Review of national science, technology, and innovation landscape for translation of university research and innovation into enterprises

June 2025

Author | Dominique Diouf

DeSIRA LIFT

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Support to RUFORUM in the review of national science, technology, and innovation landscape for translation of university research and innovation into enterprises

Author: Dominique Diouf

June 2025

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Acronyms

ADPME	Agence de Développement des Petites et Moyennes Entreprises
ADSPIT	Agence Sénégalaise pour la Propriété Industrielle et l'Innovation Technologique
ANACIM	Agence nationale de l'aviation civile et de la météorologie
ARIPO	African Regional Intellectual Property Organization
ASPIT	Agence Sénégalaise pour la Propriété Intellectuelle
ASSP	Agriculture Sector Strategic Plan
BBBEE	Broad-Based Black Economic Empowerment
CATI Uds	Centre d'Appui à la Technologie, à l'Innovation et à l'Incubation de l'Université de Dschang
CBR	Centre for Basic Research
CED	Canada Economic Development
CEI	Centre for Entrepreneurship and Innovation (at the University of the Western Cape).
CGIAR	Consultative Group on International Agricultural Research
CIAT	Alliance of Biodiversity International and the International Center for Tropical Agriculture
CIRAD	Centre de coopération Internationale en Recherche Agronomique pour le Développement
COCES	Chike Okoli Centre for Entrepreneurial Studies
CORAF	Conseil pour la Recherche Agricole en Afrique
CoVE	Centres of Vocational Excellence
COWIL	Co-operative Education and Work-Integrated Learning Canada
DER/FJ	Direction de l'Entrepreneuriat Rapide des Jeunes et des Femmes
DFRSDT	Direction du Financement de la Recherche Scientifique et du Développement Technologique
DGRI	Direction Générale de la Recherche et de l'Innovation
DGRST	Direction Générale de la Recherche Scientifique et Technique
DIVPITT	Direction de l'Innovation, de la Valorisation, de la Propriété intellectuelle et du Transfert technologique
DPCS	Department for the Promotion of Scientific Culture
DSPR	Direction des Stratégies et de la Planification de la Recherche
ECTS	European Credit Transfer and Accumulation System
EDHE	Entrepreneurship Development in Higher Education
ENABEL	Agence Belge de Développement
FCDO	Foreign Commonwealth and Development Office

FET	In Full-Time equivalent
FIRST	Fonds d'Impulsion pour la Recherche Scientifique et Technique
FNRAA	Fonds National de Recherche Agricole et Agro-alimentaire du Sénégal
FONGIP	Fonds de Garantie des Investissements Prioritaires
FONSIS	Fonds Souverain d'Investissements Stratégiques
FARA	Forum Africain pour la Recherche Agricole
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on Research & Development
GETEC	Genius and Talent Exhibition Show
HEIs	Higher Education Institutions
HESA	Higher Education South Africa
ICT	Information and Communication Technologies
IDNeuf	Initiative pour le développement du numérique dans l'espace universitaire francophone
IDRC	International Development Research Centre
ILO	International Labour Organization
INP	Institut National de Pédologie
IOSRC	Initiative des Organismes Subventionnaires de la Recherche Scientifique
IRD	Institut De Recherche au Développement
ISRA	Institut Sénégalais de Recherches Agricoles
ITA	Institut de Technologie Alimentaire (ITA)
ITP	Industrial technology Park
KI	Key Informant
KII	Key Informant Interviews
KMC	Kiira Motors Corporation
KTPs	Knowledge Translation Platforms
Mak-RIF	Makerere University Research and Innovations Fund
MENSUP	Ministère de l'Enseignement Supérieur (Cameroon)
MESRI	Ministère de l'Enseignement Supérieur, de Recherche et de l'Innovation (Senegal)
MoICT	Ministry of Information, Communication Technology and National Guidance
MoSTI	Ministry of Science Technology and Innovation
MoUs	Memoranda of Understandings

MUST	Mbarara University of Science and Technology
MVPs	Minimum Viable Products
NIISP	National ICT Initiatives Support Programme
NDP	National Development Plan
NGO	Non-Governmental Organization
NIT	National Institute of Technopreneurship
NORAD	Norwegian Agency for Development Cooperation
NRF	National Research Fund
NRRU	National Research Repository of Uganda
NUC	National Universities Commission
NURRU	Network of Ugandan Researchers and Research Users
OECD	Organisation for Economic Co-operation and Development
OHADA	Organisation pour l'harmonisation en Afrique du droit des affaires
PACTE	Technical Learning Programme for Entrepreneurship
PBL	Problem-Based Learning
PCT	Patent Cooperation Treaty
PEE	Pôle Étudiant-Entrepreneur
PIBID	Presidential Initiative on Banana Industrial Development
R&D	Research and Development
R&I	Research and Innovation
RENU	Research and Education Network for Uganda
RUFORUM	Regional Universities Forum for Capacity Building in Agriculture
SEE	Student Entrepreneur Statute
SET	Science, Engineering and Technology
SGCI	Science Granting Councils Initiative
Sida	Swedish International Development Cooperation Agency
SLECI	Self-regulating, Low Energy, Clay-based Irrigation
SMMEs	Small, Medium, and Micro Enterprises
SNRASP	Système National de Recherches Agro-Sylvo-Pastorales
STEM	Science, Technology, Engineering, and Mathematics
STI	Science, Technology, and Innovation

SU	Stellenbosch University
SUNCEP	Stellenbosch University Network for Community Engagement and Partnerships
TIA	Technology Innovation Agency (South Africa)
TIBIC	Technology Innovation and Business Incubation Centre
TTO	Technology Transfer Office
UBC	University Business Cooperation
UCAD	Université Cheikh Anta DIOP
UCT	University of Cape Town
UFS	University of Free State
UIRI	Uganda Industrial Research Institute (UIRI),
UN	United nations
UNBS	Uganda National Bureau of Standards
UNCST	Uganda National Council for Science and Technology
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIVAL/ISRA	Unité d'Information et de Valorisation (UNIVAL) de l'Institut Sénégalais de Recherches Agricoles
UP	University of Pretoria
USAf	Universities South Africa
UWC	University of the Western Cape
WIL	Work-Integrated Learning (WIL)
WIPO	World Intellectual Property Organisation

Glossary

Accelerator: The International Business Innovation Association, world's largest professional association representing the field of incubation defines business incubation as follows (INBIA 2017): "Business incubation is a support process that accelerates the successful development of start-up and fledgling companies by providing entrepreneurs with an array of targeted resources and services. These services are usually developed or orchestrated by incubator management and offered both in the business incubator and through its network of contacts. A business incubator's main goal is to produce successful firms that will leave the program financially viable and freestanding. These incubator graduates have the potential to create jobs, revitalize neighbourhoods, commercialize new technologies, and strengthen local and national economies." [1]

Innovation: This report adopts the definition of innovation (OECD and Eurostat, fourth edition, 2018), originally elaborated in the Oslo Manual developed by the Statistical Office of the European Communities and the Organisation for Economic Co-operation and Development (OECD: "An innovation is a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process)."

Start-up: Canada Economic Development (CED) defines start-ups as young (generally less than five years old), innovative and often tech businesses with strong scale-up potential. They attract investor interest and transform the way things are done through their business models and the new ideas they bring to market. Start-ups can also include impact businesses.

Impact business: A business whose mission, business model and activities address social or environmental issues.

Incubator: Business incubators are organizations that offer long-term programs to provide young, innovative businesses demonstrating high scale-up potential (start-ups) with access to coaching, mentoring, investors and other forms of support, to help them get established. In addition, incubators usually provide start-ups, including impact businesses, with access to logistical and technical resources, training and shared office space.

[1] INBIA (2017). International Business Innovation Association. Accessed July 17, 2024

Executive Summary

This study aimed at supporting the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) in the review of national science, technology, and innovation landscapes for translation of university research and innovation into sustainable enterprises. It specifically reviewed the mechanisms, policies, and processes which influence the translation of research products into enterprises or strengthen existing enterprises at national level in Cameroon, Senegal, South Africa, Uganda. Data were gathered through a scoping study based on grey literature and complemented by interviews with key informants. Findings included the enablers of and barriers to the research translation process and relevant business cases that emerged from academic research outputs. These informed the study's conclusions and practical recommendations at both national and HEIs level on the procedures for the universities to translate research products into sustainable enterprises that can help address unemployment among young people and women, and support entrepreneurship in agrifood systems in Africa. Further country-specific review is needed to provide more business cases for a comprehensive and in-depth understanding of the mechanisms, policies, and processes in support of or against the translation of research outputs in African Higher Education Institutions (HEIs).

Creating an environment conducive to research, innovation and entrepreneurship through supportive policies and regulations

The research highlights, at each country level, an array of laws, institutions and other initiatives designed to regulate and foster the research and innovation (R&I) landscape as well as the entrepreneurship ecosystem. These several initiatives have the potential to enable HEIs, and their stakeholders harness the power of entrepreneurship and innovation to create businesses that can help combat unemployment among young people and women.

For instance, **South Africa** has developed two main policies to harness the power of intellectual property (IP): The Intellectual Property Policy of The Republic of South Africa Phase I 2018 and the Intellectual Property Rights from Publicly Financed Research and Development Act 51 of 2008. The later latter would provide HEIs with a framework that is allegedly conducive to the utilisation of intellectual property emanating from publicly financed research and development. At the institutional level, the Technology Innovation Agency (TIA) is a good example of an initiative that is significantly impacting the South Africa's technological ecosystem. Indeed, the TIA establishes different partnerships to fund projects and develop smart innovations within different sectors, including agriculture, in South Africa. Relevant examples include the EUREKA Climate Smart Agriculture localised weather stations developed by Metos SA (Pty) Ltd. the Technology.

In **Uganda**, several legal and regulatory frameworks and other initiatives have been put in place for an enabling environment conducive to research, innovation and commercialization of research outputs. These policies are underpinned by Uganda Vision 2040 that supports "a transformed Ugandan society, from a peasant society to a modern and prosperous country within 30 years". Relevant examples include:

- The National Agricultural Research Act, 2005;
- Uganda Small and Medium Enterprises policy, 2015;
- National Science, Technology and Innovation policy, 2009;
- Uganda Bureau of Statistics (UBoS) Act, 1998;
- National Development Plan, 2015/2019; - and Vision 2040.

In terms of funding, several initiatives and mechanisms illustrate the commitment of the Government of Uganda to strengthening quality education, research, innovation and commercialization of research outputs in Higher Institutions as a strategy for realizing Vision 2040. For instance, the **Makerere University Research and Innovations Fund (Mak-RIF)** is a unique initiative funded by the Government of Uganda to support high-impact research and innovations that contribute to national development

Senegal has initiated major institutional reforms to support research and innovation. Several measures have been put in place to harness the potential of R&I:

- The Lettre de politique sectorielle de Développement de l'Enseignement supérieur, de la Recherche et de l'Innovation 2018-2022/ Sectoral policy letter for the Development of Higher Education, Research and Innovation 2018-2022, which aims to boost R&I.
- The Concertation nationale autour de l'Avenir de l'Enseignement supérieur, la Recherche et l'Innovation (CNAES)/ National consultation on the Future of Higher Education, Research and Innovation, as a platform for equipping research centres, establishing a framework for cooperation between the private sector and universities, and defining effective strategies for disseminating research results.

Significant strides have also been made in research valorization and technology transfer, areas hitherto considered to be under-explored. In this respect, the creation of the Agence Sénégalaise pour la Propriété Intellectuelle/ Senegalese agency for intellectual property (ASPIT) marks an important milestone in the process of protecting inventions and innovations and creating synergies between innovations and technology transfer. By way of illustration, the urgent need to create jobs for young people, through productive activities, required strengthening linkages between public research and innovation. It is against this backdrop that the Senegalese authorities have elaborated a National Plan for Research and Innovation: *For an emerging Senegal by 2035: research and innovation as catalysts for sustainable development, industrialization and entrepreneurship.*

Like other countries, **Cameroon** has developed a set of tools and mechanisms designed to foster research and innovation and promote entrepreneurship. The Cameroon Vision 2035 encourages transfer of technologies and use of research results by enterprises. It aims to promote, assist in and boost research & development in the country by developing research institutes, encouraging enterprises to increasingly innovate and establishing strong partnerships between research centers and enterprises. Focusing on the promotion of entrepreneurship and the improvement of workforce employability, the government of Cameroon, through the Ministry of Small-and Medium-size Enterprises, Social Economy and Handicrafts (MINPMEESA), is providing support to young people through incubators. For instance, the pilot National Business Incubator (PNPE) was set up in 2018 to support business incubation project holders and provide resources to start-ups.

While these numerous initiatives, including national laws and policies, can help create an environment conducive to research, innovation and entrepreneurship, several factors limit their applicability and effectiveness:

- The plethora of laws, policies and other initiatives and the lack/inadequacy of coordination mechanisms -to ensure harmonization of the various policies and other mechanisms- tends to foster a fragmented support environment and prevent stakeholders from creating synergies.
- Despite an institutional environment supported by national policies, investment in research and innovation remains low.

- Lack of awareness among stakeholders, in this case researchers and entrepreneurs, of certain laws and policies. This limits both the applicability of these laws and policies and the ability of researchers and entrepreneurs to generate knowledge and mobilize the results of their research, due to a lack of knowledge of existing standards frameworks.
- Apart from a few schemes Intellectual Property Rights from Publicly Financed Research and Development Act 51 of 2008 (South Africa) and the student-entrepreneur status (Senegal), there are no clear policies with precise objectives on academic entrepreneurship.

HEIs: investing in entrepreneurship and innovation through a set of initiatives

The scoping study, the business cases, the key informant interviews and the country webinars show a convergence around several initiatives and programs as enablers of the translation of research outputs into enterprises. These initiatives and programs cover the entire innovation system of teaching, research and community impact, knowledge valorization and technology transfer etc.

- Integration of entrepreneurship and innovation into curricula and teaching models
    - AgriScale: 3960+: Total volume (in ECTS) of new/ updated courses and 461Total number of staff members trained in PBL methodology and curricula development in Kenya and Zambia and Uganda (Bishop Stuart University and Gulu University, Uganda).
    - The Student Enterprise Scheme (SES): Gulu University
    - "Strengthening Agri-Entrepreneurship and Community Engagement Training in East, West and North Africa (AgriEngage)", Gulu University (Uganda) among the partners.
- Creation of ad-hoc structures (incubators, accelerators, labs, mentoring programs) to harness the power of innovation and entrepreneurship:
    - Incubator Dekkal Yaakaar: USSEIN (Senegal)
    - LaunchLab: University of Stellenbosch (South Africa)
    - Centre d'Appui à la Technologie, à l'Innovation et à l'Incubation (CATI) : University of Dschang (Cameroun)
    - Makerere Innovation &Incubation Centre: Makerere University (Uganda)
- Setting up structures for knowledge valorization and commercialization of research outputs, including through intellectual property management and technology transfer.
    - Department of Valorization (ESP, UCAD, Senegal)
    - Directorate of Graduate Studies, Research and Innovations (Busitema University, Uganda)
    - Innovation & Intellectual Property (University of Fort Hare, South Africa)
    - Directorate of Innovation, Technology Transfer and Commercialization (University of South Africa, South Africa)
    - Research, Cooperation & Relations with the Business World, University of Buea.
    - Center for Innovation and Technology Transfer (Mbarara University of Science and Technology)
- Collaboration with private sector (industry) and local communities
    - TAGDev 2.0: a collaborative between RUFORUM, Mastercard Foundation, the Global Confederation of Higher Education Associations for Agricultural and life Sciences (GCHERA) and 12 African universities. The main goal is to strengthen universities and TVET institutions to better serve communities by skilling and empowering Africa's young people and their institutions to drive inclusive, equitable and climate resilient transformative agriculture and agrifood systems

- The University of the Free State (UFS) Wool Wise Community Project: Community project empowers local women in wool craft.

While these initiatives are spreading throughout the HEIs, gradually shaping their social mission and laying the foundations for an entrepreneurial university, some barriers remain that could limit the effectiveness and impact of these practices:

- Limited access to substantial material, financial, technological and even logistical could mitigate the impact of initiatives and actions undertaken, their scaling-up and their sustainability.
- The persistence of a mindset -among the HEIs stakeholders- that still perceives the university as a mere place for teaching and generating knowledge hinders the commercialization of academic research outputs.
- Partnerships between universities and the private sector (banks and industry) and local communities are still weak.
- Curriculum updates and/or updates meet sometimes with resistance to change from the main stakeholders (teachers, students, staff, etc.), anticipating more work and insecurity.
- Intellectual property and technology transfer remain tributary or even neglected activities in many universities (notably in Senegal, Cameroon and even Uganda).

Translating research outputs and student projects into businesses

The study identified relevant business cases from the four selected countries. The following criteria were considered:

- Be a start-up, SME or company created from a student project or idea, or from academic research;
- be incubated or have benefited from any university or research centre service (non mandatory);
- be active in the field of agriculture;
- have collaborated with a university located in one of the four countries considered;
- other criteria, such as access to data, job creation, and stage of development have been considered.

Analysis of the business cases highlighted four main observations:

All founders stated that their start-ups have been positively impacted by incubation/acceleration programs, grants, facilities such as labs, working spaces, and support for technology transfer or intellectual property management, R&D. Incubation and grants programmes are often cited as having contributed most to boosting the development of start-ups. This stresses the crucial role of the support structures and funding mechanisms in translating research and innovation outputs into enterprises.

Motivations for entrepreneurship are often driven not only by economic factors, but also by social (community involvement), environmental (climate change, land degradation) and health considerations (healthy food and nutrition). This observation suggests that universities should place greater emphasis on social entrepreneurship and social innovations in their incubation and training programs and even integrate these features into new curricula.

Apart from the three Stellenbosch University (SU) companies (Adagin Technologies, Terra Clim, Immobazyme), almost all business cases, including those on the extended list (see Annex 1) are start-ups. While it may be difficult to generalise, given the relatively limited sample and the fact that the study only

covers four countries (Cameroon, Senegal, South Africa and Uganda), two lessons can be drawn from this observation:

- The university entrepreneurial ecosystem is not yet mature enough to create a significant pool of start-ups capable of rising, "crossing the valley of death", prospering and contributing to creating jobs, generating income and fighting poverty. Indeed, beyond financial and technological barriers, the services offered, through incubation, acceleration, training and financing programs are not always tailored to the needs of researchers and student entrepreneurs, and do not sometimes include activities in monitoring and evaluation to track and assess the performance, effectiveness and impact of the programs and their potential for scaling up.
- HEIs do not generate enough marketable research outputs. This could be due to limited research capacity, inadequate research infrastructure, the quality of research outputs and/or the mindset and culture of researchers. These factors constitute bottlenecks that can hinder the commercialisation of research and innovation.

Access to adequate funding and an institutional environment that supports research, innovation, technology transfer, and entrepreneurship (such as incubators, accelerators, labs and research infrastructure) are crucial enablers for translating research outputs. Establishing connections with industry, communities, and international networks also plays a significant role. The case of SU, which has been able to generate highly promising start-ups and spin-out companies, thanks to its Innovation and Commercialisation (I&C) division, and to structures put in place such as Innovus Technology Transfer Office (TTO), SU LauchLab, Stellenbosch Network, US Enterprises (Pty) Ltd (USE), is an edifying example. In addition, licensing intellectual property and commercialising research outputs have generated revenue for this university, supporting further research and development.

Challenges and recommendations

Despite efforts made by governments, through national policies and initiatives, and by universities, through several initiatives, it worth noting that there are still many challenges hindering the process of translating research outputs into business opportunities. Overall, beyond the lack of funding, which a cross-cutting issue, the scoping study, the key informants' interviews, the case studies and the country webinars converge around identified six main issues where practical recommendations are provided:

- Fragmented national support environment: Fostering a legal and institutional environment conducive to research, innovation and entrepreneurship
- Limited research and innovation capacity: Investing in research and innovation
- Lack of entrepreneurial culture/mindset: Integrating entrepreneurship into curricula
- Limited capacities for students to develop and implement their business ideas and plans: Supporting students and researchers in developing and implementing their business ideas and plans.
- Limited use of intellectual property (IP): Leveraging IP for inventions
- Weak collaboration between HEIs and the private sector: Harnessing collaboration between HEIs and the private sector.

Issues	Recommendations
Fragmented support environment	**Fostering a legal and institutional environment conducive to research, innovation and entrepreneurship** ➢ **<u>At government level</u>** - At each country level, formulating and implementing a cohesive national policy framework to streamline and foster the commercialization processes of research outputs. ➢ **<u>At HEIs level</u>** - Carrying out research geared to the needs of ecosystems to help policymakers better understand what policies, resources and support structures are necessary to foster entrepreneurship and innovation. - Sharing research findings through publications, reports, and open data initiatives as so to inform and inspire evidence-based policymaking. ➢ **<u>RUFORUM and national/ international partners</u>** Through its consortium of universities and partners, RUFORUM can help mobilise resources, conduct activities (identifying challenges and opportunities, informing policy development; enhancing collaboration and networking, monitoring and evaluation, building capacity and knowledge) at national and regional levels and advocacy to help promote a legal and institutional framework conducive to research, innovation and entrepreneurship.
Limited research capacity	**Investing in research and innovation** ➢ **<u>At government level</u>** - Increasing the percentage (1%) of GDP spent on R&D/**industrial research**. Currently, many African countries spend less than 1% of their GDP on R&D, which is below the global average This includes funding for universities, research institutions, and innovation hubs. - Providing state-of-the-art facilities and resources, including laboratories, research centers, and high-speed internet, to support research activities. ➢ **<u>At HEIs level</u>** - Establishing and strengthening networks between universities, research institutions, and industry to promote knowledge sharing and collaboration. - Offering training and professional development programs for researchers, educators, and entrepreneurs. ➢ **<u>Recommendations for RUFORUM and its partners</u>** - Facilitating networking events, conferences, and workshops that bring together researchers, entrepreneurs, investors, and policymakers. - Supporting universities in strengthening linkages between industry and academia to ensure that research is aligned with market needs and can be effectively commercialized.
Lack of entrepreneurial culture/mindset	**Integrating entrepreneurship into university curricula** ➢ **<u>At government level</u>** - Mandating the inclusion of core and elective entrepreneurship courses (practical learning experiences) in university programs across various disciplines. - Allocating funding to universities specifically for designing relevant mentorship programs that connect students with experienced entrepreneurs and business leaders. ➢ **<u>At HEIs level</u>** - Designing well-structured and practical curricula that include clear objectives, teaching content, methods, and assessment techniques. - Including dedicated courses on social entrepreneurship and social innovation in the curriculum and teaching students about social impact, sustainable business models, and innovative solutions to community problem.

	- Providing students and researchers with access to resources such as incubators, accelerators, and funding opportunities to support their entrepreneurial ventures. - Encouraging project-based learning where students, researchers, local communities and the industry can work on real-world problems and develop entrepreneurial solutions. ➢ **Recommendations for RUFORUM and other partners** In collaboration with its partners, evaluating or benchmarking current projects (AgriEngage, AgriSCALE, the Student Enterprise Scheme (SES) at Gulu University, TagDev, Forest 21 etc.) and other initiatives using problem-based learning (PBL) or other methods, to identify both challenges and best practices. Some successful projects could be tested and scaled up in other contexts to help spread best practices in integrating innovation and entrepreneurship into higher education
Limited capacities for students and staff to develop and implement their business ideas and plans	**Supporting students and staff in developing and implementing their business ideas and plans** ➢ **At government level** - Providing dedicated grants and scholarships for entrepreneurial projects, allowing students and staff to access funding without financial burden. - Simplifying the process of business registration and licensing to make it easier for start-ups to launch and operate. - Providing tax breaks and other incentives for university-affiliated start-ups and businesses. ➢ **At HEIs level** - Offering entrepreneurship education: courses and workshops, guest lectures etc. focusing on practical skills such as leadership, project management, and innovation. - Providing mentorship and guidance and facilitating access to facilities, technical support and funding. - Connecting students and staff with experienced entrepreneurs and industry experts who can offer advice and support. ➢ **Recommendations for RUFORUM** - Advocating for partnerships between universities and corporations to provide resources, funding, and expertise for entrepreneurial initiatives. - Co-developing (with universities, and national/international organizations) online platforms where students and staff can collaborate, share ideas, and access resources and information.
Limited use of intellectual property	**Leveraging IP for inventions** ➢ **At government level** - Offering capacity-building programmes for national intellectual property management and existing technology transfer structures. - Providing support for start-ups and small businesses (emerging from universities) to help them commercialize their inventions and grow. - Developing and implementing clear IP policies within publicly funded universities that outline the rights and responsibilities of students, faculty, and other institutions regarding inventions and IP. ➢ **At HEIs level** - Establishing IP and technology transfer advisory offices within universities to provide guidance on IP issues, including patent applications, copyright, and trademark registration. - Including IP education in the university curriculum to teach students about the importance of IP rights and how to protect their inventions.

	- Fostering collaborations with industry partners to provide real-world insights and support for university innovations. ➢ **Recommendations for RUFORUM** - Collaborating (through its network of universities and national partners) with international organizations like the World Intellectual Property Organization (WIPO) to benefit from their expertise and resources. - In addition, RUFORUM could initiate a study to better understand the enablers as well as the barriers of the South Africa **Intellectual Property Rights from Publicly Financed Research and Development Act 51 of 2008** to measure to what extent this act could serve as a benchmark for other universities in other RUFORUM member countries.
Weak collaboration between HEIs and the private sector	**Harnessing collaboration between HEIs, local communities and private sector.** ➢ **At government level** - Designing and implementing policies that foster collaboration between HEIs, local communities and private sector. - Investing in upgrading digital infrastructure to support research, innovation, and collaboration between HEIs and the private sector. ➢ **At HEIs level** - Establishing vocational and technical training programs in partnership with local industries and communities. This can provide students with practical skills and improve their employability while addressing the specific labor needs of the private sector. - Integrating industry experience and community service into HEIs curricula, allowing students to engage with local communities and contribute to development projects. This hands-on experience benefits both students and communities. ➢ **Recommendations for RUFORUM** - Facilitating collaborative research between HEIs and the private sector to address local community challenges. For example, agricultural universities could partner with farming cooperatives and agribusinesses to develop sustainable farming techniques and help combat climate change and food insecurity.

Résumé exécutif

Cette étude vise à soutenir le Forum régional des universités pour le renforcement des capacités en agriculture (RUFORUM) dans l'analyse du paysage national de la science, de la technologie et de l'innovation, en vue de la valorisation et du transfert des résultats de la recherche et de l'innovation universitaires vers le secteur entrepreneurial durable. Elle examine spécifiquement les mécanismes, les politiques et les processus qui influencent la valorisation des résultats de la recherche en opportunités de création d'entreprises ou le renforcement des entreprises existantes au niveau national, notamment au Cameroun, au Sénégal, en Afrique du Sud et en Ouganda. Les données ont été recueillies au moyen d'une étude exploratoire basée sur la littérature grise et complétée par des entretiens menés auprès d'informateurs clés. Les résultats ont mis en évidence à la fois les facteurs favorables et les obstacles au processus de valorisation des résultats de la recherche, ainsi que des exemples concrets issus de la recherche universitaire. Ces résultats ont contribué à éclairer les conclusions ainsi que les recommandations pratiques de l'étude, tant au niveau national qu'à celui des établissements d'enseignement supérieur, concernant les procédures permettant aux universités de valoriser les résultats de la recherche en entreprises durables. Celles-ci peuvent ainsi contribuer à la lutte contre le chômage des jeunes et des femmes, et soutenir l'entrepreneuriat au cœur des systèmes agroalimentaires en Afrique. Une analyse plus approfondie par pays est nécessaire afin de fournir davantage d'exemples concrets permettant de comprendre de manière exhaustive et approfondie les mécanismes, les politiques et les processus qui favorisent ou entravent la valorisation des résultats de la recherche au sein des établissements de recherche et d'enseignement supérieur africains.

Créer un environnement propice à la recherche, à l'innovation et à l'esprit d'entreprise par le biais de politiques et de réglementations de soutien

Cette recherche met en évidence, au niveau de chaque pays, un ensemble de lois, d'institutions et d'autres initiatives visant à réglementer et renforcer le paysage de la recherche et de l'innovation (R&I) ainsi que l'écosystème entrepreneurial. Ces diverses initiatives ont le potentiel de permettre aux établissements d'enseignement supérieur et de recherche et à leurs parties prenantes de tirer profit de l'entrepreneuriat et de l'innovation pour créer des entreprises susceptibles de contribuer à la lutte contre le chômage des jeunes et des femmes.

Par exemple, **l'Afrique du Sud** a développé deux politiques principales pour exploiter le pouvoir de la propriété intellectuelle (PI) : The Intellectual Property Policy of The Republic of South Africa Phase I 2018 and the Intellectual Property Rights from Publicly Financed Research and Development Act 51 of 2008 : la politique de propriété intellectuelle de la République d'Afrique du Sud Phase I 2018 et la loi 51 de 2008 sur les droits de propriété intellectuelle issus de la recherche et du développement financés sur fonds publics. Cette dernière offrirait aux établissements d'enseignement supérieur et de recherche un cadre réputé propice à l'exploitation de la propriété intellectuelle issue de la recherche et du développement financés par des fonds publics. Au niveau institutionnel, l'Agence pour l'innovation technologique (Technological Innovation Agency (TIA)) constitue un bon exemple d'initiative ayant un impact significatif sur l'écosystème technologique sud-africain. En effet, la TIA établit différents partenariats afin de financer des projets et développer des innovations intelligentes dans différents secteurs, y compris l'agriculture, en Afrique du Sud. Parmi les exemples pertinents, figure le projet EUREKA Climate Smart Agriculture, avec des stations météorologiques localisées développées par Metos SA (Pty) Ltd.

En **Ouganda**, plusieurs cadres juridiques et réglementaires et autres initiatives ont été mis en place dans le but de créer un environnement favorable à la recherche, à l'innovation et à la commercialisation des résultats de la recherche. Ces politiques s'inscrivent dans le cadre de la Vision 2040 de l'Ouganda, qui vise « transformer la société ougandaise, d'une société paysanne à un pays moderne et prospère d'ici 30 ans ». Parmi les exemples pertinents, l'on peut citer :

- La loi sur la recherche agricole nationale, 2005 (National Agricultural Research Act) ;
- La politique sur les petites et moyennes entreprises de l'Ouganda, 2015 (Uganda Small and Medium Enterprises Policy) ;
- La politique nationale en matière de science, de technologie et d'innovation, 2009 (National Science, Technology and Innovation policy) ;
- Loi sur le Bureau ougandais des statistiques (UBoS), 1998 (Uganda Bureau of Statistics);
- Le Plan de développement national, 2015/2019 (National Development Plan) ;
- Et Vision 2040.

En termes de financement, plusieurs initiatives et mécanismes illustrent l'engagement du gouvernement ougandais à renforcer une éducation de qualité, à promouvoir la recherche, l'innovation et la commercialisation des résultats de la recherche au sein des établissements de recherche et d'enseignement supérieur, dans le cadre de la réalisation de Vision 2040. Par exemple, le **Fonds de recherche et d'innovation de l'université de Makerere, Mak-RIF** (the Makerere University Research and Innovations Fund) est une initiative unique financée par le gouvernement ougandais pour soutenir la recherche et les innovations à fort impact qui contribuent au développement national.

Le **Sénégal** a engagé d'importantes réformes institutionnelles pour soutenir la recherche et l'innovation. Plusieurs mesures ont été mises en place pour exploiter le potentiel de la R&I :

- La Lettre de politique sectorielle de Développement du ministère de l'Enseignement supérieur, de la Recherche et de l'Innovation 2018-2022, qui vise à dynamiser la R&I.
- La Concertation nationale sur l'Avenir de l'Enseignement supérieur, la Recherche et l'Innovation (CNAES), qui constitue une plateforme pour l'équipement des centres de recherche, l'établissement d'un cadre de coopération entre le secteur privé et les universités, ainsi que la définition de stratégies efficaces de diffusion des résultats de la recherche.

Des avancées significatives ont également été réalisées en matière de valorisation de la recherche et de transfert de technologie, des domaines jusque-là considérés comme sous-exploités. À cet égard, la création de l'Agence sénégalaise pour la propriété intellectuelle (ASPIT) marque une étape importante dans le processus de protection des inventions et des innovations, ainsi que dans la création de synergies entre les innovations et le transfert de technologie. À titre d'illustration, l'urgence de créer des emplois pour les jeunes, à travers des activités productives, a nécessité le renforcement des liens entre la recherche publique et l'innovation. C'est dans ce contexte que les autorités sénégalaises ont élaboré un Plan National de Recherche et d'Innovation : *Pour un Sénégal émergent à l'horizon 2035 : la recherche et l'innovation comme catalyseurs du développement durable, de l'industrialisation et de l'entrepreneuriat.*

À l'instar d'autres pays, le **Cameroun** a développé un ensemble d'outils et de mécanismes destinés à favoriser la recherche et l'innovation et à promouvoir l'entrepreneuriat. La Vision 2035 encourage le transfert de technologies et l'utilisation des résultats de la recherche par les entreprises. Elle vise à promouvoir, accompagner et dynamiser la recherche et le développement dans le pays en développant des instituts de recherche, en incitant les entreprises à innover davantage et en établissant des

partenariats solides entre les centres de recherche et les entreprises. En mettant l'accent sur la promotion de l'entrepreneuriat et le renforcement de l'employabilité de la main-d'œuvre, le gouvernement camerounais, par l'intermédiaire du Ministère des Petites et Moyennes Entreprises, de l'Économie Sociale et de l'Artisanat (MINPMEESA), apporte son soutien aux jeunes via des incubateurs. Par exemple, le Programme national d'incubation d'entreprises (PNPE) a été mis en place en 2018 pour soutenir les porteurs de projets d'incubation d'entreprises et fournir des ressources aux start-ups.

