and for managing the consequences of "failure".

2.3 Defining Impact, Commercialisation, Industry Engagement and Entrepreneurship

1. **Research Impact**: defined as "the effect research has beyond academia when the knowledge generated by research contributes to benefits and influences society, culture, policy, the environment and the economy."[3] Impact can be "created at any stage of the research process and is usually the result of effective knowledge exchange with an external partner"[4]. Research-led innovation is a form of Research Impact that lies alongside other means of impact.
2. **Commercialisation**: One of the most common definitions of "innovation" is *"the introduction into a market (economic or social) of new or improved products and services".*[5] In the case of Research-led innovation one of the paths to impact society would be through developing the Research Output into a product, service or process and delivering it to those who need or want it, and hence it has been commercialised, typically through a non-profit or for-profit company. We choose to refer to this dimension of Innovation as "commercialisation".
3. **External Engagement**: Bringing external entities (corporations, government, NGOs) and academic research together for mutual benefit. There are various forms of engagement between the University's research process and specific researchers and research groups on the one side, and external parties including government departments, companies, funding agencies, etc., on the other side. External parties benefit by having access to the outputs of research and suitably trained researchers including talented students who might be recruited. The University benefits via funding and other resources. In addition, external engagement improves the impact of research (see above) by bringing researchers into contact with important and interesting research questions.
4. **Entrepreneurship**: The ability to identify an opportunity to provide society with something it needs or wants and create a pathway to mitigate the large risks that go with bringing it into use, typically through a non-profit or for-profit company.

[3] University of York website https://www.york.ac.uk/staff/research/research-impact/impact-definition/ [Last accessed 8/8/2021]
[4] University of Oxford website "Research Impact: creating, capturing and evaluating" https://www.ox.ac.uk/research/support-researchers/using-research-engage/research-impact-creating-capturing-and-evaluating [Last accessed 8/8/2021]
[5] Definition of "innovation" adopted from the South African "National Research and Development Strategy (NRDS) – 2012 to 2020" quoted in McLean Sibanda, ENABLING INTELLECTUAL PROPERTY AND INNOVATION SYSTEMS FOR SOUTH AFRICA'S DEVELOPMENT AND COMPETITIVENESS, Doctoral Thesis, UNISA, April 2018.

THE INNOVATION OUTCOME AS SEEN THROUGH 4 LENSES

All Activities shown here have the potential to result in Impact within society

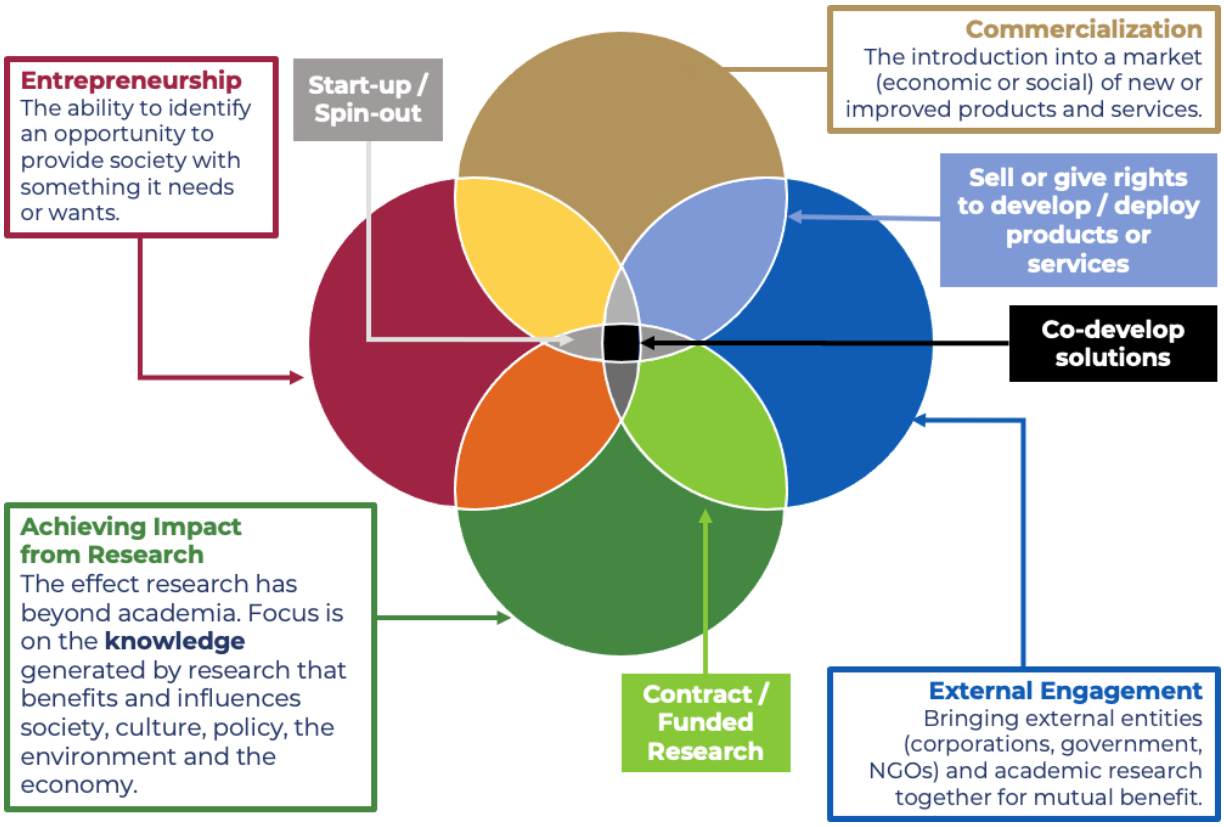


Figure 3: Venn diagram representing different perspectives on research-led innovation. Some activities within the overlapping areas are identified. Note: Circle size does not imply relative importance of each activity.

It is useful to think of this diagram as a map. We have defined "innovation" as any activity which starts with a research question that is solved using a research method (as in **Figure 2**). It ends with an outcome that is a new product, service, process, policy or intervention that addresses an unmet need, and in so doing influences and/or benefits society or the economy. Each such innovative activity can be placed somewhere on the Venn diagram of **Figure 3**, usually within one of the overlapping intersections. Some examples are shown in the Figure. These are:

- Seeking impact through commercialisation requires entrepreneurship by researchers. The relationship between the University and external partners in the commercialisation activities is grounded in an agreement which may include licencing (granting exclusive or partial rights) or transferring ownership (assignment) of the IP underpinning the solution to an unmet need (typically a new product, process or service). Such partner could be an existing company(ies) or a start-up or spin-out company established for the purpose of the commercial endeavour.
- The relationships in terms of external engagements are typically conducted under agreements that define each parties' contributions, rights to the output of that engagement, and responsibilities. It includes the rights and obligations with respect to the underlying IP.
- Appropriate management of IP is required to ensure these activities to enable and achieve fair and balanced outcomes for the University as well as its external stakeholders. The extent of this management is linked to the nature of the research activity and intended outcome.