Si ces nombreuses initiatives ainsi que les lois et politiques nationales peuvent contribuer à créer un environnement propice à la recherche, à l'innovation et à l'entrepreneuriat, plusieurs facteurs en limitent l'applicabilité et l'efficacité :

- La multiplicité des lois, politiques et autres initiatives, ainsi que l'absence ou l'insuffisance des mécanismes de coordination visant à assurer l'harmonisation des différentes politiques et autres initiatives, tendent à fragmenter l'environnement de soutien à la recherche, à l'innovation et à l'entrepreneuriat et à empêcher les parties prenantes de créer des synergies.
- Malgré un environnement institutionnel soutenu par des politiques nationales et potentiellement favorable au développement de la recherche et de l'innovation, les investissements dans la recherche et l'innovation restent faibles.
- Un manque de sensibilisation des parties prenantes, en l'occurrence les chercheurs et les entrepreneurs, par rapport au cadre légal (lois et politiques) existant : Cela limite à la fois l'applicabilité de ces lois et politiques, ainsi que la capacité des chercheurs et des entrepreneurs à générer des connaissances et à mobiliser les résultats de leurs recherches, en raison d'une méconnaissance des cadres normatifs existants.
- À l'exception de quelques dispositifs (tels que la loi sur les droits de propriété intellectuelle issus de la recherche et du développement financés sur fonds publics, Act 51 de 2008 - Intellectual Property Rights from Publicly Financed Research and Development Act 51 of 2008, en Afrique du Sud, et le statut d'étudiant-entrepreneur au Sénégal), il n'existe pas de politiques claires avec des objectifs précis en matière d'entrepreneuriat universitaire.

Les établissements d'enseignement supérieur et de recherche : investir dans l'entrepreneuriat et l'innovation à travers une série d'initiatives

L'étude exploratoire, les exemples concrets d'entreprises, les entretiens menés avec des informateurs clés et les webinaires nationaux révèlent une convergence autour de plusieurs initiatives et programmes qui facilitent la valorisation des résultats de la recherche en entreprises. Ces initiatives et programmes couvrent l'ensemble du système d'innovation, notamment l'enseignement, la recherche et l'impact communautaire, la valorisation des connaissances et le transfert de technologies.

- Intégration de l'entrepreneuriat et de l'innovation dans les programmes d'études et les modèles pédagogiques
    - **AgriScale :** 3960+ : Volume total (en ECTS) de cours nouveaux/actualisés et un nombre total de 461 membres du personnel formés à la méthodologie d'apprentissage par problèmes (APP) et au développement de programmes d'études au Kenya, en Zambie et en Ouganda (Université Bishop Stuart et Université Gulu, Ouganda).
    - Le programme d'entreprise étudiante (SES) : Université de Gulu

    - « Le renforcement de la formation en agro-entrepreneuriat et engagement communautaire en Afrique de l'Est, de l'Ouest et du Nord (AgriEngage) », Université de Gulu (Ouganda) parmi les partenaires.
- Création de structures ad hoc (incubateurs, accélérateurs, laboratoires, programmes de mentorat) pour exploiter le potentiel de l'innovation et de l'entreprenariat.
    - Incubateur Dekkal Yaakaar : USSEIN (Sénégal)
    - LaunchLab : Université de Stellenbosch (Afrique du Sud)
    - Centre d'Appui à la Technologie, à l'Innovation et à l'Incubation (CATI) : Université de Dschang (Cameroun)
    - Centre d'innovation et d'incubation de Makerere : Université de Makerere (Ouganda)
- Mise en place de structures pour la valorisation des connaissances et la commercialisation des résultats de la recherche, notamment par la gestion de la propriété intellectuelle et le transfert de technologie.
    - Département de valorisation (ESP, UCAD, Sénégal)
    - Direction des études supérieures, de la recherche et de l'innovation (Université de Busitema, Ouganda)
    - Innovation et propriété intellectuelle (Université de Fort Hare, Afrique du Sud)
    - Direction de l'innovation, du transfert de technologie et de la commercialisation (Université d'Afrique du Sud, Afrique du Sud)
    - Recherche, coopération et relations avec le monde des affaires, Université de Buea.
    - Centre pour l'innovation et le transfert de technologie (Université des sciences et technologies de Mbarara)
- Collaboration avec le secteur privé (industrie) et les communautés locales
    - TAGDev 2.0 : une collaboration entre le RUFORUM, la Fondation Mastercard, la Global Confederation of Higher Education Associations for Agricultural and life Sciences (GCHERA) et 12 universités africaines. L'objectif principal est de renforcer les universités et les établissements d'enseignement et de formation techniques et professionnels afin de mieux servir les communautés, en formant et en responsabilisant les jeunes Africains et leurs institutions pour favoriser une agriculture et des systèmes agroalimentaires transformateurs, inclusifs, équitables et résilients face aux changements climatiques.
    - Projet communautaire Wool Wise de University of Free State (UFS) : ce projet communautaire permet d'accroître l'autonomie des femmes de la région dans l'artisanat de la laine.

Alors que ces initiatives se diffusent au sein des établissements d'enseignement supérieur, façonnant progressivement leur mission sociale, et posant les bases d'une université entrepreneuriale, certains obstacles subsistent et pourraient limiter l'efficacité et l'impact de ces pratiques :

- Un accès limité à des ressources matérielles, financières, technologiques et même logistiques substantielles pourrait atténuer l'impact des initiatives et des actions entreprises, leur mise à l'échelle et leur durabilité.
- La persistance d'une mentalité - parmi les parties prenantes des établissements d'enseignement supérieur et de recherche - qui considère encore l'université comme un simple lieu

d'enseignement et de production de connaissances entrave le processus de commercialisation des résultats de la recherche universitaire.
- Les partenariats entre les universités et le secteur privé (banques et industrie) et les communautés locales restent encore faibles.
- Les mises à jour et/ou actualisations des programmes d'études se heurtent parfois à la résistance au changement des principales parties prenantes (enseignants, étudiants, personnel, etc.), qui anticipent un surcroît de travail et un sentiment d'insécurité.
- La propriété intellectuelle et le transfert de technologie restent des activités secondaires, voire négligées, dans de nombreuses universités (notamment au Sénégal, au Cameroun et même en Ouganda).

Valoriser les résultats de la recherche et les projets des étudiants via la création d'entreprises

L'étude a permis d'identifier des cas d'entreprises (ayant émergé de la recherche universitaire ou de projets d'étudiants) pertinents dans les quatre pays sélectionnés. Les critères suivants ont été pris en compte :

- Être une startup, une petite et moyenne entreprise (PME) ou une entreprise issue d'un projet ou d'une idée d'étudiant, ou d'une recherche universitaire ;
- avoir été incubée ou avoir bénéficié d'un service d'une université ou d'un centre de recherche (non obligatoire) ;
- être active dans le domaine de l'agriculture ;
- avoir collaboré avec une université située dans l'un des 4 pays considérés ;
- d'autres critères, tels que l'accès aux données, la création d'emplois et le stade de développement ont été pris en compte.

L'analyse des études de cas a mis en évidence quatre observations principales :

Tous les fondateurs (des startups ou PME) ont déclaré que leur start-up ou entreprise avait été positivement influencée par les programmes d'incubation/accélération, les subventions reçues, les installations telles que les laboratoires, les espaces de travail et le soutien au transfert de technologie ou à la gestion de la propriété intellectuelle, et à la recherche et au développement. Les programmes d'incubation et de subventions sont souvent cités comme ayant le plus contribué à l'essor des start-ups. Cela souligne le rôle crucial des structures d'accompagnement et de mécanismes de financement pour transformer les résultats de la recherche et de l'innovation en entreprises.

Les motivations à entreprendre sont souvent liées non seulement à des facteurs économiques, mais aussi à des considérations sociales (engagement communautaire), environnementales (changement climatique, dégradation des sols) et sanitaires (alimentation et nutrition saines). Cette observation suggère que les universités devraient mettre davantage l'accent sur l'entrepreneuriat social et les innovations sociales dans leurs programmes d'incubation et de formation, voire intégrer ces éléments dans les nouveaux programmes d'études.

Hormis les trois entreprises de l'Université de Stellenbosch (SU) (Adagin Technologies, Terra Clim, Immobazyme), la quasi-totalité des cas d'entreprises, y compris celles figurant sur la liste élargie (voir l'annexe 1), sont des start-ups. Bien qu'il soit difficile de généraliser, compte tenu de l'échantillon relativement limité et du fait que l'étude ne couvre que quatre pays (le Cameroun, le Sénégal, l'Afrique du Sud et l'Ouganda), deux enseignements peuvent être tirés de cette observation :

- L'écosystème entrepreneurial universitaire n'est pas encore suffisamment mature pour créer un vivier significatif de start-ups capables d'émerger, de « traverser la vallée de la mort », de prospérer et de contribuer à la création d'emplois, à la génération de revenus et à la lutte contre la pauvreté. En effet, au-delà des obstacles financiers et technologiques, les services proposés par les programmes d'incubation, d'accélération, de formation et de financement ne sont pas toujours adaptés aux besoins des chercheurs et des étudiants entrepreneurs, et n'incluent pas toujours des activités de suivi et d'évaluation pour suivre et évaluer la performance, l'efficacité et l'impact des programmes et leur potentiel d'expansion.
- Les établissements d'enseignement supérieur et de recherche ne produisent pas suffisamment de résultats de recherche commercialisables. Cela peut s'expliquer par une capacité de recherche limitée, des infrastructures de recherche inadéquates, la qualité des résultats de la recherche et/ou l'état d'esprit et la culture entrepreneuriale des chercheurs. Ces facteurs constituent des goulets d'étranglement susceptibles d'entraver la commercialisation de la recherche et de l'innovation.

L'accès à un financement adéquat et un environnement institutionnel soutenant la recherche, l'innovation, le transfert de technologie et l'entreprenariat (tels que des incubateurs, des accélérateurs, des laboratoires et des infrastructures de recherche) sont des facteurs essentiels pour la valorisation des résultats de la recherche. L'établissement de liens avec l'industrie, les communautés et les réseaux internationaux joue également un rôle déterminant. Le cas de l'Université de Stellenbosch (SU), qui a su générer des start-ups et des spin-out très prometteuses, grâce à sa division Innovation et Commercialisation (I&C), ainsi qu'aux structures mises en place telles que le bureau de transfert de technologie Innovus (Innovus Technology Transfer Office (TTO), SU LauchLab, Stellenbosch Network, US Enterprises (Pty) Ltd (USE), en est un exemple édifiant. En outre, la concession de licences de propriété intellectuelle et la commercialisation des résultats de la recherche ont permis à cette université de générer des revenus, soutenant de futurs projets en matière de recherche et développement.

Défis et recommandations

Malgré les efforts déployés par les gouvernements, à travers des politiques et initiatives nationales, ainsi que par les universités, au moyen de plusieurs interventions, il convient de noter que de nombreux défis entravent encore le processus de transformation des résultats de la recherche en opportunités de création d'entreprises durables. Dans l'ensemble, au-delà des difficultés d'accès à du financement, qui représentent un enjeu transversal, l'étude exploratoire, les entretiens menés auprès d'informateurs clés, les études de cas et les webinaires nationaux convergent autour de six questions principales pour lesquelles des recommandations pratiques sont formulées :

- Environnement national de soutien fragmenté : favoriser un environnement juridique et institutionnel propice à la recherche, à l'innovation et à l'entrepreneuriat ;
- Capacités limitées en matière de recherche et d'innovation : investir dans la recherche et l'innovation ;
- Absence de culture/mentalité entrepreneuriale : intégrer l'entrepreneuriat dans les programmes d'études ;
- Capacités limitées des étudiants à développer et mettre en œuvre leurs idées et leurs projets d'entreprise : accompagner les étudiants et les chercheurs dans le développement et la mise en œuvre de leurs idées et de leurs projets d'entreprise ;
- Utilisation limitée de la propriété intellectuelle (PI) : valoriser la PI pour soutenir les inventions ;

- Faible collaboration entre les établissements d'enseignement supérieur et de recherche et le secteur privé : renforcer la collaboration entre les établissements d'enseignement supérieur et le secteur privé.

Enjeux	Recommandations
Environnement de soutien fragmenté	**Favoriser un environnement juridique et institutionnel propice à la recherche, à l'innovation et à l'entreprenariat** ➢ **<u>Au niveau gouvernemental</u>** - Au niveau de chaque pays, formuler et mettre en œuvre un cadre politique national cohérent pour rationaliser et favoriser les processus de commercialisation des résultats de la recherche. ➢ **<u>Au niveau des établissements d'enseignement et de recherche</u>** - Mener des recherches axées sur les besoins des écosystèmes afin d'aider les décideurs à mieux comprendre quelles politiques, ressources et structures de soutien sont nécessaires pour encourager l'entreprenariat et l'innovation. - Partager les résultats de la recherche par le biais de publications, de rapports et d'initiatives de données ouvertes afin d'informer et inspirer l'élaboration de politiques fondées sur des données probantes. ➢ **<u>RUFORUM et partenaires nationaux / internationaux</u>** Grâce à son consortium d'universités et de partenaires, le RUFORUM pourrait contribuer à mobiliser des ressources, mener des activités (identifier les défis et les opportunités, éclairer les processus d'élaboration des politiques, améliorer la collaboration et la mise en réseau, le suivi et l'évaluation, renforcer les capacités et les connaissances, s'engager dans la plaidoirie) aux niveaux national et régional et pour promouvoir un cadre juridique et institutionnel propice à la recherche, à l'innovation et à l'entreprenariat.
Capacités de recherche limitées	**Investir dans la recherche et l'innovation** ➢ **<u>Au niveau gouvernemental</u>** - Augmenter le pourcentage (1 %) du PIB consacré à la R&D / **recherche industrielle**. Actuellement, de nombreux pays africains consacrent moins de 1 % de leur PIB à la R&D, ce qui est inférieur à la moyenne mondiale. Cela inclut le financement des universités, des institutions de recherche et des pôles d'innovation. - Fournir des installations et des ressources de pointe, notamment des laboratoires, des centres de recherche et un accès à l'internet haut débit, pour soutenir les activités de recherche. ➢ **<u>Au niveau des établissements d'enseignement supérieur et de recherche</u>** - Établir et renforcer les réseaux entre les universités, les instituts de recherche et l'industrie afin de promouvoir le partage des connaissances et la collaboration. - Proposer des programmes de formation pratique et de développement professionnel en entrepreneuriat (entrepreneuriat social), développement d'affaires pour les chercheurs, les enseignants et les entrepreneurs. ➢ **<u>Recommandations pour le RUFORUM et ses partenaires</u>** - Faciliter les événements de mise en réseau, les conférences et les ateliers qui rassemblent les chercheurs, les entrepreneurs, les investisseurs et les décideurs politiques pour créer des synergies et des opportunités de collaboration. - Soutenir les universités dans le renforcement des liens entre l'industrie et le monde académique afin de s'assurer que la recherche soit alignée sur les besoins du marché et qu'elle puisse être commercialisée de manière efficace.
Manque de culture et d'esprit d'entreprise	**Intégrer l'entreprenariat dans les programmes universitaires** ➢ **<u>Au niveau gouvernemental</u>**

	- Entamer des réformes visant à initier des cours d'entreprenariat obligatoires et facultatifs (expériences d'apprentissage pratique) dans les programmes universitaires des différentes disciplines. - Allouer des financements aux universités spécifiquement pour concevoir des programmes de mentorat pertinents connectant les étudiants à des entrepreneurs et des chefs d'entreprise expérimentés. ➢ **<u>Au niveau des établissements d'enseignement et de recherche</u>** - Concevoir des programmes d'études bien structurés et pratiques qui comprennent des objectifs clairs, des contenus pédagogiques pertinents, des méthodes et des techniques d'évaluation. - Inclure dans les programmes des cours consacrés à l'entrepreneuriat social et à l'innovation sociale, et enseigner aux étudiants l'impact social et environnemental, les modèles économiques durables et les solutions innovantes aux problèmes communautaires. - Permettre aux étudiants et aux chercheurs d'accéder à des ressources telles que des incubateurs, des accélérateurs et des opportunités de financement pour soutenir leurs initiatives entrepreneuriales. - Encourager l'apprentissage par projet où étudiants, chercheurs, communautés locales et industries peuvent travailler sur des problématiques réelles et développer des solutions entrepreneuriales. ➢ **Recommandations pour le RUFORUM et d'autres partenaires** En collaboration avec ses partenaires, évaluer et, si possible, mettre à l'échelle les projets en cours (AgriEngage, AgriSCALE, Student Enterprise Scheme (SES) à l'université de Gulu, TagDev, Forest 21, etc.) et d'autres initiatives utilisant l'apprentissage par problèmes ou d'autres méthodes, afin d'identifier les défis et adopter les meilleures pratiques. Certains projets réussis pourraient être testés et transposés à plus grande échelle dans d'autres contextes afin de contribuer à la diffusion des meilleures pratiques en matière d'intégration de l'innovation et de l'entreprenariat dans l'enseignement supérieur.
Capacités limitées des étudiants et du personnel à développer et mettre en œuvre leurs idées et projets d'entreprise	**Soutenir les étudiants et le personnel dans le développement et la mise en œuvre de leurs idées et plans d'affaires** ➢ **<u>Au niveau gouvernemental</u>** - Accorder des subventions et des bourses dédiées aux projets entrepreneuriaux, permettant aux étudiants et au personnel d'accéder à des financements sans contrainte financière. - Simplifier le processus d'enregistrement et d'obtention de licences pour les entreprises afin de faciliter le lancement et le fonctionnement des start-ups. - Offrir des allègements fiscaux et d'autres incitations aux start-ups et entreprises affiliées aux universités. ➢ **<u>Au niveau des établissements d'enseignement et de recherche</u>** - Proposer une formation à l'entrepreneuriat : cours et ateliers, conférences, etc. axés sur des compétences pratiques telles que le leadership, la gestion de projet et l'innovation. - Fournir du mentorat et du conseil et faciliter l'accès aux installations, à l'assistance technique et au financement. - Mettre en relation les étudiants et le personnel avec des entrepreneurs expérimentés et des experts du secteur capables de leur offrir conseils et soutien. ➢ **<u>Recommandations pour le RUFORUM</u>** - Plaider en faveur de partenariats entre les universités et les entreprises afin de fournir des ressources, un financement et une expertise pour les initiatives entrepreneuriales.

	- Codévelopper (avec les universités et les organisations nationales/internationales) des plateformes en ligne où les étudiants et le personnel peuvent collaborer, partager des idées et accéder à des ressources et des informations.
Utilisation limitée de la propriété intellectuelle	**<u>Valoriser la propriété intellectuelle pour les inventions</u>** ➢ **Au niveau gouvernemental** - Proposer des programmes de renforcement des capacités, au niveau national, pour la gestion de la propriété intellectuelle et les structures existantes de transfert de technologie. - Soutenir les start-ups et les petites et moyennes entreprises (issues des universités) afin de les accompagner dans leur processus de développement et de commercialisation de leurs inventions. - Élaborer et mettre en œuvre, au sein des universités financées par des fonds publics, des politiques claires en matière de propriété intellectuelle qui définissent les droits et les responsabilités des étudiants, des enseignants et des autres institutions en ce qui concerne les inventions et la propriété intellectuelle. ➢ **<u>Au niveau des établissements d'enseignement et de recherche</u>** - Créer des bureaux de conseil en matière de propriété intellectuelle et de transfert de technologie au sein des universités afin de fournir une expertise sur les questions de propriété intellectuelle, y compris les demandes de brevet, les droits d'auteur et l'enregistrement des marques. - Inclure l'enseignement de la propriété intellectuelle dans les programmes d'études universitaires afin de sensibiliser les étudiants à l'importance des droits de propriété intellectuelle et à la manière de protéger leurs inventions. - Favoriser les collaborations avec des partenaires industriels afin de fournir des informations concrètes et de soutenir les innovations universitaires. ➢ **Recommandations pour le RUFORUM** - Collaborer (par l'intermédiaire de son réseau d'universités et de partenaires nationaux) avec des organisations internationales telles que l'Organisation mondiale de la propriété intellectuelle (OMPI) afin de bénéficier de leur expertise et de leurs ressources. - En outre, le RUFORUM pourrait initier une étude afin de mieux comprendre les éléments facilitateurs ainsi que les obstacles liés à la **loi sud-africaine sur les droits de propriété intellectuelle issus de la recherche et du développement financés sur fonds publics (Act 51 de 2008),** afin de déterminer dans quelle mesure cette loi pourrait servir de référence pour d'autres universités membres du RUFORUM.
Faible collaboration entre les établissements d'enseignement et de recherche et le secteur privé	**Exploiter la collaboration entre les EES, les communautés locales et le secteur privé.** ➢ **<u>Au niveau gouvernemental</u>** - Concevoir et mettre en œuvre des politiques favorisant la collaboration entre les établissements d'enseignement supérieur et de recherche, les communautés locales et le secteur privé. - Investir dans la modernisation des infrastructures numériques pour soutenir la recherche, l'innovation et la collaboration entre les établissements d'enseignement supérieur et de recherche et le secteur privé. ➢ **<u>Au niveau des établissements d'enseignement et de recherche</u>** - Instaurer des programmes de formation professionnelle et technique en partenariat avec les industries et les communautés locales. Cela permettrait aux étudiants d'acquérir des compétences pratiques et d'améliorer leur employabilité tout en répondant aux besoins spécifiques du secteur privé en matière de main-d'œuvre.

	- Intégrer l'expérience en entreprise et le service communautaire dans les programmes d'études des **établissements d'enseignement et de recherche**, ce qui permettrait aux étudiants de s'engager auprès des communautés locales et de contribuer à des projets de développement local. Cette expérience pratique profite à la fois aux étudiants et aux communautés. ➢ **Recommandations pour le RUFORUM** - Faciliter les opportunités de recherche collaborative entre les établissements d'enseignement et de recherche et le secteur privé pour relever les défis des communautés locales. Par exemple, les universités agricoles pourraient s'associer à des coopératives agricoles et à des entreprises agroalimentaires pour mettre au point des techniques agricoles durables et contribuer à la lutte contre les changements climatiques et l'insécurité alimentaire.

1. Introduction

1.1 Context and rationale

According to UN, Africa has the youngest population in the world, with 70% of sub-Saharan Africa under the age of 30. Data from Statista point out that, as of 2023, around 40 % of the population was aged 15 years and younger, compared to a global average of 25 percent. Such demographic growth, driven by the younger age group, presents both challenges and opportunities. While the many challenges are mainly related to education, training and health, access to sustainable employment, above all, is one the most pressing today.

While employment figures are tricky in Africa, they all tend to demonstrate the high rate of youth unemployment in Africa. For instance, according to Statista (2023) in 2024, around 11.2 percent of the African youth, those aged between 15 and 24 years old, are expected to be unemployed (Statista, 2023)[2]. A report published by Afrobarometer in 2023[3] suggests that about four in 10 young adults (39%) across the 39 surveyed countries are unemployed and looking for a job. Addressing youth unemployment in terms of decent jobs, the International Labour Organization (ILO) states that the youth unemployment rate in Sub-Saharan Africa which is at 8.9 per cent in 2023, was 0.6 percentage points below the rate in the pre-pandemic year 2019.[4] In addition, the ILO report mentions that in 2023, nearly three in four (71.7 per cent) of young adult workers (aged 25 to 29) were in a form of work deemed "insecure", representing a decrease of just 0.6 percentage points over the past 20 years.[5]

Against this backdrop, in addition to eradicating poverty, combating youth unemployment, and building skills for access to decent jobs have been among the most pressing challenges facing African governments over the last ten years. Among the many initiatives put in place by government, HEIs and other stakeholders, entrepreneurship appears to be one of the most viable solutions, not only to help absorb the huge number of young people entering the market each year, but also, in the long term, to eradicate the poverty that affects a large proportion of the population. Indeed, entrepreneurship is often considered to be one of the key factors in economic growth and development in Africa, as it is linked to wealth creation and poverty reduction (Adenutsi, 2023).

In recent decades, HEIs around the world have been particularly interested in ways in which they can contribute to fulfilling their third mission, that is to say their contributions to economic and societal development of territories (Aranguren et al. 2016; Petersen et al., 2022) or the combination of the traditional missions of teaching and research with a contribution to society (Nabaho et al., 2022; Compagnucci & Spirarelli, 2020; Knudesen et al., 2019; Sin et al., 2019). HEIs have taken significant actions to integrate entrepreneurship education into their university curricula to encourage the entrepreneurial spirit and strengthen the development of entrepreneurial skills among young people (Boldureanu et al. 2020; Plewa et al., 2015; Osario and Cordero, 2014). In Africa, thinking about the third mission of universities dates to the 1960s (Nabaho et al., 2022). The final commitment of the 1962 UNESCO

[2] Statista (2023). Youth unemployment rate in Africa 2012-2024. Accessed 18 June 2024

[3] Appiah-Nyamekye Sanny, J., van Wyk-Khosa,S., Asunka, J. (2023). Africa's youth: More educated, less employed, still unheard in policy and development. Afrobarometer Dispatch No. 734. Accessed 20 Nov. 2024.

[4] ILO (August 2024). Global Employment Trends for Youth 2024 Sub-Saharan Africa. Accessed 20 Nov. 2024.

[5] ILO (August 2024. Ibidem. Accessed 20 Nov. 2024.

conference on the development of higher education in Africa asserted that far "from being ivory towers detached from the society in which they are situated, higher education institutions in Africa must be in close and constant touch with society…"[6]. There has been renewed interest in the third mission of universities in Africa since 2000 (Nabaho et al., 2022), particularly in relation to youth unemployment, sustainable development, local development, fight against poverty issues etc. Youth unemployment would certainly be one of the fields of exploration through which universities could give substance to their third mission. Indeed, universities can no longer confine themselves to teaching and research, they should also prepare their students for professional integration. Better still, universities should mobilize their research outputs to contribute to the creation of sustainable businesses that can help reduce unemployment and add social and economic value in Africa. Indeed, academic entrepreneurship has the potential "to equip the youth with functional knowledge and skill to build up their character, attitude and vision and plays vital role in developing eco-system that promotes innovation and solving unemployment challenges of nations" (Okoro et al., 2022, p.214).

Nevertheless, while universities are known to be the main contributors of knowledge, innovation and technology advancement, the ways and means of transforming research into successful businesses capable of contributing to the economy and society are not yet clearly defined and are struggling to be deployed. Stakeholders involved in academic entrepreneurship face several challenges. Three of these challenges are particularly crucial:

- Faculty staff and students have limited capacity to translate prototypes of products or services into businesses and thus need incubation.
- There is a mismatch between the expected outputs, outcomes, and duration to produce innovations and enterprises by both universities and private enterprises.
- At the science, technology, and innovation ecosystem level, there is limited understanding of entrepreneurial architecture, key players, opportunities, and barriers to successfully translating research & innovation outputs from universities to enterprises that create jobs for young people.

To meet these challenges, it is important to nurture an environment that allows academic research and innovation to flourish. This involves assisting the university senior management to develop strategies to improve academic entrepreneurships for all faculties as well to instil a greater entrepreneurial spirit among the relevant stakeholders (Rorwana & Tengeh, 2015). Such actions are perfectly in line with RUFORUM's strategic objective of strengthening the capacities of African universities to generate and deploy science solutions to address development challenges. Thus, recognising the need to generate actionable knowledge, DeSIRA-LIFT, and RUFORUM have commissioned a scoping study on the national science, technology, and innovation landscape and on the mechanisms to transform research outputs originating from universities into enterprises in Cameroon, Senegal, South Africa and Uganda.

[6] United Nations Educational, Scientific and Cultural Organization (UNESCO). (1963). The development of higher education in Africa: Report of the Conference on the Development of Higher Education in Africa, Tananarive, Madagascar, p.12 https://unesdoc.unesco.org/ark:/48223/pf0000056657. Accessed on 23 September. 2024.

1.2 Objectives

The overall objective of this scoping study is to generate knowledge for supporting agribusiness incubation and entrepreneurship in African universities targeting faculty and students as entrepreneurs, innovators, and job creators.

The specific objectives of the study are to:

- Identify examples of innovative *business cases* and/or mechanisms for transforming research results into economic activities that strengthen existing enterprises (especially SME) and/or create new enterprises and decent youth employment in sustainable agriculture and food systems.
- Analyse the different models and mechanisms used by universities, research centres and private companies with a focus on among others, enabling/constraining factors, funding mechanisms, services and support provided.
- Suggest, based on these cases, how universities' capacity could be strengthened to support responsible innovation and job creation from research processes, and
- Provide practical recommendations on the procedures for the universities to translate research products into enterprises.
- Widely disseminate the outputs of the study to various stakeholders using various channels.

The study reviewed the mechanisms, policies, and processes that either support or hinder the translation of research products into enterprises or the strengthening of existing enterprises at the national level in Cameroon, Senegal, South Africa, Uganda. These countries were selected for different reasons. Cameroon has a mixed anglophone and francophone education system hence important to obtain cases in this context. Uganda and Senegal are from purely anglophone and francophone education systems respectively and have dedicated government efforts to invest in commercialisation of academic research. The Government of Uganda has invested in this area and given RUFORUM the mandate to build on earlier pilots. South Africa is relatively advanced in this area and can provide homegrown solutions to the challenges based on its own experience.

The report begins by presenting the study's methodological framework. It then reviews the various national policies and initiatives developed by the governments of the four selected countries to shape a legal and institutional environment conducive to research, innovation and entrepreneurship, including academic entrepreneurship. Subsequently, it identifies and analyses the initiatives and programmes implemented by the HEIs. The report then examines the factors or challenges hindering the translation of academic research outputs. Finally, it provides recommendations on the procedures for universities to translate research products into enterprises.

2. Methodological Framework

The methodology for this study was based on grey literature and interviews with key informants. Research questions were formulated to address the objectives and deliverables. Relevant and innovative business cases and mechanisms were selected to showcase how universities and other partners are transforming research output into business opportunities. In addition to reviewing grey literature and conducting semi-structured interviews, participation in the Windhoek conference and the organization of country level webinars contributed to gleaning more actionable insights.

2.1 Research questions

To structure the scoping study and achieve the objectives and deliverables, the following questions were (re)formulated:

- Are there business cases linked to research outputs or graduates from universities that can be documented?
- What are the different models and mechanisms (including funding mechanisms, services and support provided) used by universities, research centres and private companies for transforming research results into economic activities that strengthen existing enterprises (especially SME) and/or create new enterprises and decent youth employment? What are the enabling/constraining factors associated with these models and mechanisms?
- How universities' capacity could be strengthened to support responsible innovation and job creation from research processes?
- What practical recommendations on the procedures for the universities to translate research products into enterprises can be provided?
- What are the most effective channels and formats for widely disseminating the outputs of the study to various stakeholders?

These research questions played a crucial role in guiding study the design, data collection and analysis. In addition, they helped to better identify the relevant data sources and design the data collection tools.

2.2 The scoping study

Scoping involves the synthesis and analysis of a wide range of research and non-research materials to provide greater conceptual clarity about a specific topic or field of evidence (Davis et al., p.1386). The purpose is to identify the main documents and statements from government agencies and professional bodies that have a bearing on the nature of practice in that area (Anderson *et al.* 2008). In this spirit, grey literature is an important source for accessing relevant information to help achieve the objectives set. The term grey literature is used to describe a wide range of "information produced on all levels of government, academia, business and industry in electronic and print formats not controlled by commercial publishing" i.e. where publishing is not the primary activity of the producing body"[7]. As a form of knowledge synthesis, a scoping study allows evidence to be comprehensively summarized and synthesized with the aim of informing practice, programs, and policy and providing direction to future research priorities (p. 1291). Thus, it was particularly well suited to this study. Its relevance lies in the fact that it would make it possible to identify the main sources and types of evidence available, through grey literature and

[7] Third International Conference on Grey Literature in 1997 (ICGL Luxembourg definition, 1997 - Expanded in New York, 2004). Accessed on 28 August. 2024

information provided by key informants, and map the key initiatives, policies and funding mechanisms supporting the translation process of academic knowledge into potential businesses (Colquhoun et al., 2014).

Four stages shape the data collection process through grey literature.