2.4 Defining "Innovation Ecosystem" and Related Physical Infrastructure

This Strategic Plan for Innovation is underpinned by an "Innovation Ecosystem" consisting of Institutional Entities and physical infrastructure. This Ecosystem provides various "services" that will enhance the University's ability to support innovation. The Ecosystem also provides an environment that will promote the growth of an "innovation mindset" at Wits.

The ecosystem resulting from this Strategic Plan will include physical facilities. We have classified these facilities based on the dominant nature of the activities carried out using three labels: "hubs", "incubators" and "accelerators".

There is much discussion, very little agreement, and some controversy, associated with the definition of these terms we are therefore suggesting our own "Wits definitions" for these terms.

We will define a "**hub**" as a physical space that encourages interaction, co-creation, collaboration, and chance encounters. A hub is about people and ideas connecting and interacting to promote development of solutions to needs. Ideas are shared and refined. Solutions to problems are explored. The nature of the programmes and services provided and the design of the physical space and how it is configured should encourage creative interactions between people and the flow of innovative ideas. A hub can include one or more "incubators".

An "**incubator**" is a physical space that provides dedicated space, services and programmes in a social environment that supports the refinement of an idea – often into the form of a new product or even further to the point of a startup company. Since the idea brought into the incubator is typically not yet fully formed, some hub-like activities are still beneficial. An incubator should therefore be set up to both provide a business-friendly environment within which innovations can be prepared for commercialisation, and encourage interaction, co-creation and collaboration with others engaged with their own incubation activities.

"Virtual incubation" is a concept dealing with the nurturing of the innovation journey, and consists of support, programmes, services and infrastructure that are not necessarily co-located / available in the same physical space. This is particularly relevant in a research-intensive environment where there may be highly specialised infrastructure (e.g. laboratories) and other support where it is not cost effective to provide this in an incubator that is a dedicated physical space.

Our "Wits" definition for an "**accelerator**" is a business-friendly physical or virtual "space" with services and programmes that assist in growing a business that already has some traction in selling products/services to those

who have the need for it (also termed “the market” for the solution offered). It’s often the first work address for a new company and/or a first production facility for new products. It might be set up to share resources and facilities (such as meeting rooms, “chill areas” or access to specialised equipment) between businesses with similar needs, but the focus is on helping new ventures to grow sales, and product/service range. While the shared experience with the broader community is of value, team building and consolidation of a culture within each enterprise is far more important. The layout (for a physical space) and/or configuration (where virtual) of an accelerator needs to nurture this.

3 Innovation Vision and Mission

Vision:

Wits will be at the leading edge of innovation that serves society.
Wits will play a key role as a hub that links innovation ecosystems at universities in the Global North to those in the Global South.

Mission:

Wits strives to meet society’s needs by turning knowledge into impactful solutions.

Values

Innovation is what drives us forward. We enable a space to create, collaborate, and engage in impactful innovation, across disciplines and boundaries.
We are committed to using our knowledge for the advancement of our community, city, country, continent, and the globe.

4 Strategic Objectives

In this “Strategic Plan for Innovation” we have aligned our objectives to Wits’ recently adopted Strategic Framework as articulated in the document “Wits 2033: The leading edge of the Global South”. This document states “*Innovation in today’s world is fostered by breaking down disciplinary silos. The University must cultivate multi-disciplinarity in finding solutions to the major challenges which confront humanity and our planet. And in order to ensure the University’s success, it must adopt similar multi-disciplinary approaches in its organisation and management structures and processes*.” Our key strategic objective in setting out this Plan is therefore ensuring that we actively cultivate a multi-disciplinary approach, and that we drive change that will foster an innovative mindset at Wits.

Wits 2033 Strategic Framework provides a high-level direction for the University. The intention is that detailed implementation plans, such as this “Strategic Plan for Innovation”. will be devised from this Framework. There are a number of ‘Themes’ with a corresponding set of commitments which the University undertakes to achieve by 2033.

The University’s commitments that relate to innovation will be achieved via this “Strategic Plan for Innovation”.

Table 2 summarises the innovation-related commitments under each theme drawn from the Wits 2033 document.

Table 2: Themes and commitments relating to innovation in the Wits 2033 Strategic Framework

Theme	Wits commits to ….
Wits identity: A culture of agility, and innovative and entrepreneurial thinking	▪ Leveraging our history of being an innovator for advancement across all disciplines. ▪ Promoting Wits' achievements to enhance our reputation both locally and globally. ▪ Leveraging our location to build partnerships that are based on shared goals, values and achieving societal impact.
Academic excellence: Encouraging innovative ways of approaching our curriculum and knowledge production	▪ Translating fundamental knowledge into technological innovation that will spawn companies to change the world. ▪ Leveraging our research and using innovative thinking to tackle future global challenges using the Global South perspective; ▪ Developing a culture of research and innovation in both our undergraduate and postgraduate programmes; ▪ Motivating and investing in people to be research active and innovative.
Academic excellence (innovation and academic entrepreneurship): The knowledge we produce within our university is capable of influencing what happens in society if it is channelled appropriately. We must ensure the translation of that knowledge into practice by building the capacity and capability of our academics and researchers to take their research beyond the academy, whether it be through policy intervention or commercialisation.	▪ Encouraging academics to use innovative and extraordinary ways to create and fund impactful research endeavours. ▪ Ensuring that our knowledge economy translates into novel and purposeful solutions. ▪ Creating the opportunities and processes to transform research findings into commercial opportunities.
Social impact: Wits must continue to be a catalyst for change and play an active role in our society, on the african continent and globally. Our diverse campuses can act as an incubator for change in our community by using our knowledge and expertise to experiment, innovate, and debate the solutions to current and future big challenges including climate change, inequality, public health, and social justice.	Using our intellectual and human capital to make a purposeful impact on evidence-based policy decision-making;
Social impact (climate change and inequality) These are two pressing crises facing society today, and they have implications for the global economy, for south africa and for our university. In the south african context, dealing with climate change and inequality while ensuring	Developing a multifaceted approach to deal with climate change and inequality that goes beyond teaching and research and includes integration into national and international policy networks,

our energy security is particularly complex and requires integrated solutions. South africa, and wits in particular, has the opportunity to lead in this respect and offer new insights in managing this transition that would not only serve as a basis for a sustainable and equitable transition in the country, but also as an exemplar for other developing countries.	social activism, and the internal management of the transition within the University.
Wits sustainability	▪ Using innovation to reimagine how we work in the interests of improving sustainability, efficiency, and access. ▪ Expanding and diversifying our income streams.

The Wits 2033 Strategic Framework offers a glimpse into the future. In 2033 Wits will look like this:

> *Wits' academics are leading voices on issues relating to the advancement of knowledge in South Africa, on the continent, and globally, and our research is having an impact on developments in the public and private sectors.*
>
> *We will have developed a culture of collaboration and innovation across all spheres of the University.*

This "Strategic Plan for Innovation" is the bridge via which the University will move from where it is now to where we hope it will be in 2033.

5 Supportive Framework

5.1 Innovation Ecosystem

Having defined "innovation" in Section 2.1, we turn to discussing viable support mechanisms that will assist researchers and students in moving their ideas from research outputs to "innovation". In **Figure 2** this is represented by the block "**Innovation Support**". This is underpinned by an **Innovation Ecosystem** consisting of services, programmes and physical infrastructure.

5.2 Institutional Entities

As a key step in developing this Strategic Plan for Innovation for Wits we are proposing an organisational architecture (an "Innovation Ecosystem") that will **both** support innovation at Wits **and** promote the growth of an innovative mindset. **Figure 4** shows this architecture.

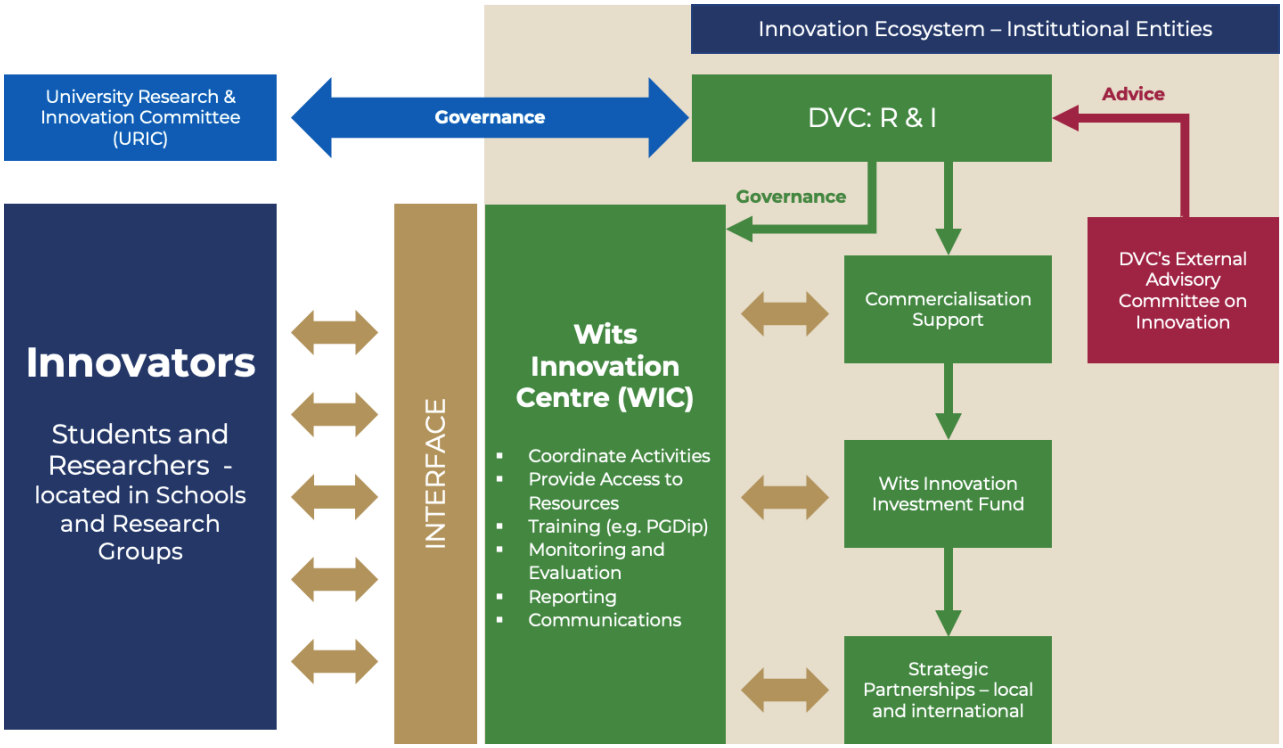


Figure 4: Initial version of the proposed Innovation Ecosystem for Wits – showing institutional entities

At the heart of the proposed Innovation Ecosystem are the University's researchers and students, located in individual Schools, research entities and Faculties. It is their research and innovative outputs that will drive innovation at Wits. The institutional entities shown in **Figure 4** will provide resources and services **to support** these innovators.

Note: While the representation in **Figure 4** suggests specific inter-relationships between institutional entities, this suggested structure should not be seen as static. We propose that an innovative approach should characterise the Innovation Ecosystem itself. The ecosystem should be flexible and adaptive. It should be easy to modify the structure suggested in the Figure over time, as Wits learns how best to support innovation within our own institution.

The **"Wits Innovation Centre" (WIC)** will play a role in encouraging, facilitating, and supporting the connection between research and innovation. It will drive the **Innovation Support Process** shown in **Figure 2**. It will also

assist in encouraging the growth of an **Innovation Mindset** at Wits. It will actively engage in strengthening each of the 4 dimensions of research-led innovation shown in the Venn diagram of **Figure 3**, namely Research Impact, External Engagement, Commercialisation, and Entrepreneurship. For example, the WIC will set up and manage a team of experienced researcher/innovators, called "Resident Innovators", who will undertake innovations brought to Wits by corporate and other stakeholders. These engagements ("Researcher-led Innovation") will draw on expertise and knowledge from Wits' researchers while solving "real-world" problems. This is but one example of how the new WIC will make it possible for Wits to operate in a way that has not previously been successful. This aspect of the WIC's activity will align with the "Centre of Competence" structures envisaged in the Government's 2019 White Paper on Science, Technology and Innovation (see Section 1.2).

The WIC will be headed by a person appointed to the newly established "**[Named] Chair in Innovation**". This person will be selected on the basis of having a proven track record in university-based innovation. They will be required to have actually "done" innovation themselves. They will also be required to have experience and knowledge of university-based innovation as a research area. A strong team of experienced innovators will also be appointed in the WIC.

Another important and specific service offered by the WIC is to co-ordinate university-wide academic courses and programmes on innovation and related subject matter. These will be offered to academic staff/researchers as well as students registered at Wits, both undergraduates and postgraduates. They will promote and grow "Student-led Innovation" at Wits. They will also be offered to other universities and as Wits-branded short courses as in-house learning opportunities to employees of companies and government departments, and to the general public.