- **Step 1: A brief and overview search** was carried out to gather information, using different databases such as Google Search, Google Scholar and other sources (Poly Commons, OpenGrey etc.). These search engines provided access to articles, blogs, interviews, press releases, etc. published on the websites of companies, government organisations, NGOs, civil society, academic and research institutions, and so on. In addition, they helped identify business cases, initiatives or best practices in the African context and even worldwide that could serve as benchmarks for translating academic research products into enterprises. At this stage, no inclusion or exclusion criteria was applied. Keywords such as "innovation" "innovation landscape", "academic entrepreneurship" "entrepreneurial university'' "research translation'' and others associated with the title of the assignment "national science, technology, and innovation landscape for translation of university research and innovation into enterprises" helped to find several documents and collect relevant data.
- **Step 2: Data collection process was further filtered** and particularly focused on the four target countries (Cameroon, Senegal, South Africa, Uganda). The search engines, especially Google was used to gather data (articles, press articles, reports, technical reports, government documents, white papers, policy literature, company/industry information, newsletters, etc.) collected from the websites of local, national, or even international organisations (which deal with issues relating to the four selected countries). Inclusion and exclusion criteria were established. Although it might be difficult to establish some boundaries, the geographic coverage was, as much as possible, established as an inclusion criterion in the selection of relevant data addressing a specific country. In addition, the data collected should 1) address national business cases, national science, technology, and innovation landscape for translation of university research and innovation into enterprises 2) and focus on the sustainable food/agriculture systems sector.
- **Step 3: Selection of relevant documents**: First, a list of relevant documents was drawn up. Then, the date and accuracy of any information were checked to find an update if available. Next, a Word file with relevant data on the subject was created. In addition to the references (author's name, title, publication date, etc.), the documents were classified according to their sources (articles, newspaper, report, etc.) and their content, i.e. the specific issue addressed. Four categories of issues associated with the first four questions (excluding the last one) will be considered: 1) business cases and lessons learned; 2) different models and mechanisms and enabling/constraining factors; 3) strengthening universities' capacity; 4) practical recommendations. Relevant extracts were included in the corresponding categories and used as evidence in the analysis or contribute to the production of the report.

2.3 Semi-structured interviews

Semi-structured interviews were conducted to gather additional data and validate data gathered from the grey literature. Key informants included researchers, students, entrepreneurs, academic managers, managers of support structures (accelerators, incubators, innovation hubs), experts (in Intellectual Property Rights (IPR), innovation, patents, entrepreneurship), ecosystem builders, industrial and financial

partners, policymakers, etc. An interview guide was drawn up, taking into account the previously identified themes that have emerged from the research objectives and questions. The principle of saturation or theoretical sampling was applied. Interviews were conducted remotely, or online using tools such as WhatsApp, Zoom, Microsoft Teams etc. A qualitative (thematic) analysis of the data collected was carried out. All semi- structured interviews were conducted virtually. Participants for the KII were sampled through both purposive and snowball sampling. A total of 26 key informants have participated.

Table 1: Break down of Key Informants

Country	KI interviews
Cameroon	**5**: 2 coordinators (incubator); 2 entrepreneurs; 1 dean
Senegal	**10**: 2 coordinators (incubators); 2 professors; 3 researchers/experts; 1 deputy manager; 2 entrepreneurs
Uganda	**5**: 1 dean; 2 entrepreneurs; 1 professor; 1 director (innovation / incubation centre)
South Africa	**4**: 1 transfer technology officer; 1 innovation officer; 1 IP manager; 1 expert; 1 dean
Other	**1** expert from an international agricultural organisation
Total	26

2.4 Selection of business cases

For each country, relevant business cases were identified based on the following criteria:

- be a start-up, SME or company created from a student project or idea, or from academic research;
- be incubated or have benefited from any university or research centre service (non mandatory);
- be active in the field of agriculture;
- have collaborated with a university located in one of the 4 countries considered;
- other criteria (such as access to data, job creation, and stage of development may be considered.

2.5 Observation, participation, informal discussions

The Second RUFORUM Triennial Conference which was hosted by the Government of Namibia and RUFORUM member Universities in Namibia, took place from 12-16 August 2024 under the theme "*Operationalising Higher Agricultural Education and Research Ecosystems for Innovation, Industrialisation, and Economic Development in Africa: A Call for Action.*" At this occasion, KIIs and discussions were held to gather further information.

2.6 Country Level Webinars (CLW)

Four country webinars were held in the four countries covered by the study to share the preliminary findings and get the feedback of stakeholders. The CLWs were a space for discussion, networking and dissemination of the study results, with a view to gathering comments and recommendations from participants.

3. National policies, institutions and initiatives

The aim of this chapter is to examine how the legal and institutional frameworks contribute to shaping an environment conducive to the development of academic entrepreneurship and the translation of research outputs.

The study identifies, at each country level, policies, institutional mechanisms and initiatives developed by governments and other actors to help regulate and foster a favourable environment for research, innovation and entrepreneurship. Where possible, evidence is produced to support the analysis and demonstrate how such mechanisms can appear as enablers to the process of translation of research outputs. The analysis considers various policies related to research, innovation and entrepreneurship, including academic entrepreneurship. Indeed, to be successful, the research translation process must be based on high-quality, innovative knowledge/research products (Corral de Zubielqui et al., 2019). Policies can help to support the implementation of mechanisms that have the potential to significantly improve the quality of research and stimulate innovation.

The study shows that various institutional frameworks and policies are designed in each of the 4 countries targeted by the study. Such policies, laws, regulations and other initiatives have the potential to support an environment conducive to university research, student entrepreneurship, technology transfer and the translation of academic research products into intellectual property, licenses and patents.

3.1 South Africa

3.1.1 The research and innovation landscape

South Africa's research and innovation landscape is vibrant, evolving, and deeply rooted in addressing both national and continental challenges. South Africa's research and innovation landscape is characterized by a mix of strengths and challenges. While the country ranks highly in innovation outputs, particularly in areas like market capitalization and logistics performance, it faces hurdles in innovation inputs, such as funding for research and development[8]. The government, through the Department of Science and Innovation (DSI), plays a crucial role in fostering a knowledge-based economy and promoting socio-economic development through research and innovation. Moreover, several ministerial departments, divisions and other bodies have set up initiatives in collaboration with councils, universities, grassroots communities and even the private sector such as the Technology Innovation Agency highlighted below.

Highlight 1: The Technology Innovation Agency (TIA)

The Technology Innovation Agency (TIA)[9] is an entity of the Department of Science and Innovation (DSI). The TIA promotes the development and exploitation of discoveries, inventions and innovations to improve the quality of life for all South Africans. It serves as the key institutional intervention to bridge the innovation chasm between research and development from higher education institutions, science councils, public entities, and private sector, and commercialisation. The TIA funds Higher education institutions, Science councils and research institutions, SMEs and industry and grassroots innovators operating outside formal innovation institutions and have limited access to infrastructure. The TIA's focus is on technology development from proof of concept to pre-commercialisation.

[8] The Global Innovation Index 2023

[9] Who we are - Technology Innovation Agency. Accessed 22 May 2024

The TIA establishes different partnerships to fund projects and develop smart innovations within different sectors, including agriculture, in South Africa. For instance, the TIA recently launched the EUREKA Climate Smart Agriculture localised weather stations developed by Metos SA (Pty) Ltd. This initiative is funded through the partnership of TIA, DSI and the global consortium comprised of TerraClim, Pessl Instruments GmbH, Metos SA (Pty) Ltd and Geosmart Space (Pty) Ltd. In addition, the TIA supports technologies with potential for commercialisation. Its success stories within the agriculture sector include SMRI (Development of continuous seed preparation system for sugar processing) and Setsong Tea Crafters, a grassroot company that produces indigenous knowledge-based teas and health infusions from wild South African indigenous plants.

TIA offers various funding instruments to support the development of technologies and innovations[10]:

- **Technology Development Fund**: Supports the development of technologies from proof of concept leading to product prototype and ultimately demonstration thereof in an operating environment.
- **Pre-Commercialisation Fund:** Prepares innovators for follow-on funding by supporting market testing and validation.
- **Grassroots Innovation Programme:** A multi-tiered package is offered in the Grassroots Innovation Programme. This support package is complemented through various initiatives and incentives through partnership with public and private institutions inclusive of institutions that facilitate IP protection, supplier development and technology development.
- **Technology Acquisition and Deployment Fund:** facilitates the deployment of locally developed technologies to Sector Departments and Municipalities. This instrument is also designed to provide market entry support, uptake and commercialisation of South African innovations developed by local technology Start-ups and SMMEs.
- **Industry Matching Fund:** The Industry Matching Fund (IMF) is a co-funding instrument with Venture Capital (VCs), Angel investors, institutional investors, and industry. The IMF offers market access and incubation as a commercialisation instrument to support late-stage technologies. The fund is structured to leverage TIA funding, through risk sharing with other funders and attract industry participation.
- **SEED Fund:** Assists innovators at Higher Education Institutions (HEIs), Science Councils (SCs) and small and medium-sized enterprises (SMEs) to advance their research outputs into prototypes and fundable ideas for commercialisation. It also enables innovators to de-risk research outputs for follow-on funding from TIA and/or other funders.
    - Funds researchers at Universities, Science Councils and SMMEs for ideas and research outputs to develop prototypes.
    - Partners with tech transfer offices at HEI's and science councils to support researchers.
    - Partners with incubators and regional development agencies to support SMMEs.

The TIA collaborates, through adequate seed funding mechanisms, with universities (through their innovation offices, technology transfer offices), science councils, incubators, regional development agencies to support innovative ideas and technologies in different sectors. These must comply with the Intellectual Property Rights from Publicly Financed Research and Development Act 2008.

In addition to funding mechanisms, TIA supports other enabling programmes executed to support innovators beyond just funding. Some of these Innovation enabling programmes are managed with partner organisations. Four programs are currently being executed: Technology Platforms, Technology Stations, The Innovation for Inclusive Development, The Innovation Skills development . The Technology Stations programme is particularly relevant for this study. It was established to enable Universities of Technology to provide technology development services to SMMEs. There are 18 Technology Stations (TS) based at 11 Higher Education Institutions in South Africa. The two following TS aim at supporting the agriculture sector.

[10] University TTO/Research Councils - Technology Innovation Agency. Accessed 22 May 2024

- Agri-food Technology Station – Cape Peninsula University of Technology: It is a Pilot Plant with different processing areas for baked goods, meat products, beverages, chocolate & sweets, spray drying & extrusion and general heat processing and drying. The mandate of the ATS is to assist small and medium enterprises and other appropriate companies to improve their use of technology, implied improvement of efficiencies and concomitant improved ability to employ more staff and empower such persons in terms of the field of technology in which it operates.
- Limpopo Agrifood Processing Technology Station – University of Limpopo**:** LATS serves as a TIA connector in the Limpopo Province that catalyses partnerships between SMEs, industries and Universities to develop an enabled supporting agroprocessing innovation for global competitiveness. The LATS supports technology based agrifood processing products, processes and services through research and development (R&D) and facilitating the development and improvement of agro-processing, technology innovation and commercialisation of agrifood products by start-ups and existing SMEs in Limpopo Province.

The following data shows the capital role that this institution is playing in the development of research, innovation and entrepreneurship in South Africa.[11]

  - TIA's performance on commercialised innovations included in 2021-202215 licensed or 48 assigned technologies
  - 48 joint collaborations between academia and industry
- TIA's performance in 2022/23 focused on SMEs supported through strategically informed and regionally distributed Technology Stations.
  - 08 New centres established and supported (Number of new technology and innovation support centres providing Science, Engineering and Technology (**SET**) and enterprise development support in targeted regions.
  - 2903 SMMEs and cooperatives having received SET and enterprise development support
  - 195 high-level students and post doctoral fellows admitted to the high-level human capital development program.
  - 197 IP – and knowledge-based innovation products produced
- TIA's performance in 2022/23 on delivering on the bio-economy strategies.
  - 8 technology Platforms managed and supported
  - 8 technology Innovation Clusters managed and supported.

Other programmes and activities initiated by diverse institutions, including the national councils and research institutions are summarized in the following table.

Table 2: Other programmes and structures from the South African Government

Policy / institution / initiatives	Overseeing Department / Entity	Objectives / Activities	Reference to and impact on R&I / entrepreneurship
Small Enterprise Development Agency (SEDA)	Department of Small Business Development	Enterprise Development Division Programmes **Entrepreneurship in schools programme:** learners are guided to develop the attitudes and entrepreneurial mindset needed for success in entrepreneurship.	As the programme is introduced from an early age, by the time learners leave high school they will know what it takes to start and run a business.[12]

[11] Department Science & Innovation (Republic of South Africa) & Technology Innovation Agency. Annual Report 2022`2023. Driving Innovation: Empowering Economies, Transforming Futures. Accessed 22 May 2024

[12] Entrepreneurship in schools programme

Policy / institution / initiatives	Overseeing Department / Entity	Objectives / Activities	Reference to and impact on R&I / entrepreneurship
		The Entrepreneurship In Schools programme focuses on grade 8 to 12 educators and learners and is aligned with the Curriculum Assessment Policy Statement (CAPS) and supported by the Department of Education.	
National Skills Fund (NSF).	Higher Education & Training	The NSF funds skills programmes identified by the National Skills Development Plan (NSDP) 2030 as national priorities, and/or are related to the achievement of the Skills Development Act, 1998 (Act 97 of 1998) (SDA), and/or considered to be an activity undertaken by the Minister to achieve a standard of good practice in terms of skills development."	NSF funding is also aimed at improving the post-school, education and training system, with a focus on capacity building, investing in skills infrastructure, research and innovation.
National Research Foundation **(NRF)**	The NRF is an independent statutory body established through the National Research Foundation Act (Act No 23 of 1998), following a system-wide review conducted for the Department of Arts, Culture, Science and Technology (DACST).	The NRF promotes South African research and innovation interests across the country and internationally, and together with research institutions, business, industry and international partners, build bridges between research communities for mutual benefit that contributes to National Development.	Ex: the NRF is supporting O.R. Tambo Africa Research Chair in Technology Entrepreneurship and Youth Employability. This research chair is advancing research, training postgraduate students, and mentoring emerging researchers in technology entrepreneurship a nd youth employability. The chair's focus is at the interface of technology entrepreneurship a nd agribusiness, financial inclusion, and health.
The Council for Scientific and Industrial Research (CSIR)	The CSIR is an entity of the Department of Science and Innovation	**RD&I Stakeholders**[13] These are stakeholders with whom the CSIR collaborates in conducting RD&I by bringing together complementary skills, expertise, competencies, infrastructure and capabilities to achieve shared objectives. These may be national or international partners, including:	• Conduct research, development and innovation of transformative technologies and accelerate their diffusion. • Improve the competitiveness of high-impact industries to support South Africa's re-

[13] CSIR Corporate Brochure (?). Introducing the CSIR. Accessed 18 Oct. 2024.

Policy / institution / initiatives	Overseeing Department / Entity	Objectives / Activities	Reference to and impact on R&I / entrepreneurship
		• Research and technology organisations; • Higher education institutions (HEIs), including universities, and Technical Vocational Education and Training colleges; • RD&I associations/players; • International public/private organisations; • Private organisations / Customers; • Industry.	industrialisation by collaboratively developing, localising and implementing technology; • Drive socioeconomic transformation through RD&I that supports the development of a capable state; • Build and transform human capital and infrastructure; and • Diversify income and maintain financial sustainability and good governance.
University Technology Fund (UTF)	South Africa SME Fund	The University Technology Fund (UTF) is the first fund of its kind for the African continent. It was initially established by the SA SME Fund in its endeavour to partner with South African universities to commercialise the technologies and business concepts arising from these institutions. Stocks & Strauss was appointed as the fund manager for the UTF.	The UTF fund projects that possess tenable patents, prototypes and Intellectual Property originating from South African universities.

With regard to intellectual property, two policies have been developed: The Intellectual Property Policy of The Republic of South Africa Phase I 2018 and the Intellectual Property Rights from Publicly Financed Research and Development Act 51 of 2008.

The South Africa IP Management and the Commercialization of Publicly Funded Research Outcomes, highlighted below, is particularly inspiring.

Highlight 2: The Intellectual Property Rights from Publicly Financed Research and Development Act 51 of 2008

The Intellectual Property Rights from Publicly Financed Research and Development Act 51 of 2008 in South Africa aims to ensure effective utilization of intellectual property (IP) resulting from publicly funded research and development (R&D). This Act is designed to enhance the management and commercialization of IP, fostering innovation and economic growth.

The legislation pursues three key objectives[14]:

[14] Brant, J. and Sibanda, M. (2018). Ibidem. Accessed 25 Nov. 2025.

- First, IP emanating from publicly financed R&D must be identified, protected, utilized, and commercialized for the benefit of South Africans.
- Second, South African creativity and ingenuity must be acknowledged and rewarded; and
- Third, the commercialization framework for publicly funded research in South Africa must provide preferential access to publicly financed IP to SMEs and Broad-Based Black Economic Empowerment (BBBEE) entities.

Here are some key points[15]:

- **Establishment of Offices**: The Act establishes the National Intellectual Property Management Office (2010) and the Intellectual Property Fund.
- **Technology Transfer Offices**: It mandates the creation of technology transfer offices at institutions to manage IP and facilitate its commercialization.
- **Disclosure Requirements**: Institutions are required to disclose potential IP to the relevant funding agencies.
- **Commercialization**: The Act promotes the commercialization of IP to benefit society and ensure reasonable terms for its use.
- **IP Transactions**: It covers agreements related to IP, including licensing, assignment, and other arrangements for transferring IP rights.

Although this act has not yet reached its full potential, it remains a fairly innovative intellectual property management mechanism encouraging publicly-funded universities to harness the potential of the IP to simulate innovation and enhance economic growth.

From an institutional point of view, the establishment of the TIA has made a considerable contribution by encouraging the development of an innovative technological ecosystem, as evidenced by the performance achieved in terms of SMMEs supported through strategically informed and regionally distributed Technology Stations, commercialised innovations and bio-economy strategies. Another example is the National Research Fund (NRF), where research grants and bursaries account for 40% of the total of its expenditure disbursed for research grants, scholarships and bursaries at universities through various funding instruments. In terms of innovation in key critical service delivery areas (state capacity in entrepreneurship), the NRF has granted 45 SARChI Chairs in health and more than 10 Chairs in energy and climate change-related areas and SARChI on Intellectual Property, Innovation and Development and DSI/NRF Trilateral Research Chair in Transformative Innovation in 2022/2023. Furthermore, it has established the Research and Innovation Support and Advancement (RISA) "to support, promote, and advance research and human capacity development, through funding to facilitate the creation of knowledge, innovation and development in all fields of science and technology, including humanities, social sciences and indigenous knowledge."[16]

South Africa has set an ambitious target to spend 1.1% of its GDP on research and development (R&D) by 2024[17]. This would translate to approximately R54 billion (US$3.5 billion). Regarding efforts in research

[15] Government Gazette, Republic of South Africa (22 December 2008).No. 51 of 2008: Intellectual Property Rights from Publicly Financed Research and Development Act. Vol. 522 Cape Town No. 31745. Accessed 25 Nov. 2025.

[16] National Research Foundation (2024/2025). NRF Annual Performance plan. p. 2. Accessed on 26 Nov. 2024.

[17] Research Professional News (3 Feb. 2022). South Africa need "billions" to hit R&D spending target. Accessed on 26 Nov. 2024.

and job creation funding, the 2024/2025 consolidated government expenditure in innovation, science and technology is R20.2 bn and R22.2 bn in job creation and labour affairs.[18] Recent reports indicate that gross domestic expenditure on R&D (GERD) in South Africa grew to R28.282 billion in 2022/23, a 2.1% year-on-year increase from the previous year.[19]

Regarding financial support to entrepreneurial ecosystem, "while private investors emerge as the most common provider of financial support, followed by capacity development providers, Government agencies also play a meaningful role in the landscape, with examples being the Black Business Supplier Development Programme and the Youth Challenge Fund overseen by the Department of Small Business Development''[20]

South Africa has a robust capacity development landscape where different business development support (BDS) providers and government entities as well as finance providers such as foundations, private investors, and DFIs are offering non-financial business support. For instance, the share of funding sources offering non-financial support by Organization type is 96% for capacity development provider and 91% for Government agency.[21] These various policies, reforms and initiatives "are helping to create a more entrepreneurial culture in South Africa, and they are helping to equip young people with the skills and mindset they need to succeed as entrepreneurs." [22] According to a professor and Deputy-Vice Chancellor (KI Interview), South Africa has a range of initiatives to promote entrepreneurship, including academic entrepreneurship. She goes on to argue that although not all these initiatives and policies are always relevant, there are some, such as Intellectual Property Rights from Publicly Financed Research and Development Act 51 of 2008, which, despite its limitations, has nonetheless contributed to the appropriation of intellectual property and the development of technology transfer by HEIs.

3.1.2 The entrepreneurial ecosystem

In South Africa, various stakeholders (universities, governments, the private sector and even communities) are increasingly interested in entrepreneurship and strive to co-creating a more enabling environment for entrepreneurs. This multi-stakeholder involvement is one of South Africa's greatest assets in building a resilient, inclusive entrepreneurship ecosystem. At the government level, agencies like **SEDA**, the **Department of Trade, Industry and Competition (DTIC)** and **TIA** play a critical role in creating policy frameworks and offering seed funding, grants, and support programs for youth and marginalized communities.

[18] National Treasury. 2024/2025 Highlights. Budget 2024 Highlights.pdf. Accessed on 26 Nov. 2024.

[19] Human Sciences Research Council (HSRC) Press Release (28 Nov.2024). HSRC survey results show signs of recovery for R&D spending in South Africa. Accessed 28 Nov. 2024.

[20]Davidson, A. Kim, S. & Almaguer, F. (Feb. 2024) State of the small and growing business sector in South Africa, Aspen Network of Development. p.16. Accessed 28 Nov. 2024.

[21] Davidson, A. et al. (Feb. 2024). Ibidem. Accessed 28 Nov. 2024.

[22] Maka, L. (2023). Op. cit. p.4. Accessed on 22 August 2024.

The government of South Africa has developed several national policies and initiatives to promote research, innovation and entrepreneurship education[23]. These include:

- **The National Entrepreneurship Development Strategy (NEDS):** This strategy, which was developed by the South African government in 2010, identifies entrepreneurship education as a key priority for economic development. The NEDS sets out several goals for entrepreneurship education, including increasing the number of learners who receive entrepreneurship education, improving the quality of entrepreneurship education, and creating a more supportive environment for entrepreneurship.
- **The Entrepreneurship Development in Schools (EDS) programme:** This programme, which was launched by the Department of Basic Education (DBE) in 2013, aims to teach entrepreneurial skills to learners from Grade 4 to Grade 9. The EDS programme provides teachers with training on how to teach entrepreneurship, and it also provides learners with access to resources and support.
- **The Framework for Entrepreneurship Education in Higher Education**: This framework, which was developed by the Department of Higher Education and Training (DHET) in 2018, encourages universities to offer entrepreneurship modules and to create entrepreneurial ecosystems on their campuses. It provides universities with guidance on how to develop and deliver effective entrepreneurship education programmes.
- **The National Entrepreneurship Awards**: Such awards, hosted by the South African government, recognize and celebrate the achievements of entrepreneurs and entrepreneurship support organizations. They help to raise awareness of the importance of entrepreneurship and to promote entrepreneurship culture in South Africa.

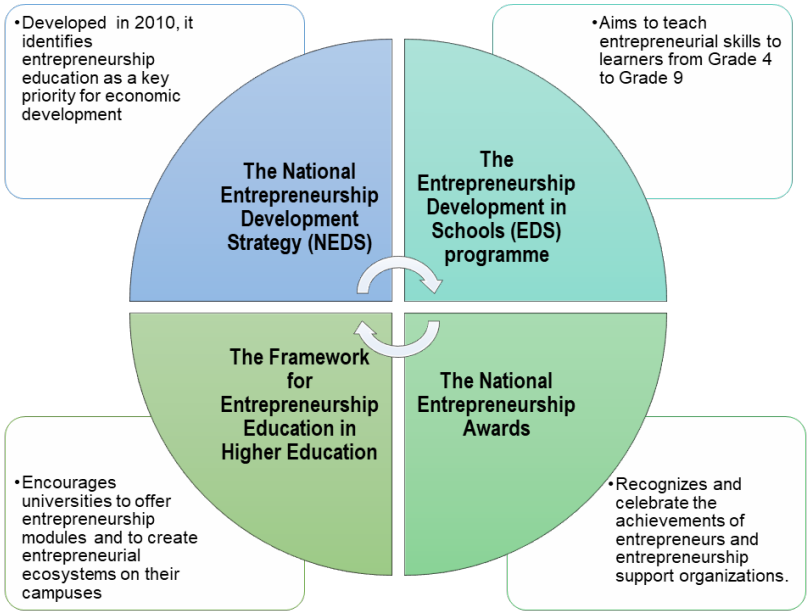

Figure 1: Illustration of some national policies and initiatives

[23] Maka, L. (2023). Entrepreneurship Education in South Africa: Policy Implementation and Impact on Youth Empowerment. Accessed on 22 August. 2024.

In addition to these initiatives, South Africa has been actively cultivating academic entrepreneurship through a mix of national policies, university programs, and collaborative initiatives. For instance, the **Entrepreneurship Development in Higher Education (EDHE)**, a flagship initiative developed by the Department of Higher Education and Training (DHET), aims to develop entrepreneurial capacity among students, academics, and institutions.

- **National Development Plan (NDP)**: Encourages higher education to contribute to entrepreneurship by integrating business skills into curricula.
- **Human Resource Development Council (HRDC)**: Established a Technical Task Team to promote entrepreneurship across universities, leading to the creation of FEDCI (Forum of Entrepreneurship Development Centres).

Through these policies and initiatives, the government aims to achieve the following strategic objectives:[24]

- **Optimizing the Regulatory Environment**: Creating a favorable business environment through supportive policies and regulations.
- **Improving access to finance**: Ensuring entrepreneurs have the financial resources needed to start and grow their businesses.
- **Entrepreneurship education and skills building**: Providing training, mentorship, and support services to help entrepreneurs develop their skills and knowledge.

3.2 Uganda

3.2.1 The research and innovation landscape

Uganda's higher education landscape is characterized by a mix of around 40 public and private universities, offering a range of opportunities for education and training. The 2024 Ugandan University Rankings stresses that most of these institutions are "offering at least three-year bachelor's degrees or postgraduate master's or doctoral degrees and delivering courses predominantly in a traditional, non-distance education format"[25]. The top five universities include Makerere University (1), one of the oldest and prestigious institution and Mbarara University of Science and Technology and Kyambogo University (2). These two institutions have also been ranked internationally for their research and innovation.[26] The research outlook 2023 produced by UNCST noted that, over the past three decades, the number of researchers in Uganda has grown steadily, due to the "establishment of a robust research quality assurance system with a global reputation excellence."[27]

[24] United Nations Conference on Trade and Development (2023). South Africa: Entrepreneurship strategy). Accessed on 27 Nov. 2023.

[25] Top Universities in Uganda | 2024 University Rankings, provided by UNIRANK, the ranking uniRank aims to provide a non-academic *League Table* of the top Ugandan Universities and Colleges based on valid, unbiased and non-influenceable web metrics provided by independent web intelligence sources rather than data submitted by the Universities themselves.

[26] Naidu, E. (2023). UGANDA: More highly qualified researchers needed for HE and industry. University world News, Africa edition. 29 June 2023.

[27] UNCST (June 2023). National Research Outlook Report. Unlocking Uganda's Research Potential for Long-Term Development and Prosperity. P. 22. Accessed on 16 Oct. 2024.

The Ugandan government has set two broad policy goals for higher education: increasing the number of graduates, particularly in science and technology, and expanding access to a broader population[28]. Beyond these goals, several legal and regulatory frameworks and other initiatives have been put in place for an enabling environment conducive to education quality, research and innovation and commercialization of research outputs. An analysis of the National Innovation System in Uganda developed in 2018 by Makerere University, Lira University and Kyambogo University, as part of the consortium of the ERASMUS+ project "African Higher Education Leadership in Advancing Inclusive Innovation for Development / AHEAD" stated:

"There are legislative acts, policies or public agencies enabling or supporting the commercialization of research or technology transfer from universities or PROs to industry and the marketplace. Yes, the relevant acts and policies include:

- The National Agricultural Research Act, 2005;
- Uganda Small and Medium Enterprises policy, 2015;
- National Science, Technology and Innovation policy, 2009;
- Uganda Bureau of Statistics (UboS) Act, 1998;
- National Development Plan, 2015/2019; - and Vision 2040.[29]"

These policies are underpinned by Uganda Vision 2040 that supports "a transformed Ugandan society, from a peasant society to a modern and prosperous country within 30 years"[30]. It places great emphasis on education, research, science, technology and innovation. Regarding the education sector, the Vision stipulates that "the entire education curriculum will be reviewed to align it with the global and national socio-economic needs." [31] The vision also stresses the urgent need to progressively review and develop new curricula and learning content in order to align "what students are taught and what industry globally requires"[32]. At the same time, the government acknowledges the crucial role of innovation as the main driver of economic growth and the key pillar of competitiveness in trade. Thus, the vision encourages innovation to harness the full potential of the digital economy and technology innovation. Finally, the vison aims at enhancing the academia- industry- government cooperation. Government will promote cooperation through join projects and programs of mutual interest to R&D centres, SMEs and large firms to spur innovation and entrepreneurship.[33]

To give substance to this vision, particularly through science, technology and innovation, several mechanisms, structures and funding schemes have been put in place. Regarding institutional reforms, in line with the Uganda Vision 2040 and to better embed innovation within Ugandan policies, including the areas education, research, science and technology, the Ministry of Science, Technology and Innovation

[28] Turyahikayo, E. (2024). Revamping Higher Education in Uganda, New Vision, August 23, 2024.

[29] Mulumba, O. et al. (2018). Analysis of the National Innovation System in Uganda, AHEAD, Erasmus+ Programme Capacity Building in Higher Education, p.24.,Accessed on 16 Oct. 2024

[30] Uganda Vision 2040 (p.III). Accessed 17 Oct.2024

[31] Uganda Vision 2040 (p.24). Accessed 17 Oct.2024

[32] Uganda Vision 2040 (p.36). Accessed 17 Oct.2024

[33] Uganda Vision 2040 (p.24). Accessed 17 Oct.2024

(MoSTI) was created in 2016. MoSTI has three (3) directorates which are dedicated to addressing STI, research and entrepreneurship issues:

- Science, Technology and Innovation Regulation;
- Science, Research and Innovation; and
- Techno-preneurship.

To achieve its overall mission, the MoSTI has four agencies that all contribute to developing R&D and leveraging local innovations:

Uganda National Council for Science and Technology (UNCST): The mandate of UNCST is "to develop and implement policies and strategies for integrating Science and Technology (S&T) into the national development policies; to advise the Government of Uganda on policy matters necessary for promoting S&T and; to coordinate and guiding national research and development (R&D) in Uganda"[34]. In addition to providing grants and publishing annual reports (see the Uganda's National Research Outlook Report 2023), the UNCST fulfils other functions:

- Regulating all aspects of science, technology, and innovation (STI).
- Translating STI policies into regulations and standards to guide the operations of the entire STI system.
- Monitoring and evaluation of STI activities and compliance with STI regulations.
- Homing of science professional institutions and continuing professional development.

Uganda Industrial Research Institute (UIRI): The UIRI is a model institution and a centre of excellence for the incubation of industry; and to be a pioneer of self-financing Research and Development (R&D) to elevate the level of technology development in Uganda and the region[35]. Among its core-services are incubation, research and development, training skills, business development, technology transfer.

Kiira Motors Corporation: Kiira Motors Corporation (KMC) is a State Enterprise established to champion value addition in the nascent Motor Vehicle Industry in Uganda through Technology Transfer, Contract Manufacturing and Supply Chain Localization. Among the main shareholders are the Government of the Republic of Uganda represented by the Ministry responsible for Science, Technology and Innovation, Office of the President (96%) and Makerere University (4%)[36]. KMC represents an endogenous model of innovation and technology transfer between the Ugandan government and Makerere University. This success shows that government support and collaboration with the private sector are of paramount importance and enablers in the process of commercializing academic research outputs. It's also worth noting that the Ugandan government introduced The National Science, Technology and Innovation Policy (2009) and a National Intellectual Property Policy (2019), demonstrating its commitment to boosting research and innovation and fostering the commercialization of research outputs (including R&D outputs) and IP. The policy highlights the importance of STI in the development of the country.

Presidential Initiative on Banana Industrial Development (PIBID): The Vision of PIBID is to "establish state-of-the-art banana processing enterprises in Uganda, producing value-added matooke products with

[34] Uganda National Council for Science and Technology. Accessed 16 Oct.2024

[35] About us | Uganda Industrial Research Institute, accessed 17 Oct. 2024.
[36] About - Kiira Motors Corporation, accessed 17 Oct.2024.

competitive market strength both locally and globally, manned by rural farmers/ entrepreneurs"[37]. The project has different units, including the Industrial technology Park (ITP) and the Research and Training Units. The ITP has different functions, including the commercialisation of proven secondary value addition technologies while the Research and Training Unit "is targeting to address demand-driven capacity building and research needs for all farmers /processors so as to ensure quality production of both raw materials processed products"[38].

Table 3 highlights some of these initiatives and their relevance regarding research, innovation and entrepreneurship and even commercialization of research outputs.

Table 3: Main institutional frameworks, policies, and other initiatives in Uganda

Policies/Plans/Frameworks, institutions	Reference to Education, Research, STI, Entrepreneurship
Uganda's Government Vision 2040 Uganda Vision 2040 emphasizes the significance of entrepreneurship in the country's development trajectory.	A shift towards **entrepreneurial universities that can equip students with the necessary skills and mindset for job creation and advancement.**
Micro, Small and Medium Enterprises (MSME) Policy	Government shall provide necessary **support, appropriate incentives, guidelines and collaborative initiatives to private sector, civil society, academia to contribute towards the realization of a competitive and well developed MSME sector (p.17).**
Ministry of Science, technology and Innovation (created I June 2016)	The mission of the MoSTI is to provide leadership, an enabling environment and resources for scientific research and knowledge-based development for industrialization, competitiveness and employment creation leading to a sustainable economy.
National Development Plan III (NDP III 2020/21 – 2024/25)	A strategic focus on private sector development and most importantly, the growth of MSMEs.
National Intellectual Property Policy	The purpose of this National Intellectual Property (IP) Policy is to provide direction on short, medium and long-term activities and interventions that **will enable IP stakeholders effectively work together towards creating, protecting and commercially exploiting research results, innovations, new technologies and creative works (p,7).**
Uganda National Council for Science and Technology (UNCST)	The Uganda National Council for Science and Technology (UNCST) was established in 1990 by Act of Parliament (CAP 209 of the Laws of Uganda) as a semi-autonomous government agency to advise, **develop, implement policies and strategies for integrating Science, Technology and Research development in Uganda.**
National Research Repository of Uganda (NRRU) is a repository system managed and maintained by the Uganda National Council for Science and Technology (UNCST).	NRU was established in 2021. NRU is a collection of scholarly output by researchers from the UNCST Community, including scholarly articles and books, electronic theses and dissertations, conference proceedings, journals, technical reports and digitised

[37] Banana Industrial Development - presidentialinitiatives.go.ug, accessed 17 Oct.2024
[38] Research & Training – PIBID: Presidential Initiative On Banana Industrial Development, accessed on 17 Oct. 2024.

Policies/Plans/Frameworks, institutions	Reference to Education, Research, STI, Entrepreneurship
	library collections. It is the official Institutional Archive (IA) of UNCST[39].
The National science, Technology and Innovation Policy (2009). This policy highlights the importance of STI in the development of the country.	The objectives of the policy are to: i. Create an enabling policy environment to foster STI and augment their contribution to national development. Ii. Build STI sector capacity to generate and transfer technology. Iii. Establish and strengthen the legal and regulatory framework to ensure ethics and safety in STI development and application. Iv. Strengthen the STI coordination framework to enhance sector performance (p.14)
Uganda Industrial Research Institute (UIRI)	The main objectives of the UIRI are: • To carry out applied research for the development of products and provide platforms for innovation, application of science and technology • To develop/acquire appropriate technologies in order to create a strong, effective and competitive industrial sector. • To promote value addition activities so as to transform local raw materials into competitive marketable products. • To bridge the gap between academia, government, and the private sector and to enhance commercialization of R&D.
Agriculture Sector Strategic Plan 2015/16-2019/20	Promote strategic partnership between research, technology development and extension services at all levels. Under this intervention, MAAIF will establish functional multi-stakeholder innovation platforms (MSIPs) to carry out joint implementation of adaptive research activities and strengthen linkages between agricultural research, extension services, M&E and data systems.
Agriculture Sector Strategic Plan (ASSP) This Strategic Plan is for the period from Financial Year 2015/16 to Financial Year 2019/20.	**Agricultural research** To accelerate production and productivity at national and household level, the ASSP will focus on **generating and up scaling the use of sound agricultural research and climate change resilient technologies across the priority and strategic commodities (p. VIII).** . **Human resource development, training and capacity building** …It will also involve developing a comprehensive sector **capacity building programme that will capture not only the knowledge and skills gaps but also career development needs;** identifying the institutions in the sector with the most urgent capacity building needs; identifying partners (service providers) to assist with the capacity building; and implementing the capacity building plans including periodic reviews of achievement (p. ix). **Agriculture sector training institutes and centres** This intervention aims at transforming Bukalasa Agricultural College (BAC), Fisheries Training Institute (FTI), the National Farmers Leadership Centre (NFLC) and District Agricultural

[39] NRU : Home. Accessed on 17 Oct. 2024.

Policies/Plans/Frameworks, institutions	Reference to Education, Research, STI, Entrepreneurship
	Training and Information Centres (DATICs), into institutions that are responsive to knowledge and skill needs of the market in extension services. This will be attained through **curriculum review, human resources strengthening and infrastructural rehabilitation/ development** (p. ix).

In terms of funding, several initiatives and mechanisms demonstrate the commitment of the Government of Uganda to strengthening quality education, research, innovation and commercialization of research outputs in Higher Institutions as a strategy for realizing Vision 2040. Indeed, while 65% of money spent on research in Uganda is from the Global North, government budget allocations for research and development have increased by 3.5% between 2015/2016 and 2020/2021[40]. The Government of Uganda provides grants for research and R&D to the National Council for Science and Technology (UNCST), public universities, Uganda Industrial Research Institute (UIRI), Ministry of Information, Communication Technology and National Guidance (MoICT) and the Ministry of Science Technology and Innovation (MoSTI)[41]. National Council of Science and Technology receives funds from government to facilitate research and innovations in universities and public research organizations. The Government funding for universities is based on quota systems for districts to support students in acquiring higher education.

Such fundings play a pivotal by unlocking the full capacity of impact research within universities and research institutes in Uganda. The most edifying example is the Makerere University Research and Innovation Fund, which we illustrate as an innovative funding mechanism for fostering innovative research and commercial uptake of research.

Highlight 3: Makerere University Research Innovation Fund

The **Makerere University Research and Innovations Fund (Mak-RIF)** is a unique initiative funded by the Government of Uganda to support high-impact research and innovations that contribute to national development. Here are some key details about the fund[42]:

Overview

- **Funding Source**: The Government of Uganda provides special funding to Makerere University for this initiative.
- **Objective**: To increase the local generation of translatable research and scalable innovations that address key gaps required to drive Uganda's development agenda.

Achievements

- **Funding Allocation**: Over the last five financial years, the government has appropriated **UGX 130.5 billion** (approximately **US$ 6.8 million**) for the fund.

[40] UNCST (June 2023). Op. cit. Accessed on 16 Oct. 2024.

[41] Mulumba, O. et al. (2018). Analysis of the National Innovation System in Uganda, AHEAD, Erasmus+ Programme Capacity Building in Higher Education, p.24., Accessed on 16 Oct. 2024

[42] rif.mak.ac.ug

- **Projects Funded**: Mak-RIF has funded **1337 projects** across various sectors critical for development, with **667 projects** already completed.
- **FY 2024/25**: The fund expects to receive about **UGX 25 billion** (approximately **US$ 6.8 million**), with at least **UGX 5 billion** allocated to new ideas that respond to national priorities.

Impact

- **Research for Economic Development**: The fund supports research initiatives that contribute to better delivery of national development initiatives in all sectors critical to the economy.
- **Commercialization and Scaling**: The fund also focuses on the commercialization and scaling of prior funded projects.

The Mak-RIF is a significant step towards fostering research innovation and entrepreneurship in Uganda, providing researchers with the necessary resources to drive national development.

Other research and innovation funding mechanisms exist in Uganda and are supported by structures such as:

- National Agricultural Research Organisation (NARO) provides research funding for agricultural research conducted in Uganda and funds businesses for research and development.
- Uganda Bureau of Statistics (UboS) dedicates fund exclusively to research.

Regarding the infrastructure investments, the Government of Uganda, in line with the Vision 2040 and trough the NCST and the cooperation with China, "is implementing the National Science, Technology, Engineering and Innovation Skills Enhancement Project (NSTEI-SEP) to enhance the technological and skill base of Ugandans to participate in strategic national infrastructural projects and manufacturing industries"[43]. This important project includes the following[44]:

- National Institute of Technopreneurship (NIT) at Rwebitete – Kiruhura District to enhance the technological and innovative base of Ugandans through a Flexible Factory Learning and Infrastructure Model.
- Technology Innovation and Business Incubation Centre (TIBIC) at Kampala Industrial Business Park, Namanve – Mukono District that will act as a platform for technology development via the Process Industry Learning Factory Model, including common user facilities and shared workspaces for scientists and innovators and
- NSTEI Technical Service Company to provide the services strategic to the country's development agenda, including, equipment leasing and machinery rentals for infrastructural projects, contract engineering, maintenance of engineering machinery and equipment, and provision of technical services for companies implementing various infrastructure projects in the country.

University-Industry collaboration is increasingly nurtured in Uganda. This is reflected in the establishment of educational policies fostering greater connections between the public and private sectors. As a result, a new culture oriented towards technology, science and innovation is gradually being institutionalized. This involves a notable shift in the sources of public research funding [45] that tend now to incorporate the

[43] Uganda National Council for Science and Technology, accessed, on 19 Oct. 2024.

[44] NSTEI-SEP Brochure FINAL May 2021 for WEB.pdf, accessed, on 19 Oct. 2024.

[45] How Uganda is unlocking its research potential for long-term development and prosperity | SGCI Africa, accessed

development of comprehensive skills and scientific entrepreneurship both as criteria and outputs. Indeed, collaboration with the private sector can provide students with practical experience and employment opportunities, bridging the gap between education and the job market. In addition to further integrating collaboration with industry, funding sources are increasingly geared towards projects that consider the country's priorities, including crucial issues such as youth and women unemployment, the fight against poverty etc. Through Memoranda of Understandings (MoUs), agreements, treaties etc., Ugandan institutions have established several inter-agency research partnerships across business, Government and Higher education both with local organizations and foreign research institutions[46]. These forms of collaboration often take place via initiatives, networks or platforms, including Knowledge translation platforms (KTPs), involving several stakeholders betrothed to bridge the evidence into action divide (Schmidt et al., 2022). Examples include the partnership between UNCST and the SGCI:

A partnership between UNSCT, the Science Granting Councils Initiative (SGCI) and other partners (IDRC, Initiative des Organismes Subventionnaires de la Recherche Scientifique (IOSRC, National Research foundation, Sida, Deutsche Forschungsgemeinschaft (DFG), NORAD, Foreign Commonwealth and Development Office (FCDO) has made it possible to undertake a project under SGCI-II (2018–2023) titled "Public – Private Partnerships in Research and Innovation in the Manufacturing Sector." This project "aimed at enhancing research and innovation initiatives addressing the challenges within Uganda's manufacturing value chains through collaborative research efforts between universities and industries"[47]. This project yields several outputs:

- Creation of Technomart acts a hub for researchers, investors, entrepreneurs, venture capitalists, and other stakeholders interested in commercializing Uganda's R&D products. Technomart also encourages academia-industry collaboration to foster technopreneurship and leverage the commercialization of research outputs within Uganda's Science, Technology and Innovation Ecosystem.
- Funding of six successful manufacturing research projects[48]: 1) Shea Butter Fractionation Project; 2) Propolis-infused tea bags and body cream; 3) The Bakery and Confectionery Standards Gaps Research Project; 4) the local wheat production; 5) The essential oil crops project and 6) the low-cost cricket feed project.
- As part of the Bakery and Confectionery Standards Gaps Research Project, Ugandan researchers have recently come up with a simple set of guidelines to help bakeries comply with food safety standards. This project involves different stakeholders such as the Uganda National Bureau of Standards (UNBS), researchers from different Ugandan universities and research institution, the SCGI, the baking industry including, bakers, retailers, and regulators. This innovation is crucial for the bakery sector in Uganda as it simplifies compliance, making it more accessible for small- and medium-sized enterprises.[49]

[46] UNCSTtatus Report 2022-12.pdf, Accessed on 16 Oct. 2024

[47] UNCST& IDRC (2023). Strengthening Public - Private Partnerships in Research and Innovation in the Manufacturing Sector in Uganda Project. Final Technical report, p.6. Accessed on 02 Oct. 2024.

[48] UNCST& IDRC (2023). Ibidem. Accessed on 02 Oct. 2024.

[49] Ugandan researchers offer lifeline to bakers, SGCI News (?), accessed on 16 Oct. 2024.

These policies, reforms and initiatives have the potential to create a legal and institutional environment conducive to research and innovation, and even to the commercialization of research outputs. The 2003 research outlook published by UNSCT[50] argues that the success of Makerere University Research and Innovations Fund (Mak-RIF) was guided by the Research and Innovations Policy (2008), and the Intellectual Property Management Policy (2008) as well the Industrial Property Act (2014) and the Copyright and Neighboring Rights Act (2006). This corroborates the idea that, in addition to creating an environment conducive to quality education and the promotion of research and innovation, these schemes are also benchmarks' instruments for the Uganda research and innovation landscape that have the potential to nurture innovation and unlock the commercialization of research outputs.

Beyond collaboration with the industry, there is also a growing awareness on the part of the civil society organizations of the need to mobilize research outputs, especially applied research, to raise consciousness, influence policy, and help meet the socio-economic challenges facing the country. For instance, organizations such as Centre for Basic Research (CBR) is a Non-Governmental Organization, (NGO), Network of Ugandan Researchers and Research Users (NURRU), The Research and Education Network for Uganda (RENU) etc. contribute to adding inputs to knowledge flows in Uganda through generation and dissemination of knowledge, research output utilization and ICT infrastructure to uplift the quality of education and research. Additionally, initiatives like the Embedded Evidence Lab aim to enhance the capacity of the Ministry of Education to use data and evidence for policymaking, improving learning outcomes.[51]

3.2.2 The entrepreneurial ecosystem

As in other African countries, Uganda is witnessing an entrepreneurial effervescence. As one of the East Africa's fastest-growing economies, Uganda is home to emerging fintech, foodtech software, and data start-ups. The last Global Start-up Ecosystem Index 2024[52] highlights Uganda's start-up scene as recording an important milestone in 2024 by jumping one (1) spot from the previous year, outranking Bosnia and Herzegovina. The city of Kampala ranked 368 out 400 cities and jumped 22 spots. Among notable start-ups from different sectors ranked by the report are Tugende (transportation), SafeBoda (Transportation), Numida Kampala (Fintech), Rocket Health (Healthtech) Xeno Kampala (Fintech). This noticeable progress stems from different factors, including the fact that Uganda has access to global accelerator programs, grants and events to support entrepreneurship, job creation and economic growth[53]. Indeed, Uganda's entrepreneurial ecosystem benefits from various enablers including the government support, the private sector (example, MTN Uganda), the foundations (Argidius Foundation) as well as from different other entrepreneur support organizations (ESOs) such as start-up accelerators and incubators like the Stanbic Business Incubator, Innovation Village, UNDP Accelerator Lab, Hive Collab, Outbox Hub etc.[54]. Others

[50] UNCST (June 2023). Op. cit. Accessed on 16 Oct. 2024.

[51] Innovation For Poverty Actions: Innovations for Poverty Action and Uganda Ministry of Education and Sports Co-Host the 3rd Cross-Country Learning Exchange, April 22, 2024, Accessed on 16 Oct.2024.

[52] Start-upBlink start-upblink.com/start-upecosystemreport 2024, accessed on 21 Sept. 20254

[53] Nathan (December, 18, 2022). Accelerating Growth of Uganda's Start-Up Ecosystem, UNDP, Accessed, 17 Oct. 2024.

[54] Start-upBlink start-upblink.com/start-upecosystemreport2024, accessed on 21 Sept. 20254

include Village Capital, Start-up Hub Africa, Mkazipreneur etc.[55] Additional resources and stakeholders can be found via the website of Start-up Universal | Uganda Start-up Ecosystem Country Guide. Ugandan universities also offer a range of programs and initiatives through incubators, incubators and other entrepreneurial research and training structures. Some of these initiatives will be highlighted in the following section.

To help boost entrepreneurship, the government has put in place various strategies and policies over the years. Uganda Vision 2040 emphasizes the significance of entrepreneurship in the country's development trajectory. Vision 2040, the NDPIII and other policies such as the Micro, Small and Medium Enterprises (MSME) Policy provide the institutional framework for policy formulation aimed to promote entrepreneurship. For instance, the vison 2040 is advocating for a shift from entrepreneurial universities that can equip students with the necessary skills and mindset for job creation and advancement. The MSME policy provides support, appropriate incentives, guidelines and collaborative initiatives to private sector, civil society, academia to contribute towards the realization of a competitive and well developed MSME sector. In addition, the Government has implemented several reforms "implementing several reforms to simplify and reduce the cost of registering a business"[56] and to contribute to the formalization of the informal sector.

Regarding entrepreneurship education, in recent years the government has been striving to integrate entrepreneurship into all levels of the education system. Furthermore, it has also supported a number of entrepreneurship skilling programmes including establishing youth industrial hubs under H.E. the Presidential Initiatives.[57] Other initiatives include the National ICT Initiatives Support Programme (NIISP) aimed at facilitating the creation of an ICT Innovation ecosystem and marketplace for Ugandan innovative digital products.[58] Similarly, Hi Innovator, an initiative of Uganda's National Social Security Fund aimed at giving visibility to small and growing businesses to help them secure seed funding, technical assistance and partnerships for their growth.[59] Finally, the Ministry of Gender Youth Livelihood Program was launched in 2013 "with the main objective of empowering the youth to harness their social economic potential and increase self-employment opportunities and income levels."[60]

[55] See more ESOs What_Ugandan_ESOs_Can_Teach_the_World_-_A_Village_Capital_Report.pdf. Accessed 22 Oct.. 2024.

[56] United Nations Conference on Trade and Development (2023). Uganda: Entrepreneurship Policy Review, p. 2. Accessed on 22 Oct. 2024.

[57] United Nations Conference on Trade and Development (2023). Ibidem. p. 2. Accessed on 22 Oct. 2024.

[58] National ICT Initiatives Support Program – Ministry of ICT & National Guidance, Accessed on 22 Oct. 2024.

[59] Home - Hi-Innovator, Accessed on Accessed on 22 Oct. 2024.

[60] Ministry Of Gender, Labour And Social Development of Uganda (2021). Youth Livelihood Programme (YLP) Summary Update of Programme Implementation. Accessed on 22 Oct. 2024.

3.3 Senegal

3.3.1 The research and innovation landscape

Senegal has one of the oldest higher education systems in Africa, with a well-established university culture and a diversified set of training options.[61] Senegal has positioned itself as an important hub for Higher Education in West Africa and more specifically in French-speaking Africa. Over the past two decades, the higher education and research sector has undergone significant development, marked, in particular, by the creation of new universities, including virtual universities, an increase in study grants, support for research (transdisciplinary doctoral schools, legal framework, charter of ethics, improved documentation services, etc.) (Tandjigora et al. 2022) and the creation of a new "university of the future" named African Future University. There are eight public universities located in Dakar, Saint-Louis, Bambey, Thiès, Ziguinchor, and Kaolack. The UCAD has a relatively long history and is one of the largest and most prestigious universities in West Africa, with over 75,0009 students across fields of science and technology, medicine and pharmacy, languages and human sciences, education and training, and law and political sciences.62 Further, tertiary education provision has diversified recently. The creation of public Tertiary Education Vocational Institutes (Institut Supérieur des Etudes Professionnelles – ISEPs) began in 2013 through the Tertiary Education Governance and Financing for Results Project (P123673 – PGF-Sup 2011-2018) in Thiès with World Bank support63. The reach of private sector provision of tertiary education has also expanded. There are approximately 90 private higher education institutions (HEIs) enrolling 27 percent of students mostly in accounting, business, tourism, communication, and ICT programs.

To help modernize and improve the quality of higher education, the Senegalese government has made substantial efforts in 2022 by investing, with support from the World Bank, over $150 million in a program aimed at aligning graduates' skills with labour market needs. In addition to these investments, Senegal has initiated major institutional reforms to support research and innovation. Several measures have been put in place to harness the potential of R&I:[64]

- The Plan Sénégal Emergent (PSE)/Emerging Senegal Plan, whose orientations are aligned with the Sustainable Development Goals (SDGs);
- The Lettre de Politique Sectorielle de Développement de l'Enseignement supérieur, de la Recherche et de l'Innovation 2018-2022/ Sectoral Policy Letter for the Development of Higher Education, Research and Innovation 2018-2022, which aims to boost R&I.
- The Concertation Nationale autour de l'Avenir de l'Enseignement supérieur, la Recherche et l'Innovation (CNAES)/ National consultation on the Future of Higher Education, Research and Innovation, as a platform for equipping research centers, establishing a framework for cooperation between the private sector and universities, and defining effective strategies for disseminating research results.

[61] The World Bank, (Updated: 17-May-2023). SENEGAL HIGHER EDUCATION PROJECT (P178750). Project Information Document (PID). Acessed on 26 Oct, 2024.

[62] The World Bank, (Updated: 17-May-2023). Op.cit.

[63] The World Bank, (Updated: 17-May-2023). Op.cit.

[64] Plan stratégique national de la recherche et de l'innovation (2023-2032), p.2

The importance attached to research and innovation has grown considerably and is reflected particularly in the terminological evolution through which the various structures dedicated to higher education and scientific research have been named. From 1995-2000, scientific and technical research was integrated into the Ministry of Higher Education. The year 2017 marks a key date in taking innovation into account, with the broadening of missions and the establishment of the Direction Générale de la Recherche et de l'Innovation (DGRI) within the Ministère de l'Enseignement Supérieur, de Recherche et de l'Innovation (MESRI). Senegal's Ministry of Higher Education, Research and Innovation (MESRI) draws up and implements national policies on higher education, research and innovation, aimed at promoting the country's science and technology. The Direction Générale de la Recherche et de l'Innovation / Directorate General for Research and Innovation (DGRI), assists the Minister in implementing research and innovation policy. It includes :

- Direction des Stratégies et de la Planification de la Recherche (DSPR) ;
- Direction de l'Innovation, de la Valorisation, de la Propriété intellectuelle et du Transfert technologique (DIVPITT) ;
- Direction du Financement de la Recherche Scientifique et du Développement Technologique (DFRSDT) ;
- Department for the Promotion of Scientific Culture (DPCS).

These different departments play a key role in the development of research and innovation. They address crucial issues – not yet sufficiently addressed in Senegal- such as research planning and strategy, knowledge valorization, intellectual property, technology transfer, research funding, technological development etc.

Examples of major DGRI projects[65]:

- **Tele-medicine / Tele-education:** A cart for examining patients in isolated areas, with the possibility of several procedures at the same time.
- **Supercalculator:** An all-purpose machine in many sectors, such as agriculture, health care, industry...to analyse billions of pieces of data.
- **Cité du savoir (City of knowledge):** Creating the conditions for large-scale scientific knowledge on a large scale. The Cité du Savoir includes a media library, a House of Science and an arboretum.
- **Project to set up a nuclear research reactor:** To be used for teaching and research in nuclear science and technology but also to produce radiopharmaceuticals, used in nuclear medicine for the treatment and diagnosis of cardiovascular diseases and cancer, among others.

Significant efforts have been made to strengthen the funding of scientific research. Thus, several funding mechanisms have been set up in recent years. Yet, most of the research funding is provided in the form of subsidies to the various research structures (universities, public scientific establishments, graduate schools, etc.). There are also post-graduate grants and competitive funds such as the Fonds d'Impulsion pour la Recherche Scientifique et Technique (FIRST) at the Ministry of Scientific Research[66] and the Fonds National de Recherche Agricole et Agro-Alimentaire du Sénégal (FNRAA) at the Ministry of Agriculture. Established in 1989. The FIRST is dedicated to funding research projects developed by teams from one or

[65] Plan stratégique national de la recherche et de l'innovation (2023-2032), p.31

[66] Fiche pays recherche.pdf (diplomatie.gouv.fr) p.

more institutions. The Funding comes from the MESRI, sometimes in partnership with international or regional organizations such as the SGCI. The projects funded must contribute to resolving the major issues facing Senegal and have a socio-economic impact on the local communities. For the 2023 edition, 16 new projects, worth around 300 XOF million, have been selected from the 56 candidates who applied. Proposals have been selected in the following four priority areas for Senegal's development[67]: 1) Global Health, 2) Agriculture/Climate Change; 3) Food Security and Digital Economy; 4) Energy / Natural Resource Management. As for the 2024 edition, the call for applications for funding of research projects focused on the following priority areas: 1) health and nutrition; 2) water, agriculture and food security; 3) natural resource management, environment and climate change; 4) renewable energies, gas and oil.

Beyond the FIRST, other relevant funding instruments were initiated:

- Scientific and Technical Publication Fund;
- Programmed Thematic Groups;
- National Council for Scientific and Technical Research;
- Research and Test Centres;
- International cooperation.

Significant strides have also been made in research valorization and technology transfer, areas hitherto considered to be under-explored in Senegal's landscape of research and innovation. For example, the number of patents filed with OAPI has risen from 3 in 2008 to 27 in 2018[68]. In this respect, the creation of the Agence Sénégalaise pour la Propriété Intellectuelle (ASPIT) marks an important milestone in the process of protecting inventions and innovations and creating synergies between innovations and technology transfer. The new agency has a public service mission to promote invention and technological innovation. Its aim is to make productive sectors more competitive, and to provide support and guidance for industrial, agricultural and/or craft projects. ASPIT is the National Liaison Structure with the African Intellectual Property Organization (SNL/OAPI)[69]. Another government agency, under the administrative and technical supervision of the Ministry of Higher Education, Research and Innovation (MESRI), is the National Authority for Quality Assurance of Higher Education, Research and Innovation (ANAQ Sup). Its mission is to help ensure the quality of the higher education, research and innovation system and the promotion of a culture of quality assurance assessment[70]. The Concertation Nationale sur l'Enseignement Supérieur (April 6-9, 2013) recommended extending ANAQ Sup's missions to research and innovation. As a result, Decree 2012-837 of August 07, 2012, creating ANAQ Sup was replaced by the new Decree N°2018-1956 of November 07, 2018, extending its missions to research and innovation[71].

As part of this drive to promote innovation and enhance the value of research outputs, the Senegalese government has formulated an industrialization policy and strategy for 2021-2035. This policy aims, among

[67] Cérémonie de remise symbolique de chèques du Fonds d'Impulsion de la Recherche Scientifique et Technique (FIRST 2023) : Deux chercheurs de l'ISRA parmi les lauréats - | Institut Sénégalais de Recherches Agricoles,

[68] Plan Stratégique National de la Recherche et de l'Innovation (2023-2032)

[69] Agence Sénégalaise Pour la Propriété Industrielle et L'innovation Technologique (ASPIT)

[70] Décret portant création, organisation et fonctionnement de l'Autorité Nationale de l'Assurance Qualité du Ministère de l'Enseignement Supérieur, de la Recherche et de l'Innovation.

[71] ibidem

other things, to (i) orient science, technology and innovation development policies and programs towards industrial development; (ii) enhance the value of research outputs and promote access to technology for industrialists, focusing on strategic areas for boosting productivity. This policy also aims to adapt vocational and technical training programs to the needs of industry, and to develop the potential of local areas. A key objective is to accelerate the construction of the Diamniadio Digital Technology Park (PTN), to support private initiatives in industry 4.0. Axis 1 focuses on the processing of agricultural, forestry and fishery raw materials. Structuring initiatives such as the establishment of competitive and integrated agro-hubs as well as the creation of integrated industrial parks and platforms are underway or already in place[72].

Senegalese authorities are increasingly aware of the fact that mobilizing research and innovation can help address national priorities and imperatives. Indeed, mass employment (particularly for young people, women and the underprivileged), exports and so many other economic issues make research, innovation, entrepreneurship and industrialization central to development concerns and policies. By way of illustration, the urgent need to create jobs for young people, through productive activities, requires strengthening linkages between public research and innovation. The Senegalese authorities have elaborated a National Plan for Research and Innovation as catalysts for sustainable development, industrialization and entrepreneurship.

Regarding the specific sector of agriculture, Senegal has made important strides in research and innovation, focusing on enhancing productivity and sustainability. It is certainly in this area that research and innovation, in this case applied research, have flourished the most. Senegalese agriculture has a long tradition of applied research, dating back to colonial times. The history of agricultural research began with the introduction of groundnut cultivation. But the research policy of the Senegalese government was not only oriented towards agriculture. It also included veterinary, forestry and oceanographic research. Independence in 1960 ushered in a new era for agricultural research in Senegal. In November 1974, the DGRST created the Institut Sénégalais de Recherches Agricoles (ISRA) with the main aim of providing Senegal with a genuine research policy.[73] ISRA has undergone many changes since its creation. Today, as one of ISRA's unit heads states, "a new era of modern research and innovation is opening up for ISRA, enabling it to generate research and innovation results that contribute to the development of agriculture in the broadest sense, and hence to the country's socio-economic development"[74]. In addition to universities and national research institutions such as the Institut de Technologie Alimentaire (ITA), the Institut National de Pédologie, ANACIM etc., ISRA also collaborates with French research institutions such as IRD, CIRAD etc. The agricultural research and innovation ecosystem also benefits from collaboration with regional, sub-regional organizations (Conseil pour la Recherche Agricole en Afrique (CORAF) et le Forum Africain pour la Recherche Agricole (FARA) etc.), international institutions such as CGIAR, Alliance of Biodiversity International and the International Center for Tropical Agriculture (CIAT) etc. This collaboration enables the stakeholders from agriculture research and innovation landscape not only to benefit from capacity-building in terms (scientific, technical) and financial support, but also to explore new approaches in line with the involvement of Farmers in research and new challenges such as Climate-Smart Agriculture.

[72] Sénégal : Politique et stratégie d'industrialisation 2021-2035

[73] ISRA (2024). Histoire de l'ISRA et de la recherche agricole au Sénégal. ISRA, Senegal.

[74] ISRA (2024). Histoire de l'ISRA et de la recherche agricole au Sénégal. ISRA, Senegal.

- **Involvement of Farmers in Research**: One of the key insights from recent agricultural research in Senegal is the importance of involving farmers in the research process. When farmers' knowledge and experiences are integrated into research initiatives, they are more likely to adopt and share new agricultural practices[75]. This participatory approach not only improves the relevance of research outcomes but also fosters a sense of ownership among farmers, leading to better implementation of innovative practices.
- **Climate-Smart Agriculture:** Innovative initiatives are emerging, particularly in urban areas like Dakar, where women are leading efforts in climate-smart agriculture. Programs such as AICCRA-Senegal are expanding access to climate information services and promoting practices that help farmers adapt to climate change[76]. This focus on climate resilience is essential for the long-term sustainability of agriculture in the region.

Regarding regulatory and legal framework, several laws and reforms have been put in place to nurturing agriculture research and innovation. These include the Agro-sylvo-pastoral orientation law (N0 2004-16), which aims to create an attractive and incentive environment in rural areas by transforming family farming and promoting the emergence of agricultural and rural entrepreneurship[77]. In this spirit, several other initiatives, including the National Agro-Sylvo-Pastoral Research System (SNRASP), have been developed and implemented. The SNRASP is a steering mechanism for coordinating and organizing research with a view to better meeting the objectives of the agro-sylvo-pastoral development (article 68). The SNRASP is financed by the National Fund for Agricultural and Agri-Food Research (FNRAA), created by decree no. 99-85 of February 4, 1999[78].

In summary, Senegal is actively pursuing agricultural research and innovation through farmer involvement, strategic policies, climate-smart practices, and robust institutional frameworks. These efforts are crucial for enhancing agricultural productivity and ensuring food security in the face of environmental challenges.

Table 4 illustrates some of the initiatives, policies, strategies and plans put in place to harness research and innovation in Senegal, including the agriculture sector.

Table 4: Initiatives, policies, institutions and strategies to harness research and innovation in Senegal

Policies/ Plans/ Frameworks/institutions	Reference to Education Research and Entrepreneurship
Direction Générale de la Recherche et de l'Innovation **/ Directorate General for Research and Innovation (DGRI)**	Article 41[79]: Under the authority of the Minister of Higher Education, Research and Innovation, the Direction Générale de la Recherche et de l'Innovation is responsible for coordinating and harmonizing research and innovation activities. It assists the Minister in implementing research and innovation policy. The Direction générale de la Recherche et de l'Innovation comprises : - Research Strategy and Planning Department.

[75] https://theconversation.com/insights-from-senegal-involving-farmers-in-research-is-key-to-boosting-agriculture-128085 , February, 6, 2020, 7:45 EST.

[76] https://aiccra.cgiar.org/regions/senegal

[77] Loi d'orientation agro-sylvo-pastorale, p. 22.

[78] Loi d'orientation agro-sylvo-pastorale, p. 22.