The WIC will fall directly under the **DVC: Research and Innovation**. The role of the DVC is to "own" the University's Innovation Strategy and to ensure that it remains aligned with the broader Wits Strategic Framework. In particular, the DVC will ensure that implementation of the Strategic Plan for Innovation is aligned with university-wide functions such as teaching and learning, systems and operations, fund-raising, communications and marketing, external relations and partnerships, etc. The DVC also ensures alignment with all five Faculties through their Deans and Wits Entities such as Wits Commercial Enterprise and Wits Health Consortium. The DVC is also responsible for integrating and strengthening the critically important relationship between research and innovation.

To support the DVC in this role she will appoint an "**External Advisory Committee on Innovation**". This will consist of individuals, external to the University, who are invited to join because of their specialised knowledge and experience in areas such as university-based innovation, commercialisation of research, entrepreneurship, start-ups, intellectual property, engagement between universities and external parties such as companies, government and NGOs, etc. This Advisory Committee will provide a sounding board and a source of objective advice and counsel to the DVC as the Innovation Strategy is implemented and gains momentum. The Advisory Committee will meet virtually, thus making it possible for members to be drawn from anywhere in the world.

The nature of innovation, entrepreneurship, commercialisation, and other such activities is that it falls outside of the currently established university mandate, and associated funding paradigm. It is highly unlikely that the required financial resources, both for implementing the strategy and supporting innovators and academic entrepreneurs, will be simply allocated from central funds as part of the university's annual "Council Budget". One way to address this is External Engagement, and the creation of a synergistic community of commercialisation partners who provide further funding for research relevant to the products, services etc they are commercialising, and/or to the Wits Innovation Fund.

Given the global trends and perspectives on innovation the DVC Research and Innovation supported by the DFO, WIC, various entities within Wits, as well as wholly owned companies Wits Commercial Enterprise (WCE) and Wits Health Consortium (WHC), will develop new opportunities for alumni and other stakeholders for donor funding for incubation and seed funding, and for investment in innovations.

Services Offered by the WIC

The concept of the WIC is based on several successful international examples (such as the Deshpande Centre at MIT). Figure 5 represents some of the activities / services that might be offered by the WIC.

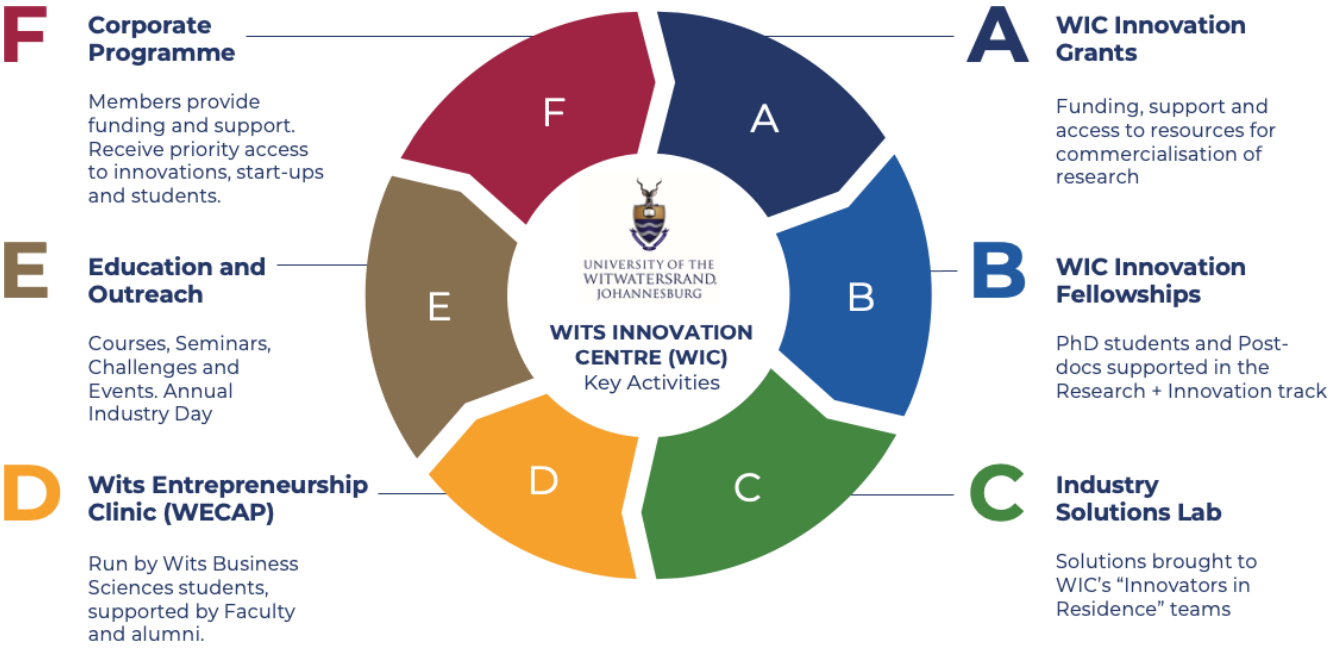


Figure 5: Some of the key activities coordinated via the WIC

Centralisation versus Decentralisation of the WIC

The impression should not be created that the WIC aims to centralise innovation activity at Wits under a single centralised entity. The aim is to have the WIC coordinate and support specific activities implemented at the level of Schools and Faculties. At the same time the WIC will endeavour to encourage, promote and incentivise inter- and trans-disciplinary collaboration. Figure 6 represents this:

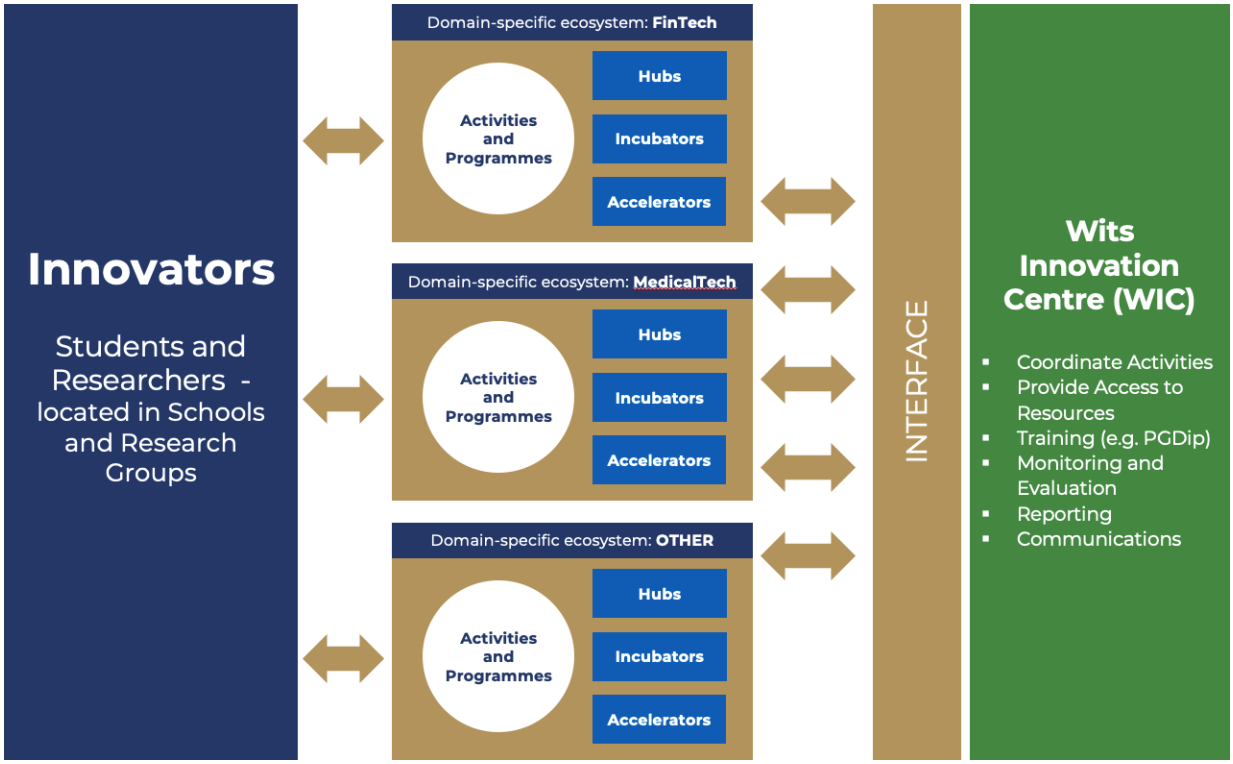


Figure 6: Decentralised nature of the Innovation Ecosystem

The WIC as a space that supports and encourages risk-taking

As was pointed out in Section 2.2 successful innovation depends on a tolerance for failure and risk-taking.

The WIC should take the lead in bringing a change in the way in which South African universities deal with innovation and the ability to encourage risk-taking. Since innovation always assumes a certain amount of risk it is important that adaptability and agility should be part of the WIC's strategy. On the other hand, innovation can be a tool to mitigate risks and help an organisation stay ahead of the curve. There are many examples of university-based entities with objectives similar to the WIC (for example Ryerson University (Toronto) has the DMZ, NYU has the Tandon Future Labs (https://futurelabs.nyc/), Stanford's D.School (https://dschool.stanford.edu/how-to-start-a-dschool), MIT's Deshpande Centre, and Olin College's undergraduate SCOPE program (https://www.olin.edu/collaborate/scope/)) .

Physical Infrastructure

As part of its proposed "innovation ecosystem", Wits will need several hubs, incubators and accelerators (see definition of these terms above). These will be distributed spatially across Wits' various campuses so as to make them easily accessible to researchers and students working in all faculties and research entities. They will also need to be differently equipped and structured to support innovators working on each of the diverse disciplinary arears – and cross-disciplinary areas - represented at Wits.

Operating hubs, incubators and accelerators requires operational funding. It will be necessary to raise funding for each one of these. In the interim some of this activity can be achieved virtually, and physical spaces developed as funding resources materialise.

A common "look and feel" supported by branding, colours, interior design, etc. will be developed so that all physical innovation spaces on and near Wits campuses – including the Wits Rural Campus – appear part of the same Wits Innovation Ecosystem.

Figure 6 shows individual hubs, accelerators and incubators as part of several "domain-specific ecosystems". 'Flavoured' programmes of activities will be coordinated via the WIC for each of these sub-ecosystems. Examples of domains to be covered are: FinTech, MedicalTech, EduTech, MiningTech, GovernmentTech, CivilSocietyTech and Rural Tech. The sub-ecosystems will also collaborate in finding cross-cutting areas of activity.

5.3 Innovation Culture and Mindset

It has been noted that natural innovators and entrepreneurs self-identify at a young age. For this reason every effort should be made to draw students – particularly undergraduate students – into the Wits innovation ecosystem and its activities. The following are a few of the ways in which an innovation culture and mindset can be created at Wits. The WIC will coordinate these activities, but they should be run at the level of individual Schools and Faculties:

- Develop a problem-solving mindset: Run activities (such as challenges and hackathons) that allows students, academic staff and professional staff at Wits to work on finding solutions to specific problems. These should be seen as low-risk experiments that can fail fast and create learning experiences.
- Form Communities of Practice: Create opportunities in physical hub spaces and virtually for diverse groups of students, researchers and others from outside of Wits to discuss complex social and other problems, with the objective of finding innovative solutions.
- Communicate our stories: Share stories of innovation at Wits – both successes and "failures". We need to collect case studies and create role models.
- Coordinate involvement by Wits students in national and international innovation challenges and competitions: Some universities encourage students to form teams to tackle high-profile innovation challenges, such as the "Solar Car Challenge". Members of the university team are given time off from

studies, provided with mentorship and resources, are connected to sponsors, etc. Participation in these challenges as part of the University's team is seen as being very prestigious.

- Some ideas on broad and inclusive innovation were suggested by task team members. These are included in text-boxes in this section.

Arts-Science Collaborations - a catalyst for innovative thinking and public engagement

There is now convincing evidence that Arts-Science collaborations can stimulate innovation at several different levels. Well established programmes such as the Swiss Artists-in-Labs (AiL) programme, the Art|Sci Centre at UCLA, Le Laboratoire in Paris, and the Advanced Visualization Laboratory at the National Centre for Supercomputing Applications at the University of Illinois, Urbana-Campaign have demonstrated that collaborative programmes that bring artists together with scientific researchers have produced important benefits. The most thorough study of these programmes to date, jointly funded by the National Science Foundation (USA) and the Arts and Humanities Research Council (UK) found that:

- These projects can transform the artists and scientists involved in them;
- Such projects can shape scientific and artistic knowledge, not only as developed in the project but broader knowledge making practices across the institution;
- These projects can reshape the institutional worlds in which they are situated. <https://artscience.arizona.edu/>

In addition, and of particular relevance to Wits and our South African context, Arts-Science collaborations can bring in "other" knowledges from outside the sphere of the project, such as community knowledge, and political and ethical perspectives on the research. The involvement of artists in scientific and technological can also greatly increase the impact and public engagement of the research, allowing a wider audience to explore and understand the research through exhibition of the artistic translation of the research processes and results.

Christo Doherty, The Wits School of Arts.