[79] Chapitre IV.- La Direction générale de la Recherche et de l'Innovation (DGRI)

Policies/ Plans/ Frameworks/institutions	Reference to Education Research and Entrepreneurship
	- Innovation, Valorisation, Intellectual Property and Technology Transfer Department - Department for Financing Scientific Research and Technological Development ; - Department for the Promotion of Scientific Culture (DPCS).
Plan Stratégique National de la Recherche et de l'Innovation 2023-2032 National strategic plan for research and innovation 2023-2032	Vision: Make R&I a catalyst for sustainable development, industrialization and entrepreneurship for an emerging Senegal by 2035. Mission: Create an R&I environment underpinned by inclusive governance.
Fonds d'Impulsion de la Recherche Scientifique et Technique (FIRST)/ Impulse Fund for Scientific and Technical Research	The FIRST is designed to fund research projects developed by teams belonging to one or more institutions in priority areas defined by the Ministry of Higher Education, Research and Innovation (MESRI).
Agence sénégalaise pour la Propriété industrielle et l'Innovation technologique (ASPIT)/ Senegalese Agency for Industrial Property and Technological Innovation	The missions of the Senegalese Agency for Industrial Property and Technological Innovation (ASPIT) include: - promoting the protection of inventions and innovations, while encouraging the valorization of creations and research results; - creating synergy between innovation and technology transfer to develop an industrial fabric that creates jobs, particularly in the small and medium-sized enterprise sector; - training, informing and coaching inventors and research institution staff, to unleash their creative potential in new areas of industrial property; - advising and providing all technical and financial assistance required to promote industrial property protection and the valorization of technological inventions; - promoting, in collaboration with higher education establishments, universities and research centres, the training of managers in industrial property and commission national empirical studies on industrial property and technological innovation; - developing decision-making and technological choice tools for researchers, business leaders and public decision-makers.
Institut de Technologie Alimentaire	The Institut de Technologie Alimentaire is a food research and development centre. Its vision is to have a food industry that is diversified, competitive, creates jobs and generates income, while preserving the natural environment.
LOI N0 2004-16 portant loi d'orientation agro – sylvo- pastorale LAW N0 2004-16 on the agro - silvo-pastoral orientation law	Article 8: The strategic axes of the agro-sylvo-pastoral development policy include different issues such as: - Formal recognition of agricultural trades and professional agricultural professional agricultural organizations; - Diversification of agricultural production, integration of agricultural sectors and market regulation; - Development of infrastructure and public services in rural areas.

Policies/ Plans/ Frameworks/institutions	Reference to Education Research and Entrepreneurship
	- Development of agricultural information, education and training agricultural professions; - Capacity-building for professional agricultural organizations, civil society organizations civil society organizations, local authorities and government services; - **Development of agro-sylvo-pastoral research and advice;** - **Financing agro-sylvo-pastoral development.**
DECRET n° 2008-1259 du 10 novembre 2008 portant organisation et fonctionnement du Système National de Recherches Agro-Sylvo-Pastorales (SNRASP).	Article 1. – This decree is taken in application of law 2004-16 of June 4, 2004 relating to the Agro-Sylvo-Pastoral orientation law, in particular in its article 68. It regulates the organization and operation of the Committee set up to coordinate the National Agro-Sylvo-Pastoral Research System (SNRASP). Art. 2. – The Committee's purpose is to: coordinate the activities of the SNRASP, take stock of the financing of agricultural and agri-food research, advise the State on the programming and financing of agricultural and agri-food research, decide on the financing of priority research projects. It is placed under the supervision of the Minister responsible for Agriculture.[80]
Décret n° 99-85 du 4 février 1999 portant création et organisation d'un Fonds national pour la Recherche agricole et agro-industrielle (FNRAA).	Art.3 : The purpose of the NAAF is to use the resources made available to it to finance agricultural and agri-food research projects considered to be priorities by the State, the national agri-food research system (NARS), development partners and the users of research results.

3.3.2 The entrepreneurial ecosystem

Senegal boasts a vibrant entrepreneurial ecosystem, recognized as one of the most mature in Francophone Africa. This ecosystem serves as a hub for start-ups and emerging ventures, fostering innovation and economic growth across various sectors. This entrepreneurial dynamic is supported by Senegal's political environment. Indeed, Senegal is one of the most stable countries in Africa and "has experienced three peaceful political transitions since gaining independence in 1960"[81]. Added to this is the establishment of a legal and institutional framework that helps reinforce the entrepreneurial culture through which the country has long distinguished itself. Other factors include the financing opportunities offered by the government, the private sector and other organizations, including cooperation and international organizations, as well as incubation and acceleration programs initiated by support organizations and other entities, aimed at scaling up start-ups.

Through the Senegal government's supportive policies, the entrepreneurial ecosystem has enjoyed remarkable success in recent years. According to the Global Start-up Ecosystem Index 2024, although Senegal dropped 4 places to 86th, it still occupies 3rd place in West Africa, overtaking Ghana, and 7th place in Africa, ahead of Namibia (8th place)[82]. The report goes on to mention that Dakar is the only ranked city in Senegal and is among the top 300 globally. The creation of the Direction de l'Entrepreneuriat Rapide

[80] DECRET n° 2008-1259 du 10 novembre 2008 portant organisation et fonctionnement du Système National de Recherches Agro-Sylvo-Pastorales (SNRASP).

[81] The World Bank in Senegal (last updated, Oct. 17, 2024). Overview.

[82] Start-upBlink (2024). The Global Start-up Ecosystem Index 2024.

des Jeunes et des Femmes (DER/FJ) marks a historic turning point in the development of entrepreneurship in Senegal, particularly in terms of financing for young people and women with projects, and multiple non-financial supports such as help in formalizing companies and technical assistance (training and consulting services). In addition to DER, other structures include ADPME, FONGIP and FONSIS. ADEPME is the State's operational arm for providing non-financial services to SMEs.

Table 5 illustrates some of the initiatives, policies, strategies and plans put in place to harness entrepreneurship in Senegal**.**

Table 5: Initiatives, policies, structures and plans to harness entrepreneurship in Senegal

Policies/ Plans/ Frameworks/structures	Reference to Research, Innovation and Entrepreneurship
Start-up Act	**Start-up Act:** a piece of legislation that catalyzes the start-up sector by offering incentives to encourage their development. In Senegal, it encourages start-ups with tax exemptions, administrative facilities and access to dedicated financing.
Statut National de l'Étudiant-Entrepreneur (SNEE)/ National Student-Entrepreneur Status (NSEE)	The NSEE enables students and young graduates **to set up their own project, while continuing their studies.** It is part of the central role played by all higher education establishments in **facilitating the economic and social integration of their students and graduates.**
Délégation générale à l'Entreprenariat Rapide des Femmes et des Jeunes (DER/FJ) **General Delegation for Rapid Entrepreneurship of Women and Youth (DER/FJ)**	Created by Decree No. 2017-2123 of November 15, 2017, the Délégation Générale à l'Entreprenariat Rapide des Femmes et des Jeunes (DER/FJ) is tasked with driving and promoting entrepreneurship among women and young people, notably through: - Defining and implementing strategies to promote self-employment for women, young people and groups; - Support and technical assistance for project leaders; - Resource mobilization and financing of business start-up projects and support for income-generating activities; - Strengthening the technical and managerial capacities of beneficiaries; - Supervision and monitoring-evaluation of funded projects. The DER and the Centre d'Incubation et de Développement d'Entreprises Innovantes (University Cheikh Anta) are in the process of establishing a partnership to operationalize the status of student entrepreneur.

3.4 Cameroon

3.4.1 The research and innovation landscape

With 11 public universities and over 200 private schools and institutes, Cameroon's education system is one of the most viable in Central Africa. Cameroon is a nation characterized by a dual cultural identity, which is also reflected in its educational system, implementing both the French and English programs, distinguishing it from its African counterparts and contributing to its unique educational landscape. [83] Since 1993, the government has introduced several reforms which, despite their limitations, have helped

[83] Deugreme (2024), Modernization of Higher Education in Cameroon: History, Problems and Prospects. Education research & Development. Accessed 19 Sept. 2024.

to bring about change in the education landscape, particularly in higher education. Indeed, it's the Ministère de l'Enseignement Supérieur (Ministry of Higher Education) that draws up and implements the government's higher education policy. Mensup comprises several divisions, including the Division of University Research and Cooperation. Mensup gives top priority to university entrepreneurship. Since 2019, in collaboration with Agence Universitaire de la Francophonie (AUF), the Cameroonian government has set up three programs or initiatives:

- ERASMUS+ Concrete and Technical Learning Programme for Entrepreneurship (PACTE). This initiative is complementary to the programs already implemented in Cameroonian universities (the Bachelor-Master-Doctorate system, the professionalization of teaching, business incubators, the Cameroonian Student Genius and Talent Exhibition Show (GETEC)) and aims systematically at integrating the entrepreneurial spirit into training programs.
- IDNEUF, which is an initiative of the International Organization of the Francophonie (OIF), implemented by Francophonie University Agency of the (AUF), culminating in the digital development in the Francophone University Space.
- Digital Atlas of Central African Researchers. This important instrument should contribute to a better visibility of Cameroonian researchers and their productions, fruits of the Special Grant for the Modernization of University Research instituted by the Head of State.

In addition, to ensure the digital transformation of Cameroonian universities through the digitization of teaching and university administrative activities, the E-National Higher Education Network was launched in 2025 in collaboration with China.

To achieve the objectives of Cameroon's National Development Strategy 2020-2030 (SDN30), the government relies on scientific research and innovation sub-sector as a decisive role to play. The Ministry of Scientific Research and Innovation will have to play a greater role, notably through its various bodies, including the Institute of Agricultural Research for Development and other institutions such as CIRAD. To this end, Cameroon's first national research and innovation strategy has been drawn up for 2022. Indeed, the Policy Support Facility (PSF) helped the Ministry of Scientific Research and Innovation (MINRESI) to draw up a first national research and innovation strategy to develop an inclusive, knowledge-based economy by:

- Creating a bridge between research and the business world by strengthening public-private partnerships.
- Promoting open science.
- Addressing societal challenges, related to food sovereignty, population health, climate change, and endogenous industrialisation.
- Boosting international cooperation in the field of research.
- Valuing indigenous knowledge.
- Reducing the gender gap in STEM.
- Making research a lever for the employability of young graduates.

This strategy is strongly aligned with the different laws, policies, visions or programs in order to give it a lot of coherence, given that innovation is a cross-cutting issue. These include not only the National Development Strategy 2020-2030, Cameron Vision 2035 and the National Employment Policy, but also the National Entrepreneurship Development Plan (under development).

Table 6: Policies, institutions and other initiatives in Cameroon

Policies/ Plans/ Frameworks	Reference to Education Research and Entrepreneurship
National Development Strategy 2020-2030	Set up a National Innovation System; (ii) pool the infrastructural and scientific capacities of research centres and universities by ensuring the upgrading of technical platforms; (iii) create a mechanism for sustainable financing of research in all sectors; (iv) define a strategy for international partnership in the field of research in order to capture technologies and knowledge that would have significant added value for the country's development; V) densify research and strengthen innovation » for the sustainable development of Cameroon.
Cameroon Vision 2035	To improve youth employability, it is urgent to increase in secondary school and higher education, the rate of students enrolled in scientific and technological courses notably from the current 5 per cent to 30 per cent by 2035. An industrial fabric has been established and is providing the whole economy with the production means for its growth, notably by promptly adding value to research results. (p.19) Thanks to various incentives, small peasants settled into cooperatives and other forms of effective professional organisations likely to help them to access inputs, agricultural research results, credit and marketing of their products (p.21). 1.4 Building the capacity of the education, training and research system to: • produce a critical mass of semi-skilled workers and second-line managers • foster the emergence of the knowledge economy. **Development of research, innovation and technical standardization**: emphasis will be laid on the development and mastery of science and techniques in the industrial area. In the medium and long terms, efforts will be made to: (i) encourage transfer of technologies and use of research results by enterprises; (ii) promote, assist in and boost research & development in the country by developing research institutes, encouraging enterprises to increasingly innovate and establishing strong partnerships between research centres and enterprises; (iii) promote the use of local material; (iv) develop and apply an appropriate technical regulation.(p.38)
National Entrepreneurship Development Plan (under development)	This plan is part of the National Development Strategy 2030 (SND30) and helping to create a virtuous entrepreneurial environment conducive to the creation and development of innovative businesses run by young people and women.
Promoting entrepreneurship and improving skills in support of industrialization (PEAC)	PEAC will seek to (ii) promote entrepreneurship and productive self-employment among young people as well as professional integration, especially in targeted growth sectors; (iii) boost business competitiveness; and (iv) build the institutional capacity of modernized technical and vocational actors.
National Employment P8i..u8700-9phg,im,ng weh olicy	Focuses on the promotion of entrepreneurship and the improvement of workforce employability. In this regard, the Government, through the Ministry of Small-and Medium-size Enterprises, Social Economy and Handicrafts (MINPMEESA), has placed special emphasis on providing support to young people through incubators. Thus, in 2018, the Government set up the pilot National Business Incubator (PNPE) at Edea to support business incubation project holders and provide assistance to start-ups

Policies/ Plans/ Frameworks	Reference to Education Research and Entrepreneurship
The growth and employment strategy paper (GESP)	Other measures will be taken to facilitate implementation of the education strategy, namely: (i) ear-mark budget resources necessary for education; (ii) improve the student-teacher ratio to about 40 students per teacher; (iii) set up a support fund for vocational training and human resources, and technological centres; (iv) set up a research and higher education teacher training support fund; (v) regularly ensure the allocation of subventions to private education; (vi) promote a school and university health system based on prevention and clinical management

3.4.2 The entrepreneurial ecosystem

Regarding the initiatives undertaken to support the entrepreneurial ecosystem, the following are worth highlighting:

- **Start-up Act**: The Nkafu Policy Institute highlighted[84] the pressing need for a comprehensive "Start-up Act" in Cameroon to provide funding, extend market outreach, find collaborators, and develop business ventures. This act is seen as essential for supporting and promoting the growth of start-ups and entrepreneurial activities. Countries such as Senegal have already introduced a start-up act.
- **Tax Incentives**: The 2021 Finance Law introduced tax incentives to encourage private investment and support innovative start-ups[85]. These incentives include exemptions from various taxes and reduced corporate tax rates for start-ups in the information and communication technology sector.
- **Support for SMEs**: The government has various support programs for small and medium-sized enterprises (SMEs), including training, administrative support, and policy recommendations to enhance their development.

Following the examples of Senegal, South Africa and Uganda, Cameroon has put in place important mechanisms that have the potential to promoting research and innovation, as well as entrepreneurship and youth employability. However, the effectiveness of these policies is questionable: ''Cameroon has many support programs put in place to ensure the growth and sustainability of SMEs. But the question lies with the effectiveness and good coordination of these programs. These initiatives haven't worked as well as they could have. It is important therefore to examine the extent to which government support programs improve entrepreneurship in Cameroon."[86]

This observation also applies to other countries. Indeed, the study shows that not only are there a plethora of policies and initiatives, but there are few efforts to harmonise them. Moreover, apart from a few instruments and tools, there are very few policies specifically dedicated to academic entrepreneurship. Policy implementation in Africa faces major challenges such as unrealistic goal setting, political patronage, neglect of target beneficiaries and lack of consideration of policy environment (Ajulor, 2018).

[84] Nkafu Policy Institute (April 26, 2024). The Need for Adopting a Start-up Act in Cameroon. Accessed on 28 Nov. 2024.

[85] VOUFO**.** T.N. (09 May 2021**).** Innovative Start-Up In Cameroon: From A Tax Incentive Regime. The Nkafu Policy Institute. Accessed on 28 Nov. 2024.

[86] Kum, D. (March 2024). Enhancing SME development in Cameroon: Evaluating government support program. On Policy Africa. Accessed on 29 Nov. 2024.

4. Initiatives and programs developed by HEIs

Beyond the legal and institutional framework, the scoping study, key informant interviews and even country level webinars show a convergence around several initiatives and programs as enablers of the translation of research outputs. These initiatives and programs cover the entire value chain of teaching, research and community impact, knowledge valorization and technology transfer etc. The following table illustrates, through examples, some of these initiatives developed by universities in Cameroon, Senegal, Uganda and South Africa.

Table 7: Initiatives developed by universities

Initiatives	Illustrations

Integration of entrepreneurship and innovation into curricula and teaching models	- AgriScale:
	  ○ 3960+: Total volume (in ECTS) of new/ updated courses in partner HEIs Kenya and Zambia and Uganda (Bishop Stuart University and Gulu University, Uganda).
	  ○ 461Total number of staff members trained in PBL methodology and *curricula development (baseline,14)
	- The Student Enterprise Scheme (SES): Gulu University
	- "Strengthening Agri-Entrepreneurship and Community Engagement Training in East, West and North Africa (AgriEngage)", Gulu University among the partners

Implementation of ad-hoc structures: - Research innovation Fund - incubators, accelerators, labs, mentoring programs	- Incubateur Dekkal Yaakaar: USSEIN (Senegal) - LaunchLab: University of Stellenbosch (South Africa) - Centre d'Appui à la Technologie, à l'Innovation et à l'Incubation (CATI) : University of Dschang (Cameroun) - Makerere Innovation &Incubation Centre: Makerere University (Uganda) - University of Venda Centre for Entrepreneurship Rapid Incubator (UCFERI) - South Africa Universities: EDHE Programme
Knowledge valorization and commercialization of research outputs through intellectual property management and technology transfer: Structures, start-ups, spinout, spin off generated/commercialized from academic research and students' projects.	- Department of Valorization (ESP, UCAD, Senegal) - Directorate of Graduate Studies, Research and Innovations (Busitema University, Uganda) - Innovation & Intellectual Property (University of Fort Hare, South Africa) - Directorate of Innovation, Technology Transfer and Commercialization (University of South Africa, SA) - Research, Cooperation & Relations with the Business World, University of Buea. - Center for Innovation and Technology Transfer (Mbarara University of Science and Technology)
Multi-stakeholder partnerships to promote research, innovation and entrepreneurship	TAGDev 2.0: a collaborative between RUFORUM, Mastercard Foundation, the Global Confederation of Higher Education Associations for Agricultural and life Sciences (GCHERA) and 12 African universities. Forest 21: a joint project for strengthening capacity in South African higher education in forestry. The project is implemented in collaboration of five higher education institutions (HEIs) in South Africa that have forestry curricula or will start teaching forestry. AgriSCALE Innovation for African Universities: designed to support the development of Africa – UK University Partnerships that build institutional capacity for HE engagement in entrepreneurship and innovation ecosystems in selected African countries.

Initiatives	Illustrations
	The China Funds-in-Trust (CFIT) Phase III: Higher technical education in Africa for a technical and innovative workforce La Chaire Pierre Castel: Its vocation is to work with Africa to meet the current and future challenges of agriculture and training for youth employability. It is built in collaboration with the Faculty of Agronomy and Agricultural Sciences at the University of Dschang in Cameroon, the École Supérieure d'Agronomie at INP-HB in Yamoussoukro, Côte d'Ivoire, and Bordeaux Sciences Agro in France. **Africa Higher Education Centers of Excellence (ACE) Project** The Africa Higher Education Centers of Excellence (ACE) Project is a World Bank initiative in collaboration with governments of participating countries to support Higher Education institutions in specializing in Science, Technology, Engineering and Mathematics (STEM), Environment, Agriculture, applied Social Science / Education and Health. It is the first World Bank project aimed at building the capacity of higher education institutions in Africa. **ACE Impact Achievements as of October 2024** - 10,363 MSc Students enrolled - 3,244 PhD Students enrolled - 10,425 Female Students enrolled so far at different levels - 17,676 Prof. Short Course Students enrolled - 9,892 Regional Students enrolled from the sub-region and beyond - 7,219 Practical sector-based internships undertaken so far - 190 Total number of programmes with national accreditation - 2,889 Total Research articles published in internationally recognized journals - USD 80 million Revenue generated from external sources. The Resilient Africa Network (RAN) funded by USAID is a partnership of 20 African universities in 13 countries. It is led by Makerere University with the Initiative for Disaster Resilience and Humanitarian Affairs Elliott School of International Affairs at George Washington University, Stanford University and the Center for Strategic and International Studies (CSIS) as partners. **Regional Scholarship and Innovation Fund (RSIF)** supports doctoral training, advanced research, and innovation ecosystems. The fund provides scholarships, research awards, and innovation awards to faculty and students, fostering a culture of entrepreneurship and innovation. RSIF is the flagship programme of the Partnership for Skills in Applied Sciences, Engineering and Technology (PASET), an Africa-led, World Bank-affiliated initiative.
University-Community Projects	The University of the Free State (UFS) Wool Wise Community Project: **Community project empowers local women in wool craft**

4.1 Integrating entrepreneurship and innovation into curricula and teaching models

The recent surge in entrepreneurial activity across Africa has significantly impacted the Higher Education Institutions sector. Whereas entrepreneurial education used to be taught mainly by business schools, universities have taken a major step forward in this trend by helping to strengthen students' skills and mindsets, so that by the end of their journey they are no longer mere jobseekers, but job creators. Indeed,

to help fulfil their third mission – community engagement – many universities are increasingly aware of the need to embed entrepreneurship education in the curricula of university programs.

> *"Entrepreneurship is taught, but only in certain institutes. But it's essential that it be generalized. It's essential if we want to make an impact. We are slowly but surely getting ready. We must recognize that it's a major undertaking that requires not only structural changes but also changes in the mindset of both teachers and students."* (Head of Innovation and Entrepreneurship Division, Coordinator of the UCAD Student Entrepreneur Pole, from the semi-structured interviews).

> *"We go beyond theoretical teaching to provide students with tools, workshops or bootcamps to make student entrepreneurship more practical and enable students to be entrepreneurs in their field."* (Head, LaunchLab, SU, from the semi-structured interviews).

Several approaches are being tried in the process of integrating entrepreneurship into curricula. These approaches can vary significantly between universities and programs. However, the embeddedness of entrepreneurship "requires retooling of teaching methods, blended case study with project work approaches and integrating indigenous knowledge in the teaching of new knowledge, skills and value systems."[87]

The following examples illustrate different approaches and objectives:

The Student Enterprise Scheme (SES): Gulu University

The Student Enterprise Scheme (SES) targeting competences of entrepreneurial knowledge, skills, mindsets and attitudes for agriculture students. It is both an innovative learning model and a financing mechanism for student business projects. The SES model is built around four key stages (Kalule et al., 2017).

- Course work for theoretical coverage and exposures to business practices: this exposes the student to technical, managerial, accounting and business knowledge as well as business practices.
- Value chain/cluster mapping
- Business plan and execution
- Feedback: sharing and dissemination of results and lessons

The process leads to the funding of successful companies which, through their business plans, have the potential to grow and scale up. The model also provides students with access to credit and micro-finance initiatives to enhance the development of their ventures.

Success stories include JuFresh Enterprise, a student enterprise made up of five young dynamic students pursuing MSc. Agri-Enterprises Development at Gulu University in Northern Uganda[88]. Founded in 2018, the student enterprise is producing a variety of fresh fruit juice and fruit salads. JuFresh Enterprise has an impact on both the university community and the community at large. Indeed, the student enterprise

[87] Ransford Bekoe (?). Constructing Entrepreneurial Universities in Africa Presents Unique Opportunities and Challenges. ACEEU (Accreditation Council for Entrepreneurial and Engaged Universities). Accessed 05 Oct. 2024. Accessed 8 Oct. 2024.

[88] The RUFORUM Blog (January 14, 2019). Gulu University Student Enterprise Win $1,000 from The Agri-preneursip Alliance. Accessed 8 Oct.2024.

"engages with fruits producer's organizations on contract basis to supply fruits as a way of reducing post-harvest loss, improving farmers' income, alleviating key micronutrients deficiencies, improving food security and boosting the level of investments of fruit the processing sector."[89] JuFresh Enterprise already employed one female youth to help in sales and plans to recruit more young people as part of its expansion. In 2018, the enterprise won $1,000 from the Agri-Preneurship Alliance. The student enterprise loan scheme was topped up by the faculty with funding from the Student Enterprise Scheme (SES) project at Gulu University further supported by RUFORUM-MASTERCARD Foundation and worth Uganda shillings two million[90].

The success of JuFresh Enterprise, as one of them explains, is largely due to the entrepreneurial course, but above all to the inspiration that comes from the power of words and symbols: "The inspiration to make dreams come true started after we joined Gulu University for our Master's in Agri-Enterprises Development in 2017. During the very first entrepreneurship lecture, our lecturer opened with this phrase *"money defecates money"*– narrates Okello Robine the General manager and Team Leader of the group. He says that this meant that one should put money in a business to make more money**."**[91]

This example shows that entrepreneurship training, combined with incubation and mentoring programs and innovative financing mechanisms, could help unlock students' entrepreneurial potential and generate ventures capable of achieving sustainable growth.

AgriSCALE Project: "Innovative learning and co-creation of teaching methodology for scaling entrepreneurship in food and agribusiness in Sub-Saharan Africa"

AgriSCALE Project is a joint initiative for creating a new entrepreneurship learning ecosystem in Sub-Saharan Africa (SSA) by implementing problem-based learning (PBL) methods in food and agribusiness programmes in higher education institutions (HEIs)[92]. The project encourages a close collaboration between the academic sector, corporate partners, and societal actors, aims at modernizing the education of the agro-sector in Africa, encouraging curricula transformation, enhancing the capabilities of academic staff, and promoting learning through real-life cases. Co-funded by the Erasmus+ Programme of the European Union, the project involves six African and three European Universities: two universities from Kenya: Jomo Kenyatta University of Agriculture and Technology and Egerton University, two universities from Uganda: Bishop Stuart University and Gulu University, two universities from Zambia: University of Zambia and Mulungushi University, two universities from Finland: Häme University of Applied Sciences and Aalto University, and one university from Italy: the University of Pavia. The project allowed:

- Partner universities to create a new network-based learning ecosystem.
- Students to earn through problem-based learning (PBL) methods and real-life challenges: "*Through student challenge, I obtained knowledge on innovative problem solving which involves*

[89] The RUFORUM Blog (January 14, 2019). Gulu University Student Enterprise Win $1,000 from The Agri-preneursip Alliance. Accessed 8 Oct.2024.

[90] The RUFORUM Blog (January 14, 2019). Gulu University Student Enterprise Win $1,000 from The Agri-preneursip Alliance. Accessed 8 Oct.2024.

[91] The RUFORUM Blog (January 14, 2019). Ibidem. Accessed 8 Oct.2024.

[92] AgriSCALE (2021). Scaling agro-entrepreneurship through learning based problem. First year of activities. Accessed 8Oct. 2024

identification challenges in the society and solving them using technology" (Kwesiga Martin, Gulu University Student)[93].

- Academia-industry to create a network for close collaboration between the industry, societal partners and academia.

Beyond the tangible results generated by programs (see the table 6), it's important to dwell on Problem Based Learning (PBL) method used in this project. Coined in 1974 by Howard Barrows, a leading figure at McMaster University Medical School (Barrows & Neufeld, 1974), the PBL has been applied across several disciplines (health, social sciences, law etc.) with noticeable results. PBL represents an important shift in the learning process, placing the student or the farmer (in the agriculture sector) at the centre of the decision-making process and the teacher as a mentor, a facilitator. Particularly oriented towards the problem-solving perspective, the PBL is a proven methodology for achieving employability and productivity[94]. This method would be particularly relevant in the process of integrating entrepreneurship and new and practical skills into university curricula. In the specific case of entrepreneurship, this method would enable students to glimpse a practical approach to helping find a solution to the problem they aspire to solve through social entrepreneurship. In interviews with key informants, in particular, some students cite material/family reasons. The following is an edifying illustration:

"*My family lived in extreme poverty, to the point where I couldn't pay for my studies. I translated this challenge into an opportunity to create a business to support not only my family but also my community*".

In addition to gaining more knowledge and acquiring new skills beyond classroom teaching, students, through the PBL Method, could become great problem-solvers by drawing on or building on their beliefs, motivations and values.

Similar projects include AgriEngage (Strengthening Agri-Entrepreneurship and Community Engagement Training in East, West and North Africa) and PBL-BioAfrica (a collaborative project, integrating problem-based learning (PBL) methods into bio-entrepreneurship, for strengthening the capacity in bioeconomy HEIs (Higher Education Institutions) in Kenya and Zambia. The Forest 21 (joint project for strengthening capacity in South African higher education in forestry) is also in line with this perspective. All these projects have produced significant results, demonstrating the strong potential of the PBL Method in the process of integrating entrepreneurship and agro-entrepreneurship into HEIs' training programs and curricula.

Beyond these initiatives, other experiments are underway across the African continent and the world. For instance, continental organizations such as the Association of African Universities have actively organized pedagogical and methodological courses in this respect, albeit on a small scale. (Okello et al., 2024). For instance, the Chike Okoli Centre for Entrepreneurial Studies (COCES) at Nnamdi Azikiwe University (Awka, Nigeria) offers entrepreneurship education as a compulsory course. The centre provides various programs and resources to develop entrepreneurial skills among students. The program comprise 5 courses: 1) Diploma Programme: a two-year Diploma Programme in Entrepreneurship; 2) Professional/Proficiency Certificate Course: a short term (3-6 months) professional/proficiency certificate courses on entrepreneurship for adults and youths to develop the entrepreneurial culture; 3) Industrial Training:

[93] Project Results | AgriSCALE, accessed 9 Oct. 2024.

[94] Consortia of partners of AgriSCALE and PBL Bio-Africa (2024). PBL PRACTITIONERS NETWORK IN AFRICA (PBL-Net Africa) 1st Strategy, 2024. Accessed, 9 Oct. 2024.

students are posted to different firms where they are exposed to such skills that they are being trained; 4) Degree Programme on Entrepreneurship: a BSc Degree Programme in Entrepreneurship since 2013/2014 academic year as approved by National Universities Commission (NUC)); 5) University Wide Course (ENT 301): Entrepreneurship Education and New Venture Creation: a course taught to all 300 level undergraduates irrespective of the discipline during the second semester of each academic session. Several students have benefitted from this general course on entrepreneurship (University Wide Course (ENT 301): Entrepreneurship Education and New Venture Creation) introduced in Nigerian Universities by the Federal Ministry of Education through the National Universities Commission.[95]

Here are some inspiring examples of entrepreneurship education from around the world:

- **United States**: Many universities in the U.S. have adopted a university-wide approach to entrepreneurship education (Xu & Mei, 2023). This means that entrepreneurship courses are offered across various disciplines, not just business schools. For example, courses in psychology, environmental science, and even fine arts often include elements of entrepreneurship ((Xu & Mei, 2023).
- **Canada**: The University of Ottawa offers courses like Design Thinking, New Product Development, and Software Venturing. They also focus on social entrepreneurship, family enterprise, and opportunity identification[96].
- **Europe**: The Erasmus+ Blended Intensive Programme integrates real-world entrepreneurship with international learning. This program connects students with entrepreneurial ecosystems globally, enhancing their learning outcomes and fostering international collaboration (Reimers, 2024).
- **Asia**: In China, entrepreneurship education is highly rated in universities, with a focus on innovation and addressing global challenges like climate change and poverty (Laine et al., 2024). Universities incorporate the Sustainable Development Goals (SDGs) into their entrepreneurship programs to stimulate innovation (Laine et al., 2024).

4.2 Setting up ad hoc structures to harness the power of entrepreneurship

In the process of institutionalizing their entrepreneurial practices, universities are setting up different ad hoc organizational units to harness research, innovation and entrepreneurship. The nature and forms of these ad hoc organizational units depend on the entrepreneurial culture, the different stages of the entrepreneurial process (idea generation; research and planning, financing, business execution, growth and expansion**),** national and international context etc. The scoping study, key informant interviews and country level webinars converge around the following most common organizational structures:

University (research) centres

These research centres are dedicated to promoting entrepreneurship and innovation, through research and the development of professional activities. They collaborate with faculties, incubators and accelerators, as well as other stakeholders within and outside the university. These centres perform hybrid functions of research, training or even support for other structures such as incubators/accelerators. In some cases, in addition to research, these centres serve as incubation and acceleration projects. For

[95] Programmes - Chike Okoli Centre for Entrepreneurial Studies (COCES). Accessed on 25 Nov. 2024.

[96] Daze, S. & Herrick, D. (Nov.2021). Entrepreneurship Education in Canada Annual Review – 2021. Telfer School of Management, University of Ottawa. Accessed on 25 Nov. 2024.

instance, the University of the Western Cape's Centre for Entrepreneurship and Innovation (CEI) exists to consolidate, coordinate and synergise entrepreneurship activities at UWC in order to (among other things): 1) Fulfil a coordinating role for the current and new entrepreneurship related activities at University of Western Cape (UWC) and external stakeholders; 2) Fundraise and develop a long-term sustainable financial model for the Centre by developing projects in entrepreneurship; 3) Provide the environment with a fellowship of support to new and existing entrepreneurs; 4) collaborate with national and international partners active in the area of entrepreneurship and entrepreneurship development; 5) encourage entrepreneurship across faculties and actively work to provide opportunities for students to market their businesses through market days and various pitching competitions.

Another example is that of The Bertha Centre for Social Innovation and Entrepreneurship at the University of Cape Town (UCT) Graduate School of Business. As the first specialised centre in Africa dedicated to advancing social innovation and entrepreneurship and globally ranked centre of excellence entrepreneurship, the Bertha Centre has integrated social innovation into the business school curriculum.[97] Wits Innovation Centre at University of Witwatersrand is another illustration of a university structure, but one specifically dedicated to supporting the connection between research and innovation and actively engaging in strengthening research impact, external engagement, commercialisation, and entrepreneurship. Other examples include Centre of Excellence in Entrepreneurship and Innovation at Kampala International University, the Centre for Entrepreneurship and Innovation (CEI) at Catholic University Institute of Buea etc.

University centres play a pivotal role by contributing to training and practical research on innovation, technology and entrepreneurship. They also act as intermediaries between universities and their stakeholders, sharing research results and identifying avenues for joint research or funding. In this regard, they are enablers for university entrepreneurship, knowledge transfer and the creation of companies emerging from the university ecosystem.