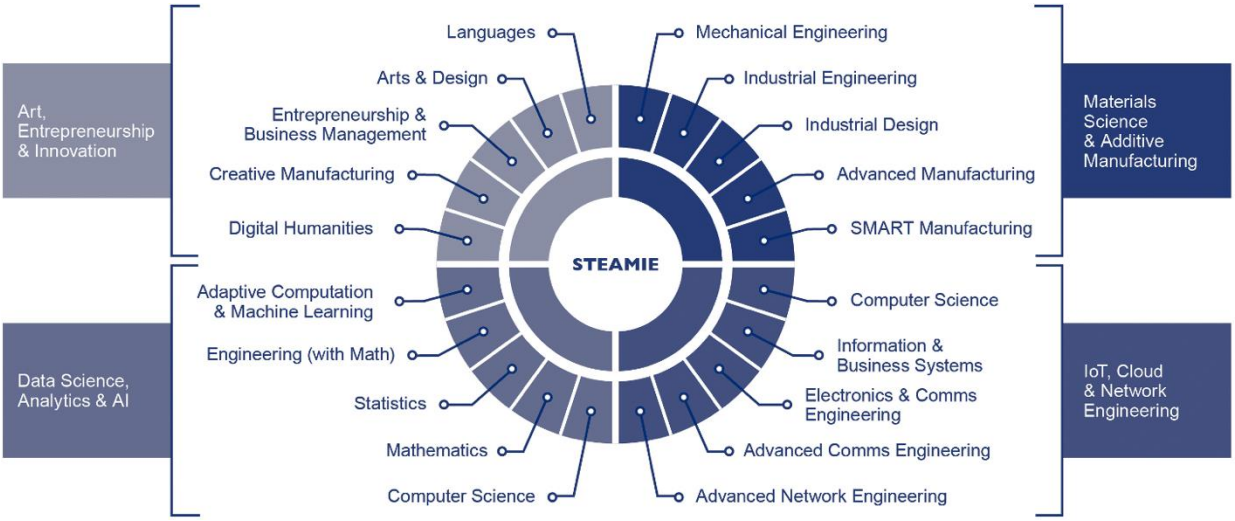
Promoting Social innovation and innovation for society

Strategic thought: Wits makes a contribution to strengthening the national system of innovation (NSI) through socially-beneficial innovation

Practice point: Incentivising innovation for social benefit and social impact

Focus: Designing social innovation projects for application in basic and higher education, directed to building 21st century skills, with particular emphasis on fostering technical, collaboration and problem-solving skills, as well as ethical awareness, cultural awareness and self-direction.

Luci Abrahams, LINK Centre



Women in science and science for women

Strategic thought: The contribution of women to science, and to science that benefits women

Practice point: Inclusive innovation with and for women

Focus: Each faculty advances a science for women project on the basis of STEAMIE (science, technology, engineering, arts, mathematics, innovation, entrepreneurship)

Luci Abrahams, LINK Centre

Proposed innovation focused interventions for Wits undergraduates

The 'Undergraduate Innovation Interventions Working Group' was set up under the framework of a Deans' Select Committee on Innovation convened by the Deans of Science and Engineering & the Built Environment. We drafted a document suggesting potential interventions for promoting innovative thinking among our undergraduates by developing an inclusive curriculum, and other extra-curricular activities, ultimately translating into individual, societal and national benefits. This document outlines the need for introducing concepts related to innovation at undergraduate level while attempting to define innovation in education, Wits' advantages and challenges ahead, and introduces several potential ideas that can be incorporated into the undergraduate curriculum. The interventions can also be run in the form of bootcamps, industry days, competitions, and seminar series etc. We hope that these interventions will sensitize final year undergraduate students to the various ways in which research and disciplinary knowledge can be applied to solve various societal problems and make students aware of innovation principles and practices, the commercialisation process and entrepreneurship, giving the student an introduction to the full innovation to entrepreneurship pathway.

Mandeep Kaur, School of Molecular & Cell Biology.

5.4 Measuring Innovation

Comparing the measuring of "Innovation" to measuring "Research"

Universities are very good at measuring "research". Data are collected on research outputs such as publication units, higher degrees awarded, etc. Data are also collected on research inputs, such as students registered, grants awarded, etc. and research impact, such as citations, prizes and awards, etc. The performance of the "research ecosystem" can also be measured. These research-related metrics is used in universities and nationally to benchmark, incentivise, subsidise and reward research-active universities. Collecting and analysing the relevant data is relatively easy and transparent.

How possible is to measure "Innovation" in a similar manner and for similar purposes? There is a substantial body of literature covering this topic. However, there is no "standard" set of measures of "Innovation" and so these will need to be developed and adopted.

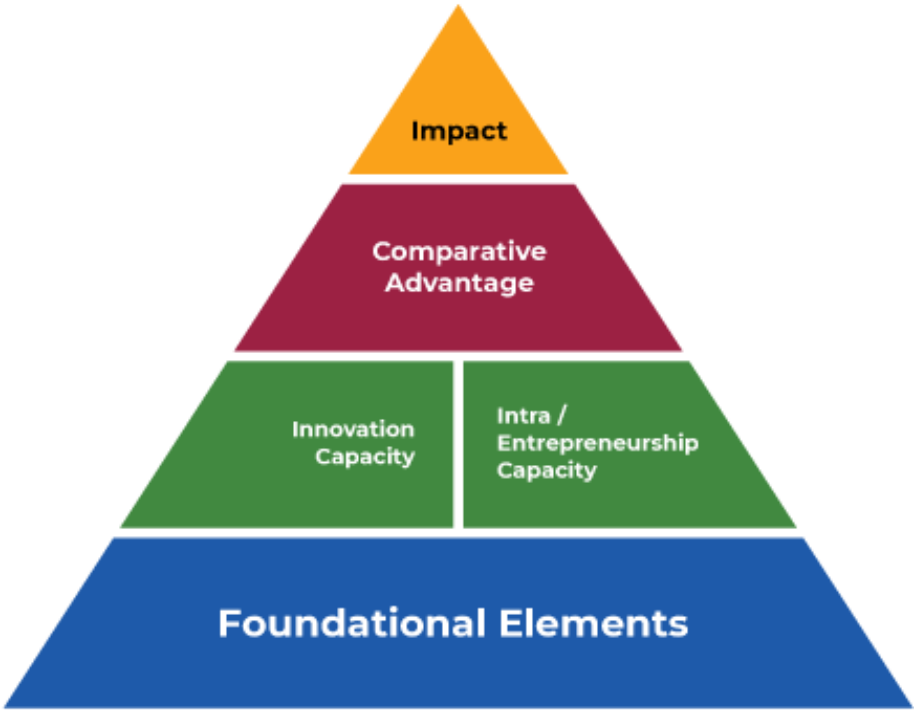
Some guiding principles

In moving towards the adoption of a measurement framework for "Innovation" at Wits we will suggest some guiding principles as part of this "Strategic Plan for Innovation". Part of the Plan is to undertake an exercise that will develop, pilot and refine a measurement framework for "Innovation" at Wits. The following Table sets out the proposed guiding principles.

What is being measured?	Guiding Principles	Examples of data that can be collected
Inputs	Innovation starts with problems and opportunities being identified. New knowledge derived from research also creates a possible Input	▪ # of research outputs (papers, theses, etc) with "innovation potential" ▪ # of R&D contracts ▪ # of discoveries and patents ▪ Amount (R) of Funding for innovation ▪ # of events to promote innovation ▪ # of participants at such events
Outputs	Tangible and intangible outputs of the innovation process	▪ Number of ▪ Products ▪ Processes ▪ Policies ▪ Start-ups / spinouts
Impact	Impact derived from innovation activities	▪ Revenue earned ▪ Jobs created ▪ Media coverage received ▪ Prizes and awards
Performance of the Wits Innovation Ecosystem	How well does the Wits Innovation Ecosystem perform? Sub-ecosystems can also be measured and compared	▪ See below.

Measuring the performance of an Innovation ecosystem

The following diagram and explanation are derived from an MIT Working Paper[6]



The measurement framework works from the bottom of the diagram up.

- The "foundational elements" in an innovation ecosystem are, in the case of Wits' ecosystem, factors that allow us to measure the extent to which the host institution (i.e. Wits University) supports or hampers innovation and entrepreneurship. How does Wits deal with risk-taking, IP policy, university rules and regulations, incentives to innovators, etc.? We would need to develop ways of quantifying and measuring these elements.
- "Innovation capacity" asks about the level of support offered via the ecosystem to take an idea from inception (eg. a research output) to impact. Metrics will need to be developed to assess the level of this capacity.
- "Intra/ Entrepreneurship capacity" asks a similar question about the way in which the ecosystem supports entrepreneurship.
- "Comparative advantage" is determined by building on the foundational elements together with the combination of (and linkages between) innovation and entrepreneurship capacities within the innovation ecosystem. Each ecosystem has a comparative advantage or disadvantage since innovation- and entrepreneurial-capacity are not always general, but are more likely to be specialised around areas of expertise.
- Finally, we measure the overall "impact" of the ecosystem as a whole.

[6] P Budden, F Murray, A Turskaya, "A systematic MIT approach for assessing Innovation-based entrepreneurship in ecosystems", MIT Lab for Innovation Science and Policy, February 2019.

6 Recommendations and Implementation Priorities

We make the following recommendations for implementation in the 5-year timeframe of this "**Strategic Plan for Innovation - 2022-2026**".

1. Create a common vision for Innovation at Wits and provide focus and coordination in its implementation.
2. Strengthen the level of attention to Innovation across all Faculties, Schools and research entities.
3. Develop a suitable measurement framework for Innovation. Pilot and refine it.
4. Provide incentives, rewards and support mechanisms for students and staff engaged in Innovation. Ensure that incentives are transparent and equitable.
5. Strengthen links with companies, civil society, public sector and other universities in support of Innovation.
6. Integrate training in Innovation and Entrepreneurship into all study programmes, both undergraduate and postgraduate.
7. Deepen commitment to interdisciplinarity in research, teaching and Innovation.
8. Encourage closer alignment with global frameworks such as the UN Sustainable Development Goals (SDGs)

Finally we revisit the commitments made by Wits in the Wits 2033 Strategic Framework. The following Table shows how this Strategic Plan responds to these commitments.

Wits commits to ….	How this "Strategic Plan for Innovation" supports this commitment
▪ Leveraging our history of being an innovator for advancement across all disciplines. ▪ Promoting wits' achievements to enhance our reputation both locally and globally. ▪ Leveraging our location to build partnerships that are based on shared goals, values and achieving societal impact.	▪ The overall Innovation Plan .. if successful … will promote Wits' reputation and result in building partnerships
▪ Translating fundamental knowledge into technological innovation that will spawn companies to change the world. ▪ Leveraging our research and using innovative thinking to tackle future global challenges using the global south perspective; ▪ Developing a culture of research and innovation in both our undergraduate and postgraduate programmes; ▪ Motivating and investing in people to be research active and innovative.	▪ The WIC Innovation Grants and the support given to researchers in the form of seed funding and commercialisation support (eg. mentoring) will achieve this. ▪ The WIC Fellowships and various education programmes (eg the PGDip) will satisfy these commitments.
▪ Encouraging academics to use innovative and extraordinary ways to create and fund impactful research endeavours. ▪ Ensuring that our knowledge economy translates into novel and purposeful solutions. ▪ Creating the opportunities and processes to transform research findings into commercial opportunities.	▪ Developing an innovation mindset ▪ Commercialisation support ▪ Activities and events run by the WIC.

▪ Using our intellectual and human capital to make a purposeful impact on evidence-based policy decision-making;	▪ Not specifically covered
▪ Developing a multifaceted approach to deal with climate change and inequality that goes beyond teaching and research and includes integration into national and international policy networks, social activism, and the internal management of the transition within the university.	▪ One of the domain-specific innovation ecosystems can focus programmes and resources on climate-change and inequality.
▪ Using innovation to reimagine how we work in the interests of improving sustainability, efficiency, and access. ▪ Expanding and diversifying our income streams.	▪ The innovation plan should try to innovate Wits University itself. This is not yet incorporated within the Strategic Plan.

Appendix: Outputs from six thinking hats workshop

Between November 2021 and February 2022, a series of five workshops was facilitated by Letlotlo Phohole (Acting Programme Manager of the WIC). Each workshop brought together a different Wits stakeholder group and aimed to explore the concept of "innovation". The groups represented: (i) Commerce, Law and Management; (ii) Engineering and the Built Environment plus Science; (iii) Health Science; (iv) Humanities; (v) Other entities including Wits Enterprise, Tshimologong Precinct, Marketing and Communications, etc. A methodology based on Edward de Bono's "Six Thinking Hats" approach was used. Although these stakeholder groups covered a broad range of perspectives within the University's diverse community, a high level of consensus was achieved. The following is a consolidated summary of the workshop outputs. **Note** that not all items listed represent consensus. In some cases they represent individual or minority viewpoints.

White Hat: This is the "Factual Hat". It answers the question "What is Innovation?"

Innovation is broad. It requires collaboration across disciplines. It covers interactions between industry, government, academia, society and the environment (the "quintuple helix"). Its outputs are both tangible (products and "things") and intangible (processes, services and ideas).