Highlight 4: Examples of Relevant University initiatives to support students

Here are a few inspiring examples from the four countries covered by this study.

❖ **South Africa**

- **University of Pretoria (UP): The UP-Entrepreneurship Programme** helps students turn their ideas into thriving enterprises. It offers guidance in market research, feasibility studies, product development, intellectual property protection, and market feasibility. The program also provides mentorship from industry experts and access to a network of innovators. Activities and services include:
    - **Training Courses[98]:** The Entrepreneurs POD online course is open to all students, regardless of their field of study.
    - **Incubation and acceleration**[99]: Through **TuksNovation** – a non-profit technology incubator and accelerator located at the University of Pretoria- UP provides start-ups with specialised product and business development support throughout their start-up growth journeys by assisting entrepreneurs to refine technologies and validate business models for the relevant markets.

[97] The Bertha Centre is the first academic centre in Africa dedicated to advancing social innovation and entrepreneurship.

[98] Training Courses | University of Pretoria

[99] About - TuksNovation

- **Mentorship and Training**[100]: The incubator provides a space where students and researchers can meet mentors, entrepreneurial peers, and potential clients, while having the professional appearance of an established business and gaining access to an established network.
- **Research Solutions**[101]: Through Enterprises University of Pretoria (Pty) Ltd (Enterprises UP), UP provides advisory services and commercial research and short courses (Face-to-Face training at an Enterprises UP Venue or the client's premises, hybrid learning options, virtual or Online Training).
- **Patenting and disclosure**[102]: UP provide guidance and support for inventors looking to patent their novel innovations.
- **Workspaces and Prototyping**[103]: UP has set a makerspace, a creative laboratory open to all registered university students and staff.

- **University of the Western Cape (UWC):** The Centre for Entrepreneurship and Innovation (CEI) at UWC aims to develop entrepreneurial thinking across all disciplines. The CEI offers opportunities for students to market their businesses through market days and pitching competitions2. It also collaborates with national and international partners to support entrepreneurship development. UWC Centre of Entrepreneurship and Innovation has recently launched a New Location in Parow to improve Service to Community Businesses. Business management skills, funding opportunities, digital skills, and design thinking skills, which will be supplemented with personalised coaching and mentoring support[104].

❖ **Uganda**

- **Makerere University Business School (MUBS) Entrepreneurship, Innovation and Incubation Centre p**rovides a platform for students and researchers to develop their business ideas into viable enterprises. It offers hands-on training, mentorship and coaching services for both urban and rural citizens aimed at igniting entrepreneurial action.[105]
  The centre activities include the following activities: [106] Incubation Programs for staff and students' entrepreneurs, The 24-hour Innopreneur Bootcamp, The Centre Runs 24hr Bootcamps, Tailor-made Programmes (tailor-made training for institutions in the public and private sector in entrepreneurship and business management), Youth Entrepreneurship Trainings, the Graduates into Employment Programme (G.I.E.P).
  Focus Areas:
  - Business Clinic
  - Resource Centre
  - Monthly Breakfast Meetings
  - The Last Lecture
  - The MUBS Women Forum:

✓ **University of Makerere's Research Support Services**: Makerere University offers research support services to small and medium enterprises (SMEs) through its libraries. These services

[100] Mentorship and Training | University of Pretoria

[101] Enterprises UP

[102] Patenting and Disclosure | University of Pretoria

[103] Workspace and Prototyping | University of Pretoria

[104] UWC News and Announcements (2 October 2024). UWC Centre of Entrepreneurship and Innovation New Location in Parow Improves Service to Community Businesses. Accessed on 29 Nov. 2024.

[105] https://eiic.mubs.ac.ug/

[106] MUBS Entrepreneurship, Innovation and Incubation Centre Quarterly Newsletter. January - March 2022. Accessed on 29 Nov. 2024.

include developing research collections, providing data literacy training, and offering bibliometric analysis to help SMEs leverage research for innovation and entrepreneurship.[107]

- **Mbarara University of Science and technology**: Mbarara University of Science and Technology (MUST) is actively supporting its students and researchers in developing and implementing their business ideas and plans through several initiatives:
  - ✓ **Business Incubation Centre**: Thanks to a $50,000 grant from the African Development Bank (AfDB), MUST has established a business incubation centre.[108] This centre provides a supportive environment for students and researchers to develop their business ideas, offering mentorship, resources, and training.
  - ✓ **Technology and Innovation Support Centre (TISC)**: The centre provides access to specialized databases and resources, helping students and researchers improve the quality of their innovations and commercialize them effectively.[109]
  - ✓ **Innovation Hubs**: The university oversees several innovation hubs, including CAMTEC Uganda, Pharmbiotrac, and the Business Incubation Centre (BIC).[110]
  - ✓ **Entrepreneurship Training**: MUST offers practical, entrepreneurship-oriented training through partnerships with organizations like UNESCO-CFIT III.[111].
  - ✓ **MUST Holdings Company**: The university has also launched the MUST Holdings Company, which aims to enhance research, safeguard intellectual property, and create jobs[112]

❖ **Senegal**

- **École Supérieure Polytechnique de Dakar (ESP)**: ESP has implemented various programs to encourage entrepreneurship among its students. La Forge is among these initiatives. It is a space for exchange, co-working and innovation set up in 2024 by the Ecole Supérieure Polytechnique de Dakar with the support of the UNDP to promote entrepreneurship and creativity among students. It has already incubated several promising start-ups. For instance, Betty Kane, a recent graduate from the Department of Chemical Engineering and Applied Biology, co-founded CHEESE' SEN, a start-up producing "Cheeses made in Senegal."[113] Betty's start-up won several awards and she now serves as a female entrepreneurship ambassador. Arraw Tech, a start up highlighted as apart of the business cases, and Tolbi- a pan-African Climate-Agtech using new technologies to significantly contribute to food security in Africa through sustainable agriculture and improving the lives of small-scale producers.- were incubated at La Forge ESP.
- Incubateur UGB Business Accelerator (Université Gaston Berger): A structure to welcome and support project leaders, business creation and development.

[107] Buwule, R. S., & Mutula, S. M. (2017). Research support services to small and medium enterprises by university libraries in Uganda: An entrepreneurial and innovation strategy. *South African Journal of Information Management*, *19*(1), 1-8. Accessed on29 Nov. 2024

[108] Agutamba, K. (The Nile Post: TUE 18 May 2021 12:19). Mbarara University gets $50,000 grant to start business incubation centre. Accessed on29 Nov. 2024.

[109] Nsimenta, B. (The Nile Post: Wed. 20 Nov. 2024 17:45). MUST Launches Innovation Center, Holdings Company for Sustainability. Accessed on29 Nov. 2024.

[110] Nsimenta, B. (The Nile Post: Wed.20 Nov. 692024 17:45). Ibidem. Accessed on 29 Nov. 2024.

[111] Resilient Digital Africa (25 April 2024). Uganda: Students harness technological innovation for sustainable development. Accessed on29 Nov. 2024.

[112] Nsimenta, B. (The Nile Post: WED 20 Nov., 2024 17:45). Op. Cit. Accessed on29 Nov. 2024.

[113] UNESCO (2023). How universities in Senegal are empowering girls and women with skills and entrepreneurship. Accessed on29 Nov. 2024.

The services provided include:

- **Training:** Training and capacity building and personal Coaching.
- **Research & Studies**: Transfer and valorisation of research outputs, R&D.
- **Assistance**: Networking/hosting/technical assistance.
- **Financial support**: Support for fundraising, consultancy -events Achievements 2017 – 2022

Incubateur UGB Business Accelerator (Université Gaston Berger) is part of various initiatives aimed at fostering entrepreneurship and job creation, particularly in sectors like agriculture. For instance, the project 'Promoting youth entrepreneurship and job creation in the West African rice value chain' (PEJERIZ) trained over 100 young Senegalese in rice entrepreneurship, providing them with technical knowledge and entrepreneurial skills[114].

❖ **Cameroon**

The Technipole Sup Valor of École Nationale Supérieure Polytechnique: The Technipole Sup Valor is an incubator created by the École Nationale Supérieure Polytechnique of the University of Yaoundé I in Cameroon. Its mission is to contribute to the socio-economic development of the country by identifying and supporting young entrepreneurs with innovative or high-growth potential projects. The- 73 -echnotor supports entrepreneurs through:

- Entrepreneurship training
- Advice and coaching
- Financing
- Accommodation for start-ups

Technipole offers:

- Premises for your business work, a meeting room, a computer room with computers, printers and broadband internet access.
- A website where you can search for a project idea or information about your project: TECHNIPEDIA
- Qualified experts to train and support you.
- Funding to start up or expand your business if your project is innovative or has a high probability of growth.
- A range of activities to help you meet new people and find out more about your target market
- A cafeteria area with hot and cold drinks and sandwiches.

Entrepreneurs incubated by the centre are housed for two years, including three months in an incubator and a maximum of 21 months in an incubator. Technipole Sup Valor, which focuses on the digital sector, also advises young entrepreneurs in all other sectors. It has already incubated several start-ups in Cameroon. Arthur Zang's Himore Medical, Alain Nteff's GiftedMom and Arielle Kitio's Caysti are among the best known.[115]

- The **Support Programme for the University of Buea Livestock Production and Agripreneurship Students Business Incubator (SP UB LPA SBI)** is an innovative initiative at the University of Buea in Cameroon. This program aims to enhance the competitiveness of Cameroon's livestock production sector by integrating a business incubator approach into the curriculum of the Master of Science in Animal Science (Livestock Production)[116].

[114] AfricaRice (?). Building capacity of youth in rice entrepreneurship brings new hope to Senegal. Accessed on 29 Nov. 2024. Accessed on 29 Nov. 2024.

[115]Koba, M. (24 Jan. 2024). Technipole Sup Valor : incubateur d'entreprise de l'école nationale supérieure polytechnique de l'université de Yaoundé). Wearetech.africa. Accessed on 29 Nov. 2024.

[116] Ewane, D., Monah, N.L., Mvondo, A.J., Esunge, E.E.E., Thaddeus, E.E., Nkemzi, A.B., Itoe, M.S., Ngonjuyi, N.W., Lytia, M.L. & Oben, P.M. (2023). A business incubator approach to the teaching of livestock production at the University of Buea: Evolution, conception and implementation hurdles. RUFORUM Working Document Series (ISSN 1607-9345), No. 22:355-365. Accessed on 29 Nov. 2024.

Here are some key features of the program[117]:

1. **Experiential Learning**: Students implement short-duration business plans (maximum six months) in animal production on the university campus. They are guided by coaches and mentors and take real-time risks to produce and sell animal products1.
2. **Graduate Family Farmers**: Students leave the university with a feasibility study and business plan, preparing them to become agripreneurs.
3. **Revenue Generation**: The program has already produced graduates who have generated revenue through their business plans, such as broiler chicken production.
4. **Support and Mentorship**: The program includes mentorship and advisory support to help students overcome challenges and succeed in their ventures.
5. **Proof of Concept**: The program demonstrates that experiential learning can improve entrepreneurial intentions among graduates.

This initiative is still in its early stages but has shown promising results, with graduates achieving average profits after loan and interest repayment.

These examples demonstrate the transformative power of entrepreneurship education in equipping students and staff with the mindset, skills, and knowledge needed to navigate the future confidently.

Incubators/Accelerators/Labs

In recent years, African innovation and entrepreneurship ecosystems have been enriched by multiple and diversified support organizations. Among these, incubators, accelerators, labs and other entrepreneurship support organizations have progressively made their mark through innovative services and benefits like funding, mentorship, office space and networking etc. According to Tracxn, Africa has 384 Accelerators & Incubators which have a combined portfolio of 5.38K companies.[118]

At the HEIs level, the same is true. The incubator and accelerator movement has spread significantly into the university sphere, thanks to the various programs and initiatives put in place to give substance to their third mission, that of community engagement. According to the Director of Makerere Innovation Hub, structures such as incubators, accelerators and innovation hubs are relevant instruments for universities to support their social mission projects. They are springboards, she added, for support young entrepreneurs in their entrepreneurial journey. In this regard, number of public universities have set up either incubator/accelerators or innovation hubs. In the four countries covered by the study, many public universities have initiated various programs supported by incubators/accelerators, innovation hubs, science parks and so on. The incubator is the most widespread form through which universities uplift students' projects. Indeed, incubators often have the mission of supporting start-ups or student projects in their initial development through capacity-building and seed funding (grants or loans). In some universities, such as Université Chekh Anta Diop (UCAD), legal and institutional mechanisms are in place to ensure the credibility and sustainability of such structures. For example:

- The Student Entrepreneur Statute (SEE), which makes it possible to integrate a business creation project into the student's academic career.

[117] Ewane et al. (2023). Ibidem. Accessed on 29 Nov. 2024.

[118] Tracxn ((Last updated, January 10, 2025). Accelerators & Incubators in Africa. . Accessed on 29 Nov. 2024.

- Pôle Étudiant Entrepreneur (PEE), a co-working space to meet the needs of students who wish to acquire or have acquired the SEE.

The process generally takes place in three phases:

- **Selection:** The selection process, as the Director Dekkal Yaakar (the incubator of USSEIN) explains, often involves a call for applications, during which the best ideas or projects are examined by a jury. In addition to the project, he added, "pitch sessions are organized to separate the candidates". (KII July 2024). The pitch is a crucial moment in the development process of start-ups or student project ideas. Upstream, it enables students to sell their project and have the chance to be selected and included in a cohort that will benefit from various services offered during the incubation period. Downstream, the pitch enables beneficiaries to convince potential investors to establish partnerships.
- **Capacity building**: This is one of the most significant services offered by incubators. Such services provide start-ups with access to training, coaching, mentoring programs as well logistical and technical resources and shared office space, networking. The facilitator of the CATI^2-Uds[119] maintains: *"The various cohorts of students we've supported since 2016 have been able to benefit from a variety of resources, ranging from formalizing their business idea, business management training, coaching or mentoring to small amounts of funding to really get their business off the ground. Today, this support is really starting to have a significant impact on the entrepreneurs themselves and the Dschang regional ecosystem.''* (KII July 2024). One of the beneficiaries of the first cohort, who founded an agricultural start-up, adds: *"Before the training I received at CATI, I just had a business idea. The program not only enabled me to formalize my business, but also to benefit from other resources that allowed me to achieve important milestones in just a few years.''* (KII September 2024).
- **Funding**: In some cases, recipients may have access to direct financing (grants or loans) or investment opportunities for more advanced projects. Depending on the purpose of the competition, these funds offer start-up entrepreneurs the opportunity to take their project idea or start-up to the next level. For example, some funding opportunities could, among other things, help start-ups to refine their business plans, develop and/or test prototypes, or undertake other business activities: *"The 1st prize at the Agro-Entrepreneurship Challenge at Mbarara University of Science and Technology (MUST, Uganda) we won has enabled us to refine our technology and, above all, to test it with farmers in order to continue improving it so that it meets farmers' needs",* says one of the co-founders of Smart Kuku Brooder, a device aimed at contributing to solve one of the biggest problems facing the farmers, high chick mortality due to poor regulation of temperature. Incubator funding comes from a variety of sources, including the private sector, aid agencies and, occasionally, some funds provided by the universities themselves. For example, Dekkal Yaakar Incubator received financial support from ENABEL (Belgium), while a strategic partnership between Kabale University (Uganda) and UNDP has been established to develop

[119] Centre d'Appui à la Technologie, à l'Innovation et à l'Incubation de l'Université de Dschang (CATI^2-UDs) is the University of Dschang Technology, Innovation and Incubation Support Center. Accessed 17 Oct. 2024.

innovation ecosystems within Uganda's public universities and to implement the Youth4Business Innovation and Entrepreneurship Facility. [120]

Other initiatives include umbrella organizations such as the Entrepreneurship Development in Higher Education (EDHE). This initiative is highlighted in below**.**

Highlight 5: The Entrepreneurship Development in Higher Education (EDHE)

The **Entrepreneurship Development in Higher Education (EDHE)** program in South Africa is an initiative by Universities South Africa (USAf) aimed at fostering entrepreneurial capacity among students, academics, and leaders. **Universities South Africa (USAf)**, formerly known as Higher Education South Africa (HESA), is an umbrella body representing the 26 public universities in South Africa. Here are some key aspects of the **EDHE:**

The goals the EDHE program are[121]:

- Student entrepreneurship, i.e. mobilising national students and graduates 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 to students and graduates through the offering of relevant knowledge, transferral of practical skills and the application of business principles across disciplines.
- Developing entrepreneurial universities, i.e. creating a conducive environment that will enable universities to adapt strategically and embark on projects whereby third-stream income can be generated through innovative business ideas.

Activities

- **Workshops and Bootcamps**: The program organizes various workshops and bootcamps to develop entrepreneurial skills and mindset among participants.
- **Hackathons and Competitions**: Events like hackathons and competitions are held to encourage innovation and problem-solving among students.
- **Incubation Programs**: The program supports incubation programs that provide resources and mentorship to help students and academics develop their business ideas.

Impact

- **Economic Empowerment**: The program contributes to the economic empowerment of students and academics by fostering entrepreneurial skills and opportunities.
- **Innovation and Job Creation**: By promoting entrepreneurship, the program helps create new businesses and job opportunities, contributing to economic growth.

The EDHE program is a significant step towards enhancing the entrepreneurial capacity of higher education institutions in South Africa, benefiting both individuals and the broader economy.

4.3 Enhancing knowledge and commercialization of research outputs through IP and technology transfer

As agents of social transformation, African HEIs are increasingly aware of the need to leverage their knowledge to improve economic growth while contributing to sustainable prosperity through technology

[120] Campus News (Kabale University, 7 July 2024). Kabale University and UNDP Uganda partner to establish a Regional Business Incubator. Accessed 17 Oct. 2024.

[121] About - EDHE

and knowledge transfer, innovation, business incubation and commercialization[122]. In this regard, efforts are underway to help mainstream the valorization of knowledge and research outputs. While South Africa has long had a head start on most of the countries of Sub-Saharan Africa, efforts are gradually being made by other countries, not only by striving to produce quality research, but also by valorizing the results of their academic research. The Head of the Innovation and Entrepreneurship Division and Coordinator of the Pôle Étudiant Entrepreneur at UCAD acknowledges that Senegalese universities are lagging behind in this area: "We are aware that our universities are lagging behind in terms of knowledge valorization, and even more so when it comes to intellectual property management and technology transfer. However, we are well on the way to bridging this gap (KI Interviews, Aug. 2024). He added: "Not only have we created the Research and Innovation Department, whose main mission is to support the definition and implementation of the University's research and innovation policy. Among other things, it is responsible for drawing up an inventory of the University's intellectual property assets and ensuring that research results are protected and promoted." (KI Interviews, Aug. 2024). In addition, we have also set up the Direction du Centre d'Incubation, de Vulgarisation et d'Appui aux Communautés (Incubation, Extension and Community Support Centre) to strengthen training, research and extension, and to foster an entrepreneurial spirit among students, teaching and research staff.(KI Interviews, Aug. 2024). In Uganda, Makerere University has made significant strides in technology transfer and commercialization of research outputs. Indeed, Makerere University Innovations Pod (under the Tubuktu Initiative) funded by the United Nations Development Programme (UNDP) will soon start driving commercialization of innovations and enterprises resulting from the research undertaken by the scholars from Makerere University.[123] In South Africa, universities have put in place structures and mechanisms to help manage intellectual property and technology transfer. According to the Director: Innovation & Contracts: Research Development at UFS, relevant mechanisms, resources and even policies are mobilized to protect, disclose and commercialize the property of UFS researchers (KI Interviews, June 2024). He added that they have set up an initiative called the Industry Engagement Mentoring Programme that help young academics develop their skills to engage with industry stakeholders and be able to establish collaboration. Such initiatives have produced tangible results. The Innovation and Commercialisation (I&C) Division of Stellenbosch University (SU) has also put in place an institutional framework and policies and regulations that are enabling the valorization and translating research outputs into spin-out companies and other technologies with different IP status and opportunity (seeking investments, potential partners, development partners, licensing etc.)" (KII, 28 June 2024). According to Deputy Vice-Chancellor: Research, Innovation and Postgraduate Studies, Stellenbosch University, these significant milestones recorded by South African studies, compared with other African countries, can be explained by institutional environment conducive to research, as well as funding and regulatory mechanisms, including the intellectual property act.

[122] USAID (2014). African Higher Education: Opportunities For Transformative Change For Sustainable Development. Accessed on 17 Oct. 2024.

[123] Betty Kyakuwa (2023). Makerere University Innovations Hub set to commercialize innovations. Makerere University. Business & Management. Accessed 17 Oct.2024.

Highlight 6: Innovation and Commercialisation at Stellenbosch University

Stellenbosch University (SU) has a robust framework for fostering innovation and commercialization through its **Innovation and Commercialisation (I&C) Division**[124]. The key components include:

Innovus Technology Transfer Office (TTO)[125]

- **Role**: Works with SU staff and students to identify, protect, manage, and commercialize their inventions and intellectual property.
- **Activities**: Licensing intellectual property to commercial entities or forming spin-out companies.
- **Impact**: Ensures compliance with the Intellectual Property Rights from Publicly Financed Research and Development Act (51 of 2008) and SU policies.

SU LaunchLab[126]

- **Role**: Provides a platform for student and faculty entrepreneurship.
- **Activities**: Offers entrepreneurial mindset workshops, faculty-specific bootcamps, SU Hackathons, EDHE Intervarsity, and ResNova incubation programs.
- **Impact**: Supports new company creation and onboarding, ensuring good corporate governance and practices.
    - 151 Patents Generated since 2009 – #1 in South Africa
    - 30,000+ World Class Undergrad & Graduate Students
    - 1,000+ Academic Staff
    - Global HQ for 20% of South African Stock Exchange
    - Largest concentration of USD millionaires anywhere in Africa.

Other Initiatives[127]

- **SUNCOM**: Focuses on commercializing SU's research outputs.
- **Short Courses Division**: Provides operational and administrative services for presenting short courses.
- **Stellenbosch Network**: Connects SU with industry partners and other stakeholders.
- **US Enterprises (Pty) Ltd (USE): a** SU's owned company that holds and manages the institution's shareholding in the SU's Group of Companies.

Impacts

The impact of Stellenbosch University's (SU) Innovation and Commercialisation initiatives has been significant in several key areas:

Economic Growth

- **Spin-out Companies**: The formation of spin-out companies has created jobs and stimulated local economic growth. Examples of Spin-Out companies include:
    - **Biotikum (Pty) Ltd**: This company develops and produces microbial additives for the agricultural industry. Their products include host-specific animal probiotics, microbial silage inoculants, and soil inoculants, which improve operations in a sustainable manner1.

[124] About us - Innovus | Making Stellenbosch University Innovation Matter, Accessed 0n 24 Nov. 2024.

[125] Technology Transfer Office - Innovus | Making Stellenbosch University Innovation Matter, Accessed 0n 24 Nov. 2024.

[126] About - LaunchLab. Accessed 0n 24 Nov. 2024.

[127] About us - Innovus | Making Stellenbosch University Innovation Matter. Accessed 0n 24 Nov. 2024

- **Susento (Pty) Ltd**: Founded by Dr. Elsje Pieterse, Dr. Michael Woods, and Dr. Neill Goosen, Susento focuses on developing sustainable protein sources from insects for both human and animal consumption to addresses food security and sustainability challenges.
- **Revenue Generation**: Licensing intellectual property and commercializing research outputs have generated revenue for the university, supporting further research and development.

Research Advancements

- **Increased Research Funding**: Successful commercialization efforts attract additional funding for research, enabling further advancements in various fields.
- **Collaborative Projects**: Partnerships with industry have led to collaborative research projects, driving innovation and practical applications of academic research. Examples of collaborative projects include[128]:
  - **Centres of Vocational Excellence (CoVE) for Climate-Smart Agriculture**: This project, funded under the Erasmus+ programme of the European Union, is a joint initiative between Stellenbosch University, Maastricht University, Mendel University, and AgriColleges International. The project aims to support students to become responsive, digitally skilled, and sustainable-oriented sector professionals in the climate- and water-smart horticulture sector1.
  - **Fraunhofer Innovation Platform for Water-Energy-Food Nexus**: Established in 2020, this strategic platform consolidates the long-standing collaboration between Stellenbosch University and the Fraunhofer-Gesellschaft. The goal is to develop sustainable solutions to promote water, energy, and food security1.

DIVAGRI Project: This project proposes a wide range of bio-based innovative solutions adapted to specific conditions in target countries. It focuses on ecosystem restoration, diverse crop production in regenerative agricultural systems, mobile biorefineries for biomass conversion, and the innovative clay-based micro-irrigation system SLECI (Self-regulating, Low Energy, Clay-based Irrigation).

Entrepreneurship and Skills Development

- **Entrepreneurial Mindset**: Programs like SU LaunchLab have fostered an entrepreneurial mindset among students and faculty, encouraging innovation and business creation.
- **Skill Development**: Participants in SU's initiatives gain valuable skills in business management, marketing, and product development.

Societal Impact

- **Innovative Solutions**: Commercialized research has led to the development of innovative solutions that address societal challenges, such as renewable energy technologies and medical advancements.
- **Community Engagement**: SU's initiatives have strengthened ties between the university and the community, promoting engagement and collaboration. Example:
  - **SUNCEP (Stellenbosch University Network for Community Engagement and Partnerships)[129]**: This network supports various community engagement projects, such as the Breede Digi Cluster and Family Math, which aims to improve education and community development.

4.4 Other initiatives

Other initiatives include academia-industry-community. Often referred to as the triple helix, where universities (producing research), industries (commercializing goods and services) and governments (regulating the markets) collaborate in sometimes complex innovation projects that may involve other stakeholders such as communities. Examples include the Limpopo Agrifood Processing Technology Station

[128] Current Projects. Accssed on 24 Nov.2024.

[129] Social Impact. Accessed on 24 Nov.2024.

– University of Limpopo and Agri-food Technology Station – Cape Peninsula University of Technology initiated by South African Technology Innovation Agency (TIA) or The University of the Free State (**UFS) Wool Wise** Community Project. These forms of collaboration are bridging the gap between theory and practice, while helping MSc and PhD students apply what they learned in the classroom, enhance the learning experience and yield better outcomes. Indeed, "learners in programs with university–industry academic partnerships—including adjunct faculty and guest speakers from industry, mentors, and advisory board members' insights into program development—could enjoy expanded access to industry expertise."[130] This also enables HEIs to acquire knowledge and capitalise on experience through different forms of collaboration with communities. For example, some of the capacity-building programmes run by the USSEIN include student entrepreneurs and young project leaders from local communities. This not only enables interactive learning, but also promotes networking and opens up opportunities for collaboration between universities and local communities.

The **Vaal University of Technology's Southern Gauteng Science and Technology Park (VUTSGSTP)** can inspire and illustrate an effective collaboration with the private sector:

Highlight 7: The Vaal University of Technology's Southern Gauteng Science and Technology Park (VUTSGSTP)

The **Vaal University of Technology's Southern Gauteng Science and Technology Park (VUTSGSTP)**[131] is a significant hub for innovation and technology development in South Africa. Located in Sebokeng, it operates a unique, world-class **Additive Manufacturing precinct** that assists entrepreneurs in developing product prototypes. Here are some key features:

1. **Advanced Manufacturing Precinct**: This precinct specializes in advanced product design and manufacturing, including state-of-the-art 3D printing technology.
2. **Technology Platforms**: The park houses several technology platforms, such as the **Technology Station in Sebokeng and Upington**, the **Idea to Product (I2P) lab**, the **Centre of Footwear Entrepreneurship (COFE)**, and the **Energy Optimisation Unit (EOU)**.
3. **Collaborations and Partnerships**: The park collaborates with major partners like **Arcelor Mittal** and **Sasol** and is supported by the **Technology Innovation Agency (TIA)**.
4. **Support for Entrepreneurs**: It provides mentorship, training, and resources to help entrepreneurs develop their ideas into viable products.
5. **Focus on Various Sectors**: The park services clients in sectors such as fashion, hospitality, tourism, and ICT, with a core focus on technology transfer and enterprise development.

The VUTSGSTP aims to align with government priorities and leverage its competitive advantage to drive regional development and innovation.

[130] University of Minnesota (January 2024). The Benefits of Collaboration Between University and Industry. Workforce Development Solutions. Accessed 22 Oct. 2024.

[131] Science Park proves its worth – Vaal University of Technology

5. Business Cases

A total of 10 business cases were selected at the end of the search process, based on the criteria presented in the methodology section. A list of additional business cases is appended.

From a geographical standpoint, they are distributed as follows:

- Cameroon : 2
- Senegal : 2
- Uganda : 2
- South Africa : 4

Table 8: The selected business cases

Business Cases	Country	University and other partners	Sector/Areas	Size and stage of development	Year/Founder and other references
LUNAS FOODS Ltd	Cameroon	University of Bamenda	Agribusiness Food 	Start-up	Jelah Christiane http://www.lunasfoodsltd.com/
Nature Guide	Cameroon	University of Dschang	Pesticide Biofertilizers as substitutes for conventional pesticides to combat soil degradation	Start-up	2021 Nkefoma Godwil Fombiuwing
Arraw Tech	Senegal	Ecole Supérieure Polytechnique (ESP, UCAD)	Manufacturing of industrial machinery Company - Areas: Agri-food, agro-industry	Start-up: 2-10 employees	Head office: Dakar Type: Food tech - Founded in 2021 by 2 students
Sesame+	Senegal	ISRA		Start-up	Created in 2022 by four experts in various fields, including Odilon-Parfait Akotchayé
Immobazyme products range from growth factors, a primary ingredient in cell-cultured meat, to enzymes like dextranase, which is used to break down contaminants in sugar.	South Africa	**Stellenbosch University LaunchLab**	Ingredient in cell-cultured meat;enzymes Immobazyme also ventured into the food and beverage industry, recently, with	Start-up: 3 founders and 9 employees.	Founded in 2019 by Dominic Nicholas, Ethan Hunter, and Nicholas Enslin

Business Cases	Country	University and other partners	Sector/Areas	Size and stage of development	Year/Founder and other references
			a variety of novel food ingredients created using its precision fermentation platform.		
ADAGIN TECHNOLOGIES From a Simple Student Hustle in 2016 to an agritech company today.	South Africa	Former SU LaunchLab Companies	Precision farming, precision harvesting, precision packing, precision job costing.	Company (expansion to Sanlucar (Ecuador) on August 2024)	2016: FG Adriaanse, joined by Justin Vellacott and JD Naudé as co-founders
TerraClim (Pty) Ltd TerraClim uses pioneering integrated data resources to give you access to detailed climate and terrain information that will help you navigate the increase in seasonal changes. TerraClim offers precise climate and environmental insights, helping you optimise planting, harvesting and resource management.	South Africa	Stellenbosch University, Innovus	Climate Resilience. Food Security. Data driven Solutions.	Start-up	2022: Dr. Tara Southey, Founder TerraClim
K'saselihle Fresh Vegetables Specializes in growing sugar beans, cabbages, potatoes, green peppers, spinach and butternut	South Africa	DUT DUT Midlands Entrepreneurship Centre	agribusiness	Start-up: 6-15 employees	2019, Mbali Bengu,
Gordon's Agricultural Organization Uganda Limited (GAO-UG)	Uganda	Kampala University / Gulu University / TAGDEV 1.0	Agriculture: market access, climate-smart agriculture; credit support	Employs over 40 young men and women. Start-up.	Susan Adong (Cofounder)

Business Cases	Country	University and other partners	Sector/Areas	Size and stage of development	Year/Founder and other references
GAO-UG supports farmers by providing market access, climate-smart agricultural inputs, and technical services, including borehole drilling, extension services, and credit support.					
The Smart kuku Brooder System is an automatic brooding system that started as an undergraduate project to solve one of the challenges in my local community, that is poor temperature regulation during brooding	Uganda	Mbarara University of Science and Technology, Uganda	Farm (poultry): mechanization	Start-up	2023 Peter Okoci, Maureen Nayebare, Aaron Etyang, Peter Beinamaani, and Frank Magezi Rubandamayonza

5.1 A diversity of business cases

The selected companies and start-ups offer diversity in terms of geography (different start-ups from different universities in four countries), fields (processing, agritech, biopesticide, data and climate resilience, food processing etc.), gender etc. They operate in the agricultural sector in the broadest sense, including food and livestock, and address a range of issues.

5.1.1 Addressing food security and healthy food

Food and nutrition insecurity remain one of the main challenges in Africa that hinders sustainable development. Conflict, extreme weather events / climate variability and economic slowdown are some of the key drivers of food insecurity and malnutrition (child malnutrition) in the continent. Multidimensional poverty and inequality among other structural problems continue to worsen the prevalence of hunger and malnutrition in Africa[132].

Student ventures aim at addressing this important issue in different ways:

LUNAS FOODS Ltd (Cameroon) is an agribusiness food company that adds value to African traditional meals by making them convenient to handle and prepare, available and affordable for people with active busy lifestyles. Founded by Jelah Bisih Christiane, and incubated at Bamenda University, Lunas Food aims at addressing malnutrition, which is a huge problem in her community where children remain weak and unhealthy[133]. Indeed, available imported food options are expensive and can be unaffordable for average

[132] African Union (?). African Union Humanitarian Summit and Pledging Conference Background Paper for Theme 2- Addressing Food Security and Nutrition challenges in the humanitarian space. Accessed 08 sept. 2024.

[133] LUNAS Pitchdeck. Accessed 18 sept. 2024

families. In addition, most options are also ultra-processed, high in salt, sugar and preservative and low in nutritional value.

The proposed solution:

- provides children with necessary nutrients for growth and optimal performance.
- uses locally available and abundant food products to obtain a unique daily ritual for nourishment.
- provides a nutrient-dense powder blend carefully formulated to meet the specific dietary needs of toddlers, convalescents and higher intellectual performers.

The operational plan of Lunas Food includes research and product development, procurement of raw material, machinery and other consumables, processing and packaging etc. According to this plan, the societal impact of Lunas Food includes:

- Stimulating economic growth through earning for all throughout its value chain.
- Contributing to the attainment of 3SDGs: No poverty, Zero Hunger and better health.
- Facilitating employability of youth in the community
- Fostering relief in the areas of crisis and poverty.
- Adding value to lives through provision of optimal nutrition food options.

Arraw Tech (Senegal): Arraw Tech SARL specializes in the manufacture of food processing machinery which transforms millet powder into granules. Founded in 2021 by two students from Ecole Supérieure Polytechnique (Dakar), the start-up was incubated at La Forge, an innovation and entrepreneurship center dedicated to the emergence of solutions for sustainable development.

La forge comprises four main entities :

- La Forge Academy: an educational innovation center focused on entrepreneurship and innovation.
- La Forge Accelerator: Accompanying start-ups and spin-offs from idea to concrete development.
- La Forge Factory: A framework for collaboration between organizations and innovative project leaders.
- La Forge Venture: Special fund dedicated to entrepreneurship and innovation.

Cereal processing products are highly coveted in Senegal, particularly the arraw, which is a must-have for dinners, christenings and so on.

> *"Our project, entitled Arraw Tech, is a processing machine set up to modernize the Arraw manufacturing process, which will then increase productivity and ultimately contribute to the mass export of this typically Senegalese product. Our priority with this project is to provide the best possible support to women members of MSEs and agricultural processing associations. In this way, the development and implementation of Arraw Tech will not only contribute to the country's economic development, but also promote women's entrepreneurship and autonomy."* (CN, Co-founder, KI interviews, Jul. 2024).

Nicknamed Noflay ("quietude", "tranquility" in Wolof, one of the local languages in Senegal), the start-up has tested and is already marketing two machines, the smaller of which can process up to 200kg per hour and the larger up to 500kg per hour).

> *"Our ambition now is to continue improving the technology so as to be able to mass-produce and mass-market in the next few years. But that still requires investment that we haven't yet secured."* Adds one of the co-founders. (CN, Co-founder, KI interviews, Jul. 2024).

SESAME+: Founded in 2022 by four experts from different fields, SESAME+ is an innovative company specializing in the transformation of sesame into a variety of useful products, from food to non-food. The start-up places particular emphasis on body care, exploiting the beneficial properties of sesame oil in cosmetics.

> *"I'm currently a researcher at ISRA. I'm also an entrepreneur. I created the Sesame+ start-up to contribute to the valorization of sesame products. My aim is to create 1,000 products from the valorization of sesame. The idea of creating this start-up goes back to my student days, particularly when I was at the bachelor's level. I was conducting a study on sesame. There was only one industry in Benin at the time, and I was aware of the potential of the sesame market, since everything produced in Africa is resold in China, while China itself grows sesame. Later, when I started my master's degree at the University of Dakar, I told my supervisor that I wanted to work on sesame. He then put me in touch with a sesame expert. Since then, I've set up a team to process sesame at ISRA. In 2022, we acquired our first machine. Later, I thought of expanding into cosmetics. I was made aware that the local cosmetics market was looking for sesame oil because sesame is not processed for cosmetics in Senegal. So, we seized this niche and are working with a cosmetics laboratory based in Dakar. Our ambition is to add value to the entire sesame value chain, from cultivation to consumption. For now, we have no salary. We work we partners depending on the activity or service we are seeking".* (OPA, co-founder, KI Interviews).

Sesame+ offers the following products:

- Food products: SESAME+ offers various sesame-based food products, such as sesame oil, sesame seeds and sesame by-products.
- Non-food products: SESAME+ offers cosmetic products, including massage oils and creams based on sesame oil.

Fresh Vegetables: K'saselihle Fresh Vegetables: With an education degree from Durban University of Technology, Mbali Bungu the founder of K'saselihle Fresh Vegetables decided to pursue a career in entrepreneurship rather than teaching. This choice was made not only for economic reasons, but also for social ones, creating jobs for her village: "That's where I developed my passion for farming. I could see it benefited a lot of disadvantaged families like mine,"[134] she said. Incubated at DUT, Mbungu maintains that the growth of his company is largely due to the training program she received at the DUST. In 2019 her enterprise and has six full-time workers and offers short-term contracts: "I would give my children water with sugar as we had nothing else. When I started here, I was able to send my kids to creche and buy food."[135], confesses one of her employees.

5.1.2 Driving new food innovation

Immobazyme products range of enzymes from growth factors, a primary ingredient in cell-cultured meat, to enzymes like dextranase, which is used to break down contaminants in sugar. Immobazyme is a

[134] Nkosi, X. (07 Feb. 2022). Mbali the farmer uplifts village! Daily Sun. Accessed 18 Sept. 2024.

[135] Nkosi, X. (07 Feb. 2022). Ibidem. Accessed 18 Sept. 2024.

South African biotechnology spin-out company of Stellenbosch University that utilises precision fermentation to produce high-value active protein ingredients. Immobazyme aims at catalysing the future of global innovation with precision fermentation: "By creating the most desirable and accessible recombinant proteins we aim to enable businesses to perfect their products and unlock the full potential of their process development"[136]. According to Good Food Institute, precision fermentation uses microbial hosts as "cell factories" for producing specific functional ingredients and represents a big potential for the market of alternative. [137]

Founded in 2019, the company has expanded significantly from its founding team of three master's candidates to a team of 9 experienced professionals, all of whom are committed to catalysing the future of global innovation through precision fermentation.[138]. The South African biotechnology start-up has secured $1.3 million (R24.5m) in its newest round of funding.[139] This start-up illustrates the translation of research output into start-up creation, and shows that with strong research or innovation supported by the right mechanisms (mentoring, funding, intellectual property management or technology transfer), it's possible to create an innovative company.

5.1.3 Precision farming and climate change

The African agricultural sector faces many challenges such as the impact of global warming, which negatively impacts weather patterns, leading to the depletion of soil nutrients and the deterioration of usable land in many parts of the continent. Considering these concerns, sustainable farming practices are understandably gaining traction, in some cases supported by digital technology to address productivity and yields.

The Smart Kuku Brooder System: Founded by 5 students from Mbarara University of Science and Technology (Peter Okoci Samuel, Maureen Nayebare, Aaron Etyang, Peter Beinamaani, and Frank Magezi Rubandamayonza), the start-up is developing a solution to transform poultry farming in Africa. The Smart Kuku Brooder System is designed to address the challenge of high chick mortality in local households due to inadequate temperature control: "It is an automatic brooding system that I started as an undergraduate project to solve one of the challenges in my local community, that is poor temperature regulation during brooding" says Peter Okoci. The success of this start-up is not only due to the ambition, passion or commitment of the co-founders to their communities. The support they received from their incubation center at MUST or from other capacity-building opportunities in entrepreneurship and business management was decisive. The young start-up has achieved some milestones through awards, grants, but above all their impact on local farms: *"We have attracted major milestones thanks to the financial support and awards we have received. But what we're most proud of is our impact on local farmers",* says one of the founders (KII October 2024).

[136] Immobazyme | Precision Fermentation Specialists

[137] The science of fermentation (2025) | GFI

[138] About Immobazyme | Team. Accessed 02 Oct. 2024.

[139] IT Web (18 June 2024). Biotech start-up Immobazyme secures $1.3m in investment. Accessed 02 Oct. 2024

TerraClim (Pty) Ltd: TerraClim uses pioneering integrated data resources to give access to detailed climate and terrain information that will help navigate the increase in seasonal changes. TerraClim offers precise climate and environmental insights, helping farmers optimise planting, harvesting and resource management. TerraClim was founded as an extension of the University of Stellenbosch. Dr Tara Southey, a founder of TerraClim tells the story of the company's origins and how it emerged from research: "I am a viticulturist by training. I started to become more interested in climate dynamics and climate change, and in 2018, we started a survey with growers, researchers, and consultants to identify what is needed in the context of climate change. Every person we interfaced with said access to climate data and access to terrain information, in South Africa, was not available for many reasons."[140] With an in-house team of 11 persons, the company continues to grow and expand its partnerships with the public and private sectors.

Adagin Technologies: Adagin Technologies is a dynamic, forward-thinking company providing innovative & practical solutions to the South African & international agricultural industry. Since inception, Adagin has grown from a simple harness solution to a full suite of high-tech solutions helping farmers manage their harvesting outputs with scanners and satellite technology managing their workforce cost with smart phones and improving their yields with smart-scale.[141] The founder FG Adriaanse started his entrepreneurial journey from a side project with a grape picking harness while doing his Masters in Logistics at Stellenbosch University. Today, the company has grown rapidly, with a significant impact on farmers in Africa and South America (Ecuador). While the company's success is due to the founder's determination to solve a specific problem on his family farm, and to the co-founders' passion for agriculture, it must be acknowledged that the support offered by the university (Stellenbosch University) has been decisive In the company's development and growth: *"I would have had little to no direction if I were to start Adagin with my own knowledge and intuition. The courses, networks, support and help we've received from SU LaunchLab over the last five years have provided us with the foundation to build an enduring and healthy company. We still have a long way to go to reach our ultimate vision, but the journey is one that the team and I would not trade for anything"*[142] says Adriaanse.

5.1.4 Land degradation and soil infertility

Nature Guide (Cameroon): *"My family and I have known hunger. I've seen relatives, neighbours and people from the same village die of hunger and all kinds of diseases like cancer. I understood later that this was due to the degradation of our land and the infertility of the soil from the harmful pesticides we have been using for years. That's why I decided to take action by creating Nature Guide, a company that manufactures and sells biofertilizers to reclaim our land and guarantee our health and that of future generations."* (KII September 2024). This is how he describes the motivation behind the creation of his start-up. The start-up was incubated at CATI (Dschang Universiy). Its founder, who declares he has a degree in soil science, says he appreciated the incubation program, which enabled him to take great strides towards formalizing his business and beginning a long road strewn with pitfalls: *"I had to fight very hard to get here. At first, I had no financial support until the NGO Heiffer gave me a small grant of $900. Later, I also received financial support from Dschang University*." The business is making headway, despite the difficulties: *"During this agricultural campaign, we produced 215 litres at 4000 FCFA per litre. But if we*

[140] Enterprise Africa (2023). TERRACLIM SA Developed Climate Tool to Drive Agri Insight. Accessed 12 Nov. 2024.

[141] https://www.adagintech.com/about. Accessed 12 Nov. 2024.

[142] LauchLaB News (Updated, Apr 5, 2022). From a simple student hustle to a successful agritech company.

have a site, we can do more. Our sales were 460000 XOF in the first half and 520000 in the second. I'm already working with two other people, including a woman in charge of marketing and management". Concluding, he firmly maintains: *"There are two problems I want to solve: food safety and healthy eating".* (KII September 2024).

5.2 Entrepreneurial motivations of founders

The start-ups were all initially created by students (including post-docs for Teraclim), either from student projects or individual business ideas. Their ambition to venture into entrepreneurship was motivated by a variety of factors. Among these, it's worth highlighting the social ones and those linked to local community issues that entrepreneurs intended to address:

> *"I come from a modest background. My parents and I experienced famine as a result of soil degradation. And that's what really motivated me to set up my own business to address the issues linked to land degradation or soil infertility, food insecurity and agriculture".* (Founder of Nature Guide, KII September 2024).
>
> *"Our parents conduct farming activities manually with rudimentary techniques. So, we wanted to automate some of the activities to ease their tasks"*, explains Aaron, currently running as the Team Leader of the Smart Kuku Brooder start-up. [143]
>
> *"We share the same vision, that is to solve community problems with the knowledge we gain from university,"* Aaron adds [144]

Other reasons, such as economic or environmental influences, are also mentioned:

> *"I developed the love for farming at the age of 18 when I was working in one of the farms located near my home. It was a fun and educational experience. I observed that the farmer was making a lot of money. I then grew up having that passion of being a farmer, however, I was always wondering as to how am I going to start due to the resources required,"* (Bengu, Founder of K'saselihle Fresh Vegetables). [145]

5.3 Role of incubators and other university structures

According to entrepreneurs, incubators and other training programs have played a crucial role in their company's development process. The impact of these programs ranges from formalizing their business, to coaching, mentoring, pitching, skill-building to grants or seed funding to get their business off the ground.

> *"The DUT Midlands Entrepreneurship Centre played a pivotal role in turning my business idea into reality, thus making my dream of being a farmer come true. They provided me with a variety of training sessions, seed fund and mentorship. They are always with me in every step of my business journey,"* [146] said Bengu.

[143] UNESCO (3 April 2024. Last update:10 April 2024). Students innovating farming in Uganda through tech & entrepreneurship. Accessed 19 Oct. 2024
[144] UNESCO (3 April 2024. Last update:10 April 2024). Ibidem. Accessed 19 Oct. 2024
[145] Durban University of Technology News (2021). Dut's B. Ed alumna supplies superspar with fresh vegetables. Accessed 28 Oct. 2024.
[146] Durban University of Technology News (2021). Ibidem. Accessed 28 Oct. 2024.

The Smart Kuku team gained entrepreneurship skills through these trainings. *"The training has tremendously improved my skills,"* says Frank Magezi Rubandamayonza, Chief Finance Officer of the Smart Kuku Brooder. *"I can now confidently pitch for funding and convince investors how great my ideas are. I feel prepared to make great changes."* Maureen Nayebare echoes the idea: *"Thanks to the training in financial planning, management and prototyping, we have brought our prototype to the market."*[147]

In addition to the very practical training I received at MUST, which already predisposed me to evolve in the field of technology, the training program I received as part of the incubation program was very practical. (FounderSmart Kuku Brooder , KII Interviews October 2024).

5.4 Challenges and achievement

Entrepreneurs mention several challenges (family, financial, gender etc.) in their entrepreneurial journey. Conversely, some achievements and or milestones have also been reached.

> *"It has not been easy for me to juggle being a student, mother, wife and businesswoman. Through God and the support that I constantly receive from my husband who is also a businessman, I can endure. Amongst other challenges that I have encountered, the biggest one was having inadequate resources to start my business. It is also difficult as a young woman to be in the agricultural space, people hardly take you seriously when you market your business,"* (Bengu, Founder)[148]
>
> *"We've been criticized. Organic is a bit more expensive because it's a bit more. I was judged by a jury (GIZ and CATI). I was selected second best innovation. First prize at the Kouna Festival in Dschang. The other challenge is the acquisition of equipment. Our competitors are strong. The other is patent protection. Ecocert certification is very difficult to obtain (XOF 5 million). We have been certified by Natura Futura"* (Founder, Nature Guide, KII October 2024).
>
> *"Farmers were initially reluctant to use our technology. What's more, we were importing equipment from China, which put a strain on our budget. But things are beginning to change. Thanks to our efforts to raise awareness, many farmers are now using our technology and finding it very practical. We're starting to make an impact, and that's what we're most proud of."* (Founder, Smart Kuku Brooder, KII October 2024).

In addition to these relevant business cases, two (02) community projects developments involving HEIs, local communities and various stakeholders, including international partners, are highlighted in.

- The University of the Free State (UFS) Wool Wise Community Project
- Managing (South) Africa and Senegal Sustainability Targets through Economic-diversification of Rural-areas (MASSTER) project.

[147] UNESCO (3 April 2024. Last update:10 April 2024). Op. cit. accessed 18 Oct. 2024

[148] Durban University of Technology News Dut's B. Ed alumna supplies superspar with fresh vegetables. Accessed 28 Oct. 2024.

Highlight 8: The University of the Free State (UFS) Wool Wise Community Project

The University of the Free State (UFS) Wool Wise Community Project is an initiative aimed at empowering local communities, particularly women, through the wool value chain. The project, which originated in 2019, is part of the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) project[149].

Key aspects of the project include[150]:

1. **Training and Workshops**: The project provides training in wool processing, including sheep handling, wool classing, herd management, and wool marketing. Participants learn various skills such as knitting, felt making, and hand embroidery.
2. **Product Development**: Community members, mostly women, create a variety of products from wool, including felt pencil cases, laptop bags, hand/book bags, tray cloths, soft toys, and even hand-felted coats.
3. **Community Upliftment**: The project aims to create sustainable livelihoods for local women by teaching them how to add value to lesser-valued wool and market their products.
4. **Recognition and Awards**: The project has received recognition for its innovative use of wool, winning accolades at events such as the OVK Innovation Competition.

The Wool Wise Community Project is a great example of how education and community development can go hand in hand to create positive change.

The success of the UFS Wool Wise Community Project can be attributed to several factors[151]:

- **Community Engagement**: The project actively involves community members, particularly women, empowering them to take ownership and pride in their work. For example, the project has trained numerous local women in wool processing and product development.
- **Skill Development**: Comprehensive training programs provide participants with valuable skills in wool processing, product development, and marketing. The project includes various training initiatives such as wool sheep information days, wool marketing workshops, and wool value chain technology transfer days.
  Innovation: The project encourages creative use of wool, transforming a lesser-valued resource into unique, marketable products. The project has received recognition for its innovative use of wool, winning accolades at events such as the OVK Innovation Competition.
- **Sustainable Livelihoods**: By teaching participants how to add value to wool and market their products, the project creates sustainable income opportunities for the community. The project has helped create sustainable livelihoods for local women by teaching them how to add value to lesser-valued wool and market their products.
- **Recognition and Support**: The project has gained recognition and awards, boosting its credibility and attracting further support and resources. For instance, the project received a US$300,000 grant from the Regional Universities Forum (RUFORUM) for their project: Building competitiveness for communal farmers through developing the wool value chain in the Free State Province of South Africa.

[149] UFS News Archive (25 June 2024). Innovative wool creations shine at Karoo Winter Wool Festival. Accessed on 27 Nov. 2024

[150] UFS News Archive (25 June 2024). Ibidem. Accessed on 27 Nov. 2024

[151] *Leonie Bolleurs* (UFS NewArchives?). Transforming a piece of wool into a livelihood. Accessed on 27 Nov. 2024

Highlight 9:Managing (South) Africa and Senegal Sustainability Targets through Economic-diversification of Rural-areas (MASSTER) project

The **Managing (South) Africa and Senegal Sustainability Targets through Economic-diversification of Rural-areas (MASSTER) project** is a collaborative effort involving the **Tshwane University of Technology (TUT)** and several international partners from Africa (South Africa and Senegal) and Europe (Germany, Italy, France, and Serbia)[152]. The project, funded by the European Union, aims to support agricultural students and small-scale farmers by providing inclusive, integrative, and reflective educational practices. In addition, the MASSTER project will contribute to socio-economic recovery and resilience in rural areas, enhancing food security and promoting sustainable agricultural practices The project aims to achieve a number of objectives[153]:

1. **Enhanced Training and Education**: The project will provide innovative educational and training tools to agricultural students and farmers, helping them develop skills in farm management, income generation, and climate resilience.
2. **Income Generation**: By offering training programs focused on income-generating activities, the project has enabled farmers to improve their livelihoods and economic stability.
3. **Migration Management**: The project addresses the issue of rural-urban migration by providing farmers with the skills and knowledge needed to sustain their farms and communities.
4. **Community Development[154]**: The involvement of higher education institutions in community development has strengthened the support system for local farmers and students, fostering a more integrated and responsive approach to agricultural challenges.
5. **Sustainability Goals[155]**: The project aligns with several Sustainable Development Goals (SDGs), including zero hunger, quality education, decent work and economic growth, and responsible consumption and production.

5.5 Lessons learned

Four lessons learned from the analysis of business cases:

All founders mention that their start-ups have been positively impacted by incubation/acceleration programs, grants or other facilities (labs, working spaces, support in terms of technology transfer or intellectual property management, R&D): this demonstrates the vital role of an enabling policy, legal and institutional environment and funding instruments in the process of translating research and innovation outputs into start-ups.

Motivations for entrepreneurship are often underpinned not only by economic reasons, but also by social ones (community involvement), environmental ones (climate change, land degradation) and health ones (healthy food and nutrition). This observation should lead universities to take greater account of social entrepreneurship and social innovations in incubation and training programs, and even in the integration of new curricula.

[152] EU (?). Managing (South) Africa and Senegal Sustainability Targets through Economic-diversification of Rural-areas. Accessed on 27 Nov. 2024

[153] EU (?). Ibidem. Accessed on 27 Nov. 2024

[154] Tshwane University of Technology (25 Nov. 2024). Agricultural students and small-scale farmers in Sub-Saharan Africa benefit from EU-funded MASSTER project. Accessed on 27 Nov. 2024.

[155] Weihenstephan-Triesdorf University of Applied Sciences (2024). Managing (South) Africa and Senegal Sustainability Targets through Economic-diversification of Rural-areas (MASSTER)

Apart from the three SU companies (Adagin Technologies, Terra Clim, Immobazyme), most of the business cases, including on the extended list (in the appendix) are start-ups. Even though, given the relatively limited sample and the fact that the study only covers four countries (Cameroon, Senegal, South Africa and Uganda), it is difficult to generalise, two lessons can be drawn from this observation:

- The university entrepreneurial ecosystem is not yet mature enough to create a significant pool of start-ups capable of launching themselves, crossing the valley of death, developing and contributing to generating income or fighting poverty. Indeed, beyond financial and technological barriers, the services offered, through incubation, acceleration, training and financing programs are not always tailored to the needs of researchers and student entrepreneurs, and do not sometimes include activities in monitoring and evaluation to track and assess the performance, effectiveness and impact of the programs and their potential for scaling up. This shows that we still have a long way to go, and that we still need more resources (human and financial) and infrastructure (laboratories, accelerators, incubators, etc.) to develop university-based entrepreneurship.
- HEIs do not generate enough marketable research outputs. This could be due to limited research capacity, the lack or deficiency of research infrastructures, the quality of research outputs and/or the mindset/culture of researchers. In any case, these different factors constitute bottlenecks that can hinder the commercialisation of research and innovation.

Access to adequate funding (including other incentives) and an institutional environment (establishment of support services for research, innovation and technology transfer, entrepreneurship (incubators, accelerators, labs), research infrastructure, etc.) conducive to learning and the production of quality research, connections with industry and communities as well as with international networks, etc. are relevant enablers for the translation of research outputs. The case of SU, which has been able to generate highly promising start-ups and spin-out companies, thanks to its Innovation and Commercialisation (I&C) Division, and to structures such as Innovus Technology Transfer Office (TTO), SU LauchLab, Stellenbosch Network, US Enterprises (Pty) Ltd (USE), is an edifying example. In addition, licensing intellectual property and commercialising research outputs have generated revenue for the university, supporting further research and development.

6. Factors hindering the translation process

Despite the development of policies to create environment conducive to research and innovation, and the various initiatives developed by the universities themselves, it is worth noting that there are still many challenges that tend to hinder the process of translating research outputs into business opportunities. The scope study key informants' interviews, case studies as well as the country level webinars converge around general factors hindering the translation process and specific factors to each country.

6.1 Factors common to four countries

6.1.1 Institutional and legal environment

There is a plethora of domestic and regional policies, laws and reforms designed to regulate and enable research and innovation landscape as well as entrepreneurial ecosystem. What's more, the four countries concerned with the study countries are also signatories to international treaties and conventions. However, the lack/inadequacy of coordination mechanisms to ensure harmonization of the various policies and other mechanisms create a fragmented support environment and prevent stakeholders to strengthen synergies. In addition, several structures have been set up that are either operating at a slower pace, or not operating at all or are simply decoupled from the basic objectives that underpinned their creation. As noted by the ISRA/UNIVAL Director, whether in Senegal or elsewhere in Africa, there is a proliferation of laws and structures to regulate research, but there is a real lack of efficiency because these structures often work in silos. Finally, the legal and financial frameworks in place still do little to promote academic entrepreneurship. In most policies, a few extracts make general reference to the importance of research and innovation for economic growth.

6.1.2 Research and innovation

A recent study published by the World Economic Forum[156] indicates that global research capacity is not distributed equitably, with Africa particularly under-served. For instance, according to UNESCO, in 2020, South Africa had 472.7 researchers per million of inhabitants (FTE) while Belgium had 5 410.8 and Chile 512.5. In terms of Africa's scientific productivity, 508,102 African scientific publications from 2001-18 were produced while the rest of the world produced 6,688,920 publications. Somalia is at the bottom of the list with 69 publications while South Africa, the top-ranking country, produced 128,435 papers[157]. This constitutes 25% of the total African contribution.

One of the reasons for this limited research capacity is that investments in research and innovation remain low. Indeed, African countries spend an average of only 0.45% of their GDP on R&D, falling well below the global average of 1.7%[158]. Hence, like other African countries, Cameroon, Senegal, Uganda and South Africa are experiencing low levels of public R&D investment while the reliance on international sources of funding continues to raise concerns[159]. This under-investment limits the opportunities to mobilize

[156] The World Economic Forum (Feb. 11, 2024). There's a science research gap in Africa. Here's how to fill it. Accessed 12 Oct. 2024.

[157] Sawahel, W. (17 Feb. 2022). Science output rising, but some countries' yields still low. Accessed 12 Oct. 2022.

[158] World Economic Forum (2023). Innovative approaches for unlocking R&D funding in Africa. Accessed 14 Oct. 2024.

[159] SGCI /IOSRS (working paper, 2023). **Research funding in Africa: highlights from the SGCI Masterclass,** Accessed 12 Oct. 2023,

intellectual capital for the development of tangible products, technologies or services that can stimulate economic growth and improve the well-being of individuals and communities. Finally, more equitable international research partnerships that make optimum use of local expertise can level the playing field. Francophone countries like Senegal and Cameroon grapple with the fact that most of the African research published internationally is in English.[160]

Another issue is related to intellectual property (IP). IP is crucial to innovation and economic growth. Intellectual property has the potential to reduce poverty, create jobs and accelerate economic growth in Africa.[161] However, the transformative power of innovation and the benefits that come from understanding intellectual property and using it strategically are not yet well understood in Africa, either by public authorities or by communities such as researchers and innovators[162]. Indeed, despite the wealth of ideas and innovation on the continent, few inventions and creations are protected by patents, trademarks or copyright. As a result, in 2023, Africa accounts for just 0.17% of international patent applications filed worldwide, illustrating the continent's persistent lag in patentable innovation.[163] South Africa, Morocco and Egypt, which concentrate most of the continent's patenting activity and compete for top positions in the various systems (PCT patents, Madrid system trademarks, Hague industrial designs).[164] One of the reasons for this lag in patentable innovation is that "the policy environment is still not robust enough to protect African innovations and inventions"[165]. Indeed, even as members of the World Intellectual Property Organisation (WIPO), most Sub-Saharan African countries possibly still have domestic laws that conform to international laws but do not cover the intellectual output produced within the countries.[166] These issues would limit researchers' efforts to publish their research results or protect their IP potential. ISRA/UNIVAL Director is aware of this challenge: *"Despite the efforts we devote to research, it is very difficult to valorize our results and, a fortiori, translate them into business creation opportunities because we lack relevant standards and policies especially for public research institutions like ISRA. Another challenge is the lack of awareness among researchers and entrepreneurs alike of the need to use intellectual property to protect their innovations and inventions"* (KII September 2024). Indeed, many researchers and entrepreneurs are unaware of, or do not yet have access to, such systems. The Director of Innovation & Contracts: Research Development at UFS corroborates this issue as a factor hindering the process of innovation and commercialization of research outputs: *"We have put in place mechanisms to communicate with and raise awareness among researchers and students about intellectual property and technology transfer"* (KII June 2024).

[160] Ransford Bekoe (?). Constructing Entrepreneurial Universities in Africa Presents Unique Opportunities and Challenges. ACEEU (Accreditation Council for Entrepreneurial and Engaged Universities). Accessed 05 Oct. 2024.

[161] Kakonge, J.O (2014). Sensibilisation à la propriété intellectuelle en Afrique : un appel à l'action, OMPI Magazine, Accessed 24 Nov. 2024.

[162] Kakonge, J.O (2014). Ibidem. Accessed 24 Nov. 2024.

[163] World Intellectual Property Indicators 2024: Highlights. Patents Highlights. Accessed 24 Nov. 2024.

[164] Le360 Afrique (2024). Propriété intellectuelle en Afrique : trois pays au coude-à-coude. Accessed 24 Nov. 2024.

[165] Boateng P. (2015). Africa needs IP protection to build knowledge economies. Accessed 05 Oct. 2024.

[166] Adegoke, S. (2011). Intellectual Property Rights in Sub-Saharan Africa.

6.1.3 Weak collaboration between universities, industry and local communities

In recent years, opportunities for collaboration between universities and the private sector, or between universities and local communities, or between these three stakeholders, have grown considerably. Some initiatives have been highlighted in the previous chapter. Despite this trend, collaboration between HEIs and the private sector (banks and industry)/local communities is still weak. The reasons for these poor linkages are to be found on each stakeholder's side. First of all, on the private sector side, one of the reasons that "prevents companies from establishing closer vertical linkages with publicly funded research organisations is that this can result in strategic knowledge leaking out to competitors."[167] Other factors hampering collaboration between private business and public research include the difference in logics and "the different motivating factors (patents versus publications), time considerations (first on the market, versus scientifically well-founded results) and even language issues (practically oriented, comprehensible language as opposed to the jargon of a scientific community)"[168]. On the university side, it must be admitted that researchers have long lived in a kind of ivory tower, placing greater emphasis on their two primary missions – teaching and research – to the detriment of their community engagement (Buckley & Du Toit, 2010). This tendency has isolated them from their external environment. As a result, universities are said to have had difficulties in establishing links with industry and communities and may even have overlooked the benefits of collaborating with such stakeholders. Communities, for their part, are not always aware of the issues and benefits of engaging with universities. Admittedly, universities have long taken an "extractivist approach", often regarding communities as open-air laboratories for data collection and/or experimentation. Although some changes are underway on both sides, the persistence of a mindset (on the part of each stakeholder group) that still perceives the university as a mere place of teaching and knowledge production hinders the process of knowledge translation and the commercialization of university research outputs.

6.1.4 Entrepreneurship

Whether in South Africa, Uganda, Cameroon or Senegal, an interconnected network of entrepreneurs, investors, support organizations, government bodies and policymakers is striving, despite many challenges, creating an environment conducive to business creation and development. Nevertheless, despite this supposedly favourable trend, several bottlenecks persist and tend to limit the efforts made in the process of translating research outputs into start-ups. Some of the factors hindering the translation of research outputs into start-ups identified by Farrell et al. (2024) resonate with and tend to corroborate some of the barriers emerging from the scoping study and key informants' interviews. The study of Farrell et al. (2024) titled "Consensus study on factors influencing the academic entrepreneur in a middle-income country's university enterprise, focusing on the case of South Africa", highlighted some of the following bottlenecks that are applicable also to other countries (here, Senegal, Uganda and Cameroon):

- **Barriers to establishing a new business:** In the specific case of universities, starting up a business for students can be a long and difficult journey. Despite the measures put in place by universities, governments and other stakeholders, including the private sector and ESOs, entrepreneurship remains particularly challenging, and many young students with innovative ideas end up throwing

[167] McKenna, P., Ozor, N., & Nyambane, M. A.(2021). Institutional Landscape for Eco-innovation Development in Case studies from Botswana, Ghana, Kenya, Malawi, Nigeria and Zambia. Africa African Technology Policy Studies Network (ATPS) Technopolicy Brief No. 60, p.4. Accessed on 23 Nov. 2024
[168] Boateng P. (2015) Op. cit., p.4. Accessed on 23 Nov. 2024

in the towel: *"As part of our student entrepreneurship support programs, we welcome hundreds of applications in our different cohorts. However, we are obliged to make a rigorous selection. And we sometimes find ourselves in the awkward position of not being able to select certain highly relevant projects, due to a lack of resources and infrastructure. These unselected projects are kept in our database in the unlikely event that additional funding becomes available. Most student projects that are not selected will have very little chance of getting off the ground."*, stresses the animator of CATI Dschang University (KII July 2024). For projects already selected, *"access to capital is often limited, and investors may be hesitant to invest in early-stage companies"* (KII July 2024). What's more, they have to face new cycles of challenges, during which many end up giving up.

- **Challenges related to academic entrepreneurship:** For academic entrepreneurs, they have particularly to cope with other inhibiting factors among those identified by Farrell et al. (2024):
    - weak entrepreneurial ecosystems (lack of demand from the private sector);
    - poorly implemented government science and technology policy (primarily related to technology transfer);
    - low government expenditure on science and technology research (incentives for university and business to foster joint research);
    - institutional factors (poor reward systems for innovation and absence of collaboration with the private sector);
    - entire burden for commercialisation placed onto individual researchers: This particularly relevant for researchers from private universities where there's no incentive or from public HEIs in Cameroon, Senegal and Uganda where mechanisms such as the Intellectual Property Rights from Publicly Financed Research and Development Act 51 of 2008 do not yet exist.
    - the socioeconomic context, political instability and severe criminality (this is particularly relevant for South Africa).

6.1.5 Resistance to change

"Teaching should move from simple to complex and from known to unknown. This also applies to integrating entrepreneurship into existing lessons or projects. Changes in the curriculum or lesson contents always meet with stiff resistance except people can identify with its relevance and importance in their lives'' (an expert in a discussion via Linked (Collaborative article) around the following question: What do you do if your teaching encounters resistance when integrating entrepreneurship?).

According to Harvey & Broyles (2010), resistance is at the heart of any change. As part of this study, two examples illustrate some of the reasons put forward to explain resistance to change. Firstly, in the context of the student-entrepreneur status experiment, some resistance was noted, notably at USSEIN: *"Despite their determination, student entrepreneurs are finding it very difficult to move their projects forward. In fact, some teachers and even some members of the administration are still reticent about the student-entrepreneur status. They are reluctant when it comes to granting them the time they need (leave of absence, catching up, etc.) to devote to their entrepreneurial project. As a consequence, they tend to stagnate in their project"*, testifies the Coordinator of the Dekkal Yaakar incubator.

This example illustrates two types of reason, one of which could be linked to "more work" and the other to "insecurity". Indeed, some reluctant teachers and officers might think that this project would mean more work for them (issuing permits, catching up, delivering extra lessons, etc.). What's more, as far as

teachers are concerned, this could lead to a situation of insecurity, as they could lose control over their student-entrepreneurs. The second example relates to Intellectual Property Rights from Publicly Financed Research and Development Act 51 of 2008. According to Deputy Vice-Chancellor: Research, Innovation and Postgraduate Studies, Stellenbosch University, despite the relevance of this provision, there has been no shortage of reluctance. For example, some researchers had to leave the public HEIs to go into private practice or launch their own ventures. This example highlights two reasons: "lack of ownership" and "lack of benefit". Reluctant researchers may fear lack of benefit or lack of ownership over the commercialization of their research outputs. Such reasons, if not properly managed, can hinder the effectiveness of a project or compromise its completion altogether.

6.2 Factors specific to each country

6.2.1 Senegal

Research and innovation

At national level

In Senegal, the governance of research and innovation at the governmental level is characterized by a breakdown of administrative and technical supervision without a unifying, coordinating national framework.[169]

This break-up has contributed to the dispersion and fragmentation of research and innovation through a multiplication and superposition of priorities. Added to this is a weakness and fragmentation of funding sources and a lack of visibility, consultation and synergy between the stakeholders.[170] .

State funding through the Direction Générale de la Recherche et de l'Innovation (DGRI) would be limited and, what's more, targeted at specific thematic areas[171], leaving other areas almost underexplored. Additional funding opportunities come from outside, notably from cooperation agencies. As a result, the country's priority development areas are underfunded and, therefore, unable to contribute sufficient added value to strengthen economic growth.

Despite several initiatives, plans and reforms, Senegal does not yet have a Science, Technology, and Innovation (STI) Policy or act[172]. The lack of this legal instrument inevitably has implications for the development and institutionalization of STI, and hence for the ability of HEIs to generate knowledge that can be mobilized to create businesses capable of absorbing the large number of unemployed young people.

Research institutions are fragmented and are under the supervision of different ministries.[173] For example, the Institut de Technologie Alimentaire (ITA) is attached to the ministry of industry while the Institut

[169] Cissé et al. (March 2019). Developing a Transformative Innovation Polity Approach. Transformative Innovation Policy Consortium & TIP Lab. Accessed 23 Aug. 2024.

[170] Cissé et al. (2019). Ibidem. Accessed on 23 Aug. 2024.

[171] Bekoe & Odufala (2024), op. cit. Accessed 23 Aug. 2024.

[172] Nicholas O. & Alfred N. (2024). What is the place of science, technology, and innovation in youth employment in Senegal?

[173] Cissé et al. (2024), ibidem.

Sénégalais de Recherche Agricole (ISRA) and the Institut National de Pédologie (INP) are attached to the Ministry of agriculture. This situation creates a lack of synergy and dispersion of efforts and contributes to the fragmentation and weakening of research and innovation processes.

Intellectual property is a crucial issue: Senegal has set up Agence Sénégalaise pour la Propriété Industrielle et l'Innovation Technologique (ASPIT) dedicated to promoting invention and technological innovation. Senegal is a member of the African Intellectual Property Organization and is therefore subject to the rules of the Bangui Agreement, with legislation in line with international standards. ASPIT is the national liaison structure with the African Intellectual Property Organization ((SNL/OAPI). In addition, Senegal became a member of WIPO in 1970 and has acceded to six other international treaties administered by the Organization, including the Paris Convention for the Protection of Industrial Property, the Berne Convention for the Protection of Literary and Artistic Works, the Patent Cooperation Treaty and the Hague Agreement Concerning the International Deposit of Industrial Designs. Despite these legal provisions, intellectual property has very little impact on research and innovation processes. In addition to being a little-known issue for researchers, there are no policies, acts or even offices for the management of intellectual property and technology transfer in universities that could serve as a reference or guide for researchers wishing to valorize research outputs (patent, invention, technology transfer). ISRA's Director of Research Valorization noted this fact, expressing her disappointment: *"We really lack legal provisions for intellectual property and technology transfer for those of us who work in public or semi-public organizations such as ISRA".* Finally, there's a lack of consistent bursaries and scholarships for graduates and PhD students to unlocking entrepreneurial potential and help transform university entrepreneurship ecosystems.

At HEIs level

The limited research and innovation capabilities of HEIs are not always conducive to the valorization of knowledge and technology transfer. Indeed, the lack of infrastructure (laboratories, research equipment), substantial research grants, capacity-building programs in research, innovation and entrepreneurship, and connections to international networks mean that university research in Senegal remains well below international standards.

Links between universities and the private sector are weak. This is due to the fact that there are no direct openings from universities to the private sector for partnerships. For example, universities' prototypes are not showcased, and their websites do not display enough content from their research results. In addition, there is no effective Research Coordination Unit that serves as a one-stop shop for scientific researchers and possibly assist them in patenting and disseminating research results.[174]

Entrepreneurship

National entrepreneurial ecosystem: Despite a very dynamic entrepreneurial ecosystem, many local entrepreneurs, in Senegal, still struggle to recognize the value of business development services and

[174] Bekoe, R. & Odufala, B. (2018). L'initiative des conseils subventionnaires de la recherche scientifique en Afrique subsaharienne : renforcer les partenariats entre les conseils subventionnaires de la recherche scientifique de l'Afrique et le secteur privé évaluation de base de partenariats public - privé dans la recherche et de la coopération scientifique au Sénégal. Association des universités africaines (AUA).

capitalize on market opportunities.[175] Furthermore, while Senegal has many active entrepreneurs and government support programs, access to finance remains a major constraint for growing SMEs.[176] These challenges also apply to the university entrepreneurial ecosystem, which is in the process of emerging.

What is more, researchers lack an entrepreneurial culture, since Senegal's education system is very little oriented towards a type of education and research capable of contributing to a practical response to the country's major challenges. The major reforms envisaged decades ago to transform the education sector (integrating new curricula to make content more practical) have yet to be implemented.

6.2.2 Uganda

Research and Innovation

At national level

The same observation in Senegal applies to Uganda: The fragmentation of the R&I ecosystem "stems from the lack of coordinated policy implementation and inadequate platforms for stakeholder engagement'' (Jjagwe et al. 2024, p. 5). For instance, linkages and synergies between the private sector and public entities, including universities, are still weak. As a result, this fragmentation, hinders knowledge transfer and leads to the duplication of efforts and inefficient allocation of resources.

The level of IP protection is very low. The UNCST attributes this "to a number of critical factors that include capacity constraints in identification of potential IP assets; low level of public awareness of IP system and services and few IP professionals and service providers, among others.''[177] Moreover, there are yet no formal mechanisms put in place to facilitate technology transfer.

At HEIs level

In terms of infrastructure, the lack of research agenda means that "the state of research, innovation, and commercialization infrastructure in Ugandan R&I institutions is inadequate" (Jjagwe et al. 2024, p. 6). As a result, only a few centres or universities have access to research facilities while research materials are often transferred to foreign laboratories for analysis at high cost.

Regarding the funding, the National R&D Survey showed that 56% of Uganda's research is foreign funded[178]. A subsequent study by UNCST (2020) showed that between 2015 and 2019, almost 40% of the research registered in Uganda was funded by foreign private companies[179]. Uganda's GERD is currently at 0.18%, which is below the level of 1% suggested by the African Union. More specifically the funding available for the translation of research outputs into commercial products is very limited (compared to Kenya that invest 0.8%).

[175] Winrock International (Sept. 2024). Supporting business acceleration and entrepreneurial ecosystem expansion in Senegal – Accessed 06 Oct. 2024.

[176] Winrock International (Sept. 2024). Ibidem.

[177] UNCST (June 2023). Op.cit. Accessed 06 Oct. 2024

[178] UNCST (June 2023). Op. cit., Accessed 23 Oct. 2024.

[179] UNCST (June 2023). Op. cit.. Accessed 23 Oct. 2024

The Government of Uganda has been making efforts to develop STI at national level. Several policies have been put in place to develop research. Nevertheless, according to D. G.[180], most of funded projects have no potential industrialization: "For instance, regarding the NRPI and LEAP-Agri (2019- 2021), 19/41 projects have no potential industrialization. Of those with potential, five have been re-aligned and funded to progress on the idea-to market journey. Indeed, scientists who attempted R&D ended at prototypes because they are unclear about the 'journey'', promised or were required to produce unrealistic results. Some became "grantpreneurs'', where grants for STI are just source for livelihoods. Scientists, who get exposed out of the country, get to know how STI works. However, they find it extremely difficult to implement because of a very non-supportive environment (…) As a result, the productivity of the Ugandan scientists is very low compared to other countries Kenya, Rwanda and Tanzania."

Entrepreneurship

UNDP Uganda has identified six important bottlenecks hindering the entrepreneurship ecosystem in Uganda.[181] These bottlenecks apply both at national and HEIs levels.

- Inadequate specialized facilities and human capital to support technology development, product development and commercialization in the various innovation clusters;
- Absence of necessary regulatory policies to support growth of clusters of technology development within the ecosystem**.**
- Inadequate private sector participation in the enhancement of the innovation ecosystem**.**
- Limited capacity for policy implementation in Uganda's innovation ecosystem; and
- Inequality in distribution of innovation and research opportunities, most being urban based.
- Limited linkages between academia and industry due to fragmentation of the various players and resources in the technology and product development value chain.

6.2.3 Cameroon

Research and innovation

Cameroon faces several challenges in the realm of research and innovation[182]:

At national level:

- Bureaucratic hurdles: A cumbersome and complicated administrative and legal system can slow down the process of starting and running research projects.
- Weak financial system: The inadequacy of the country's financial infrastructure makes it difficult for start-ups and research institutions to access capital.

At HEIs level:

- Limited funding: Research in Cameroon is often hindered by insufficient financial resources, making it difficult for researchers to conduct high-quality studies and innovate effectively.

[180] D.G (Speaker at the Country Level Webinars, February, 2024). Igniting the qualitative leap: Strategy and funding needs for science, technology and innovation in Uganda: Efforts by Science, Technology and Innovation (STI) Secretariat, Office of the President.

[181] Nathan Tumuhamye (Dec. 18, 2022). Accelerating Growth of Uganda's Start-Up Ecosystem. Accessed 06 Oct. 2024

[182] A Closer Look at 3 Groundbreaking Researchers in Cameroon - Research Key. Accessed on 29 Nov. 2024.

- Inadequate infrastructure: The lack of modern research facilities and equipment poses significant obstacles to scientific progress.
- Skilled labour shortage.

Entrepreneurship

A weak financial system, lack of skilled labour, high taxes and tariffs, bribery and corruption, a complicated bureaucracy administrative and legal system are the main hurdle limiting the potential of Cameroon entrepreneurial ecosystem, including academic entrepreneurship.[183]

Advocating for the establishment of a "Start-up Act" in Cameroon, The Nkafu Policy Institute identifies the bureaucratic constraints among the main factors hindering entrepreneurship in Cameroon: "In addition to these, the coexistence of two business laws (Cameroon government Law no. 2016/014 of 14 December 2016 and the 1997 OHADA Law, which was amended on 30 January 2014) have prevented the country from moving up the World Bank's business creation indicator. To start a business in Cameroon, several documents must be provided to the Business Creation Formalities Centre, including a photocopy of an identity card, a taxpayer's card, company registration, and a location plan. Many potential entrepreneurs wishing to formalize their businesses may find the costs of these legal documents prohibitive, which could force them into the informal sector".[184]

6.2.4 South Africa

Research and innovation

Compared with other three countries included in this study, and even with most of Sub-Saharan Africa, South Africa offers a legal and institutional framework conducive to research and innovation for economic growth. Despite this, significant challenges remain. These are summarized by the discussion group organized by the National Science & technology Forum (13-14 August 2024)[185].

At national level

Policymakers need to be onboard: Key decision makers and policy makers must have a good understanding of the link between research, sustainable economic development and innovation. Policy makers need to be aware of the importance of research and provide support to young scientists.

Rapid technological change: The pace of technological change is accelerating, presenting opportunities and challenges for researchers and innovators. Keeping up with the latest advancements, acquiring new skills, and adapting to rapidly evolving technological landscapes require ongoing effort and investment.

Infrastructure deficiencies: The laboratories, which serve as the breeding grounds for discovery, frequently show signs of neglect. Insufficient infrastructure and obsolete equipment hinder the pursuit of breakthroughs, prompting us to rethink and rejuvenate the environments where innovation flourishes.

[183] Nembot, A. & Tankeu, YM. (September 19th, 2024). Bringing Light to the Challenges that Cameroonian Start-ups face: The Pressing Need for a Law on Start-ups. Accessed on 29 Nov. 2024.

[184] Nembot, A. & Tankeu, YM. (September 19th, 2024). Ibidem. Accessed on 29 Nov. 2024.

[185] National Science and Technology Forum (13-14 August). Current challenges to Research and Innovation systems in South Africa An NSTF/Science Councils Discussion Forum 13-14. Accessed 06 Oct. 2024.

At HEIs level

Lack of funds: Securing adequate funding for research is a challenge. Mainly because of government budget constraints, shifting priorities, limited resources and unforeseen disasters.

Lack of mentorship, research and training skills: There is need for mentorship programmes and placement opportunities where young African researchers can be given opportunity to showcase their skills. And young scientists need training in proposal and thesis writing. But mentorship programmes are rare because experienced researchers are extremely time-constrained or relocating to other countries.

Heavy workload on senior researchers and postgraduates: Research requires time. Senior researchers at academic institutions have a heavy teaching load and administrative duties that interfere with their time to conduct research. Due to financial constraints, many postgraduate students find themselves needing to take on additional roles such as tutoring and assisting with lectures. These responsibilities, while providing essential income and experience, often come with significant time commitments that can detract from their primary research and academic pursuits. This added workload can lead to increased stress and reduced focus on their studies, ultimately impacting the quality and progress of their research projects. In addition to these challenges, the NRF report identifies five main research challenges[186]:

- A decline in the total number of researchers
- An anticipated shortage of academic staff due to retirement in the next five years.
- A larger proportion of academic staff without PhDs.
- A slower pace of progress in transforming research leadership at professorial levels.
- A lower intake and graduation rate in the SET.

Entrepreneurship

The entrepreneurial ecosystem in South Africa faces several challenges that hinder the growth and sustainability of small businesses and start-ups both at national and HEIs level. The main challenges are:

Limited funding and high interest rates [187]: Many small businesses struggle to secure adequate funding. Traditional financial institutions often have stringent requirements, making it difficult for start-ups to qualify for loans. In addition, the interest rates on available loans can be prohibitively high, making it challenging for small businesses to manage repayments.

Limited access to market and intense competition[188]: Small businesses often find it difficult to access broader markets due to a lack of networks and marketing resources. Moreover, intense competition from established businesses can make it hard for new entrants to gain a foothold in the market.

[186] NRF 2024/2025 Annual Performance Plan. Accessed 22 Nov. 2024

[187] Parker, M. August (2020). Entrepreneurial ecosystems and challenges of small business development in a South African Township. The World Bank Group. Accessed on 30 Nov. 2024.

[188] Santodomingo, R. 1(14 March, 2024). Unlocking Growth: What South Africa's Small Businesses Need. Aspen Network of Development Entrepreneurs. Accessed on 30 Nov. 2024.

Bureaucratic hurdles[189]: Navigating the complex regulatory environment can be time-consuming and costly for small businesses. For instance, obtaining necessary permits and licenses can be a lengthy process, delaying business operations.

Poor infrastructure and limited access to technology[190]: Inadequate infrastructure, such as unreliable electricity and internet connectivity, can hamper business operations. Many small businesses, especially in townships, have limited access to and adoption of technology, which can hinder their growth.

Lack of business management skills and educational gaps[191]: Many entrepreneurs lack essential business management skills, which are crucial for running a successful business. There is a need for more entrepreneurship-focused education and training programs to equip aspiring entrepreneurs with the necessary skills.

Weak support networks and limited access to mentorship[192]: The support ecosystem for small businesses, including mentorship and advisory services, is often underdeveloped. Entrepreneurs may struggle to find experienced mentors who can provide guidance and support.[193]

[189] Santodomingo, R. 1(14 March, 2024). Ibidem. Accessed on 30 Nov. 2024.

[190] United Nations Conference on Trade and Development (2023). South Africa Entrepreneurship Strategy Review. Accessed on 30 Nov. 2024.

[191] Iwu, C. G. (2023). State of Entrepreneurship in Southern Africa. In *The Palgrave Encyclopedia of Entrepreneurship* (pp. 1-5). Cham: Springer International Publishing.

[192] Santodomingo, R. 1(14 March 2024). Ibidem. Accessed on 30 Nov. 2024.

[193] Parker, M. August (2020). Op. cit. Accessed on 30 Nov. 2024.

7. Conclusion and recommendations

The translation of research outputs into enterprises/ businesses is not an isolated process, but rather the result of a set of factors relating to education system, research and innovation landscape, entrepreneurial ecosystem and even opportunities for collaboration with stakeholders the private sector, civil society and grassroots communities.

The study identified six main issues where practical recommendations are provided:

- Fragmented support environment at national level: Fostering a legal and institutional environment conducive to research, innovation and entrepreneurship.
- Limited research and innovation capacity: Investing in research and innovation
- Lack of entrepreneurial culture/mindset: Integrating entrepreneurship into university curricula.
- Limited capacities for students to develop and implement their business ideas and plans: Supporting students and researchers in developing and implementing their business ideas and plans
- Limited use of intellectual property: Leveraging IP for inventions
- Weak collaboration between HEIs, local communities, the private sector: Harnessing collaboration between HEIs and the private sector.

7.1 Fostering a legal and institutional environment conducive to research, innovation and entrepreneurship

The research highlights, at each country level, an array of laws, institutions and other initiatives designed to regulate and foster the R&I landscape and the entrepreneurship ecosystem. These national policies and institutions could potentially enable HEIs, and their stakeholders harness the power of entrepreneurship and innovation to create businesses that can help combat unemployment among young people and women. However, application of these various tools is not always effective due to the complexity of each environment, their lack of harmonisation and lack of awareness among stakeholders, including the academic world. In addition, apart from a few schemes (South Africa, Senegal), there are no clear policies containing precise objectives on academic entrepreneurship.

Table 9: Practical recommendations to foster a legal and institutional environment conducive to research, innovation and entrepreneurship

Issues	Recommendations
Fragmented support environment	**Fostering a legal and institutional environment conducive to research, innovation and entrepreneurship** ➢ **<u>At government level</u>** - Formulating and implementing a cohesive national policy framework, for each country, to streamline and foster the commercialization processes of research outputs. - Supporting HEIs in co-creating innovation hubs, technology parks, and business incubators to provide resources, mentorship, and networking opportunities for entrepreneurs. - Developing one-stop-shop platforms where businesses can access all necessary services, such as registration, licensing, and funding. - Promoting entrepreneurship through public campaigns, educational programs, and by celebrating successful entrepreneurs. ➢ **<u>At HEIs level</u>**

	- Carrying out research geared to the needs of ecosystems to help policymakers better understand what resources and support structures are necessary to foster entrepreneurship and innovation. - Providing evidence-based policies: HEIs can contribute through research, to providing the evidence needed to develop policies that are grounded and tailored to the specific context of African countries. - Studying and benchmarking successful policies and practices from other regions to recommend best strategies that could be adapted and implemented locally. - Facilitating stakeholder engagement by identifying key stakeholders in the research, innovation, and entrepreneurship ecosystem and enabling collaboration and networking. - Conducting research that enables continuous monitoring and evaluation of policies to determine their effectiveness and identify areas for improvement. - Building capacity and knowledge by o providing training and development programs to build the capacity of policymakers and entrepreneurs. o sharing research findings through publications, reports, and open data initiatives as so to inform and inspire evidence-based policymaking. ➢ **RUFORUM and national/ international partners** Through its consortium of universities and partners, RUFORUM could help mobilise resources, conduct activities (identifying challenges and opportunities, informing policy development; enhancing collaboration and networking, monitoring and evaluation, building capacity and knowledge, engaging in advocacy) at national and regional level to help promote a legal and institutional framework conducive to research, innovation and entrepreneurship.

7.2 Investing in research and innovation

According to the World Economic Forum, only 1% of global investment in R&D is spent in Africa, and the continent holds a tiny 0.1% of the world's patents.[194] Moreover, Africa currently has 198 researchers per million people, compared with 428 in Chile and over 4,000 in the UK and US. African governments and HEIs can take several steps to boost research and innovation, fostering economic growth and sustainable development. The following table provides recommendations for investment in research and innovation.

Table 10:Recommendations on investment in research and innovation

Issues	Recommendations
Limited research capacity	**Investing in research and innovation** Some recommendations at HEIs and government levels overlap. ➢ **At government level** - Increasing the percentage (1%) of GDP spent on R&D/**industrial research**. Currently, many African countries spend less than 1% of their GDP on R&D, which is below the global average This includes funding for universities, research institutions, and innovation hubs.

[194] Kariuki, T & kay, S. (20217). There are not enough scientists in Africa. How can we turn this around? The World Economic Forum Africa. Accessed on 27 Nov. 2024.

	- Implementing policies that create a conducive environment for innovation, such as intellectual property rights protection and streamlined regulatory processes. - Providing tax incentives and subsidies for private sector investments in research and innovation. - Providing state-of-the-art facilities and resources, including laboratories, research centres, and high-speed internet, to support research activities. ➢ **At HEIs level** - Establishing and strengthening networks between universities, research institutions, and industry to promote knowledge sharing and collaboration. - Offering training and professional development programs for researchers, educators, and entrepreneurs. - Collaborating with international organizations and research institutions to access global expertise and resources. ➢ **Recommendations for RUFORUM and its partners** - Facilitating networking events, conferences, and workshops that bring together researchers, entrepreneurs, investors, and policymakers. - Supporting universities in strengthening linkages between industry and academia to ensure that research is aligned with market needs and can be effectively commercialized.

7.3 Integrating entrepreneurship into university/HEIs curricula

Successful integration of entrepreneurship might be based on two fundamental principles: institutionalisation and inclusion/integration. On the one hand, it is crucial to put in place the necessary institutions and funding mechanisms to make the process of integrating entrepreneurship into university curricula effective. On the other, HEIs need to embed entrepreneurship at all levels of education[195]. According to The World Economic Forum 2009, "it is not enough to add entrepreneurship on the perimeter – it needs to be at the core of the way education operates".[196] Thus, to be successful, it is imperative to create a comprehensive entrepreneurship education -centred strategic plan that would serve as a guiding light for the HEIs endeavours. Here are some tailored recommendations:

Table 11: Recommendations on how to integrate entrepreneurship on curricula

Issues	Recommendations
Lack of entrepreneurial culture/mindset	**Integrating entrepreneurship into university curricula** ➢ **At government level** - Mandating the inclusion of core and elective entrepreneurship courses (practical learning experiences) in university programs across various disciplines. - Supporting faculties in providing training programs for students and researchers to equip them with the skills and knowledge needed to teach entrepreneurship effectively.

[195] Daze, S. & Herrick, D. (Nov.2021). Entrepreneurship Education in Canada Annual Review – 2021. Telfer School of Management, University of Ottawa. Accessed on 21 Nov. 2024.

[196] The World Economic Forum (April 2009). Educating the Next Wave of Entrepreneurs: Unlocking entrepreneurial capabilities to meet the global challenges of the 21st Century. P. 09. Accessed on 23 Nov. 2024.

	- Allocating funding to universities specifically for designing relevant mentorship programs that connect students with experienced entrepreneurs and business leaders. - Creating incentives for universities that successfully integrate entrepreneurship into their curricula, such as additional funding, awards, and recognition. ➢ **<u>At HEIs level</u>** - Designing a well-structured and practical curriculum that includes clear objectives, teaching content, methods, and assessment techniques. - Including dedicated courses on social entrepreneurship in the curriculum, teaching students about social impact, sustainable business models, and innovative solutions to community problem. - Providing students and researchers with access to resources such as incubators, accelerators, and funding opportunities to support their entrepreneurial ventures. - Fostering teamwork and innovation through collaborative pedagogical models like problem-based learning, peer assessment, and design thinking. - Designing hands-on learning through internships, incubators, and real-world projects. - Encouraging project-based learning where students and researchers can work on real-world problems and develop entrepreneurial solutions. ➢ **Recommendations for RUFORUM and other partners** - In collaboration with its partners, evaluating or benchmarking current projects (AgriEngage, AgriSCALE, the Student Enterprise Scheme (SES) at Gulu University, TagDev, Forest 21 etc.) and other initiatives using problem-based learning (PBL) or other methods, to identify both challenges and best practices. Some successful projects can be tested and scaled up in other contexts to help spread best practices in integrating innovation and entrepreneurship into higher education.

7.4 Supporting students and researchers in developing and implementing their business ideas and plans

Among the activities initiated by HEIs is support for students and researchers in developing and implementing their business ideas and plans. Support provided to students and researchers is even more necessary as it is through such activities, among others, that HEIs can transform their environment into an entrepreneurial and innovation ecosystem.

Despite the many initiatives put in place, HEIs still face enormous challenges in the process of supporting their students and researchers to become more entrepreneurial. The following recommendations can help universities create a robust entrepreneurship education program that prepares students to navigate the challenges and opportunities of the entrepreneurial world.

Table 12: Recommendations on how to support students and researchers in developing and implementing their business ideas and plans

Issues	Recommendations
Limited capacities for students and staff to develop and implement their business ideas and plans.	**Supporting students and staff in developing and implementing their business ideas and plans** *Some recommendations at government and HEIs level may overlap.* ➢ **<u>At government level</u>** - Providing dedicated grants and scholarships for entrepreneurial projects, allowing students and staff to access funding without financial burden.

	- Setting up advisory services within universities to provide guidance on business development, marketing strategies, and financial management. - Simplifying the process of business registration and licensing to make it easier for start-ups to launch and operate. - Providing tax breaks and other incentives for university-affiliated start-ups and businesses. ➢ **At HEIs level** - Offering entrepreneurship education: courses and workshops, guest lectures etc. focusing on practical skills such as social entrepreneurship, leadership, project management, and innovation. - Providing mentorship and guidance: mentorship programs, advisory board - Facilitating access to funding: seed funding and pitch competitions - Encouraging interdisciplinary collaboration: cross-department projects, hackathons and innovation challenges. - Providing practical resources: access to facilities and technical support. - Connecting students and staff with experienced entrepreneurs and industry experts who can offer advice and support. ➢ **Recommendations for RUFORUM** - Advocating for partnerships between universities and corporations to provide resources, funding, and expertise for entrepreneurial initiatives. - Working with other private sector, non-governmental organizations and international agencies to support and fund entrepreneurship programs within - Co-developing (with universities, and national/international organizations) online platforms where students and staff can collaborate, share ideas, and access resources and information.

7.5 Promoting IP for inventions

To secure IP for inventions, it is important to put in place, at national level, a process based on five (5) essential stages. Before suggesting practical recommendations, the five stages are developed further to provide insights to HEIs, policymakers and other stakeholders engaged in IP management processes.

- **Stage 1: Assessment of the status** of the national intellectual property systems to better understand barriers and enablers: setting-up an action plan for implementation and for continuous process improvement.
- **Stage 2: IP education**: It is crucial to invest in IP education and support the implementation of major public awareness campaigns to promote a better understanding of the system and its potential benefits. These campaigns can be carried out using traditional communication tools (radio (including community radio), television, etc.) or modern ones (social media platforms).[197] Content should be tailored to different target communities – designers, musicians, craftspeople, entrepreneurs, teachers, researchers and decision-makers – to demonstrate the benefits of using intellectual property. Guidelines for organizing awareness raising campaigns are suggested by WIPO Committee on Development and Intellectual Property.
- **Stage 3: Strengthening the knowledge and capacity of intellectual property agencies and institutes** to improve the quality of their services. The services and assistance of the World Intellectual Property Organisation (WIPO) and the African Regional Intellectual Property

[197]WIPO Committee on Development and Intellectual Property (2022 Prepared by Dr Ioannis Kikkis). Raising awareness on Intellectual Property for Creative Industries in the digital environment. Guidelines for organizing awareness raising campaigns. Accessed on 30 Nov. 2024.

Organisation (ARIPO) are essential to enable African countries to strengthen the skills and technical knowledge of the staff of their intellectual property offices. Emphasis in capacity building programs should be placed on WIPO standards for intellectual property offices aimed at simplifying data processing procedures relating to the filing, examination, publication, grant and registration of patents, trademarks and industrial designs. [198]

- **Stage 4: Designing IP training schemes:** In the case of universities, it would be vital to provide IP training for teachers, researchers, managers of IP and technology transfer offices, and even students with business start-up project. These training programmes could be drawn up in collaboration with the ministries responsible for innovation and research and intellectual property institutes and agencies. In addition, they should be formalised and certified to demonstrate their formal nature and usefulness in the progression of researchers. Particular emphasis should be placed on quality and the ability to translate IP filings into concrete products and services.
- **Stage 5: Designing mechanisms to finance innovation and IP**: Securing IP for inventions requires consistent funding. OAPI has set up a mechanism for financing invention and innovation.[199] Similarly, a structuring financing programme based on intellectual property tools has been developed and States have been called upon to submit bids to benefit from it. For example, in partnership with national development banks and the industrial sector, financing mechanisms can be put in place, consisting of start-up funding (including start-ups emerging from university research), small business loans (considering IP management) to carry out projects that will promote their growth and success, while protecting their liquidity. For university research and innovation, IP funding programmes can be combined with existing research grants, subject to certain conditions. For example, a researcher who benefits from a research grant (first stage), could also benefit from a second grant when it comes to translating the results of his or her research. However, IP funding is subject to the establishment of innovation management support services (IP and technology transfer offices). In this respect, it would be particularly necessary to make provision in university budgets for the creation and implementation of structures dedicated to innovation and IP, particularly in countries such as Senegal, Uganda and Cameroon. Such mechanisms should also allow access to IP infrastructures such as regional and international databases.
- **Stage 6: Enhancing IP legal environment:** Most IP systems in Africa operate under regional or sub-regional legislations. For instance, Uganda is member of the African Regional Intellectual Property Organization (ARIPO) is an inter-governmental organization that facilitates cooperation among its Member States on intellectual property matters, established by the Lusaka Agreement on 9 December 1976. Apart from Somalia, all ARIPO members are also Contracting Parties to the Patent Cooperation Treaty (PCT). The Organisation Africaine pour la Propriété Intellectuelle regional system manages IP applications in mainly 17 Francophone countries, including Cameroon and Senegal. South Africa stand alone and IP protection cannot be obtained through OAPI and ARIPO.[200] This particularity may not be conducive to the introduction of specific initiatives or

[198] WIPO Committee on Development and Intellectual Property (2022 Prepared by Dr Ioannis Kikkis). Ibidem. Accessed on 30 Nov. 2024.

[199] Financement de l'innovation : l'OAPI s'engage. Accessed 24 Nov. 2024.

[200] WCB (2024). The Underestimated Power of IP in Africa: Africa's Intellectual Goldmine. Accessed 24 Nov. 2024.

legislation, as the members countries have renounced their national patent and trademark legislation. Beyond these legislation and engagement, it would be particularly important for these countries to put in place an enabling legislative and policy framework that support the effective identification, protection, and management of any IP associated with the R&D results[201].

Table 13:Recommendations: Leveraging IP for inventions

Issues	Recommendations
Limited use of intellectual property	**<u>Leveraging IP for inventions</u>** *Some recommendations at national and HEIs level may overlap***.** ➢ **At government level** - Offering capacity-building programmes for national intellectual property management and existing technology transfer structures. - Providing accessible IP advisory services to help inventors navigate the IP system and understand their rights. - Offering grants and financial support for inventors to register and protect their IP rights. - Launching campaigns to inform the public and inventors about the benefits of IP rights and how to protect their inventions. - Developing