Innovation implies improvement. Innovation is finding new solutions or ways of doing things that are "better" than existing ways. This might mean faster, cheaper, less detrimental to the environment, etc. It is a different way of doing something to get a different and beneficial result.

Innovation can be taught and learnt. It involves being able to recognise problems or unmet needs in society. It sometimes requires translating new knowledge into tangible and intangible outputs. It might also require using what's available to create new and useful solutions (this is called "bricolage"). Embracing risk-taking is an important aspect of innovation.

Innovation is a collaborative activity with a focus on the individual. In the health sector, for example, the individual is the innovation entity. An individual healthcare practitioner interacts with an individual patient to deliver an innovative treatment of other intervention. In other sectors similar individual-to-individual interactions occur. However, the process of developing innovative solutions requires collaboration among multiple people from different disciplines to collaborate.

Innovation is inevitable. Society and organisations within it have always needed to change in response to changes in the environment.

Innovation has a social context. Innovation is about finding new solutions to social problems. It is about how we communicate research from and to the Global South.

Innovation is not always good. It is important to bring an ethical awareness into the evaluation of innovation.

Green Hat: This is the “Creativity Hat”. “What can be done to grow Innovation at Wits?”

Create an “Innovation Mindset”. Innovation should be seen by all at Wits as a way of responding to the enormous challenges and opportunities faced by society in the 21st Century. Many of these are captured in the UN’s SDGs (alleviating poverty, providing quality education, reducing inequality, promoting a peaceful and inclusive society, etc.). Everyone at Wits should understand that they have a role in tackling these challenges and embracing the opportunities. Innovation is the instrument to do this.

Creating space for Innovation. Wits needs to have “safe spaces” both institutionally and physically in which students and staff are permitted and incentivised for taking risks. Entrepreneurial behaviour must be encouraged. The institutional culture at Wits should encourage interdisciplinary engagement in pursuit of innovation. We need to look at things in a different way, and we need to do things in a different way. We must develop an enabling environment to allow a combination of knowledge, experience and "out the box" thinking.

Incentivising innovation. Both academics and students must be suitably incentivised to engage in innovative activities. This will require a suitable framework for measuring innovation and impact.

Identify opportunities for innovation. Examine and understand the problems and limitations in society and then develop innovative ways of solving them. The Humanities are particularly adept at doing this.

Yellow Hat: This is the “Benefits Hat”. “What are the benefits or outcomes of promoting Innovation at Wits?”

Contribute to building a better society. By finding innovative solutions to local and global challenges Wits academics and students will play a role in building a better South Africa and a better world. It is important for our students in all disciplines to see themselves as part of an integrated “whole” rather than powerless individuals. The outcomes of innovation to society must be measured in terms of actual benefits such as increased access to the Internet, number of jobs, access to water and electricity, etc., rather than numbers of patents and number of new companies.

Raise the quality of Wits research. The most innovative researchers perform best with respect to other more “conventional” research measures, including international reputation, quality of publications, access to funding, etc.

Raising Wits University’s reputation. A successful approach to innovation will enhance Wits’ reputation as a leading participant in the knowledge economy. Wits will also become more attractive to students and sponsors who value innovation.

Generating income. While this should not be the primary reason for innovation, some tangible forms of innovation outputs such as products and startups can result in substantial financial benefits to the individual, their research group or School, and the University.

Black Hat: This is the “Caution Hat”. “What can go wrong?”

Unintended outcomes: We need to be aware to unintended negative outcomes, such as innovations that might broaden the digital divide, increase pollution or increase inequality. We also need to ensure an appropriate balance between innovation and research. We must not grow innovation at the expense of reducing the quality of our research.

Failing to deliver on high expectation. Putting forward an ambitious innovation strategy creates expectations both inside and outside Wits. The University will suffer reputational damage if we fail to deliver on the innovation strategy. One reason for failure would be a lack of support and resources for the implementation of the innovation strategy.

Insufficient appetite for risk taking. There needs to be an understanding among all stakeholders that innovation requires an appetite for risk and a tolerance towards “failure”. The innovation strategy itself is an innovation, and stakeholders must be willing to adapt the strategy in response to experience gained in its incremental implementation.

Move forward at the right pace. The innovation strategy must be implemented with decisiveness and urgency. At the same time if should not progress so quickly as to create confusion, alienation and overstretch people and resources. A suiable balance between haste and caution must be found.

Institutional coordination. Innovation requires individual action (students, researchers, and others) supported by interdisciplinary cross-institutional engagement. Poor coordination will lead to a siloed approach and possible failure.

Thinking too narrowly about innovation. We do not want innovation to become synonymous with digitisation or commercialisation. If we narrow this definition too much, we run the risk of leaving some people out leading to a “them and us” situation.

Lack of positive role models. We need to ensure that we have sufficient success to create a group of successful role models from all areas of the institution. Failing to do this will make it impossible to nurture an Innovation Mindset at Wits.

Red Hat: This is the “Emotion Hat”. “What are the feelings/fears/emotions about innovation at Wits and the Strategy to promote it?”

Negative sentiments.

- **Provoking jealousy and r**esentment: The nature of innovation is that a few will succeed while many more will “fail”. This might manifest as jealousy and resentment within the institution.
- Fear of “thinking outside of the box”. People are reluctant to be seen as mavericks who don’t follow the rule.
- Innovation becomes too widespread and disruptive. Some people are concerned that innovation will become too disruptive within the Institution. There will be no stability and opportunity to engage in “business as normal”.
- Wits will become too “business oriented”. Innovation is seen as being synonymous with a culture of operating as a business. This will undermine the academic project. Many academic choose to work at a university because it is not business oriented.
- Fear that “research will be taken away from researchers and commercialised”. Researchers in some areas – particularly Humanities – fear that “the University” will take over research and then commercialise it.
- Uncertain roles and responsibilities. Fear that the new focus on innovation will lead to new organisational arrangements at Wits. This will create uncertainty regarding new roles and responsibilities.
- Added workload. Some see innovation as another burden being added onto the workload of academics who already feel overstretched.

Positive sentiments

- **Wits will** become more accommodative towards entrepreneurship. Some within the Wits community, particularly students, find the prospect of greater opportunities to be entrepreneurial very exciting.
- Opens up exciting new opportunities. The new focus on innovation opens up opportunities for broader collaboration both within Wits and outside. This will also enhance research opportunities. Innovation also opens up the prospect of working in multi-disciplinary teams.
- Creating an environment that rewards “new thinking”. If the focus on innovation brings a new incentive arrangement we will see the creation of an environment at Wits that encourages “new thinking”, experimentation and risk-taking by academics.
- Greater opportunities for social impact. We will see more opportunities to use our research to make significant positive impacts on society.

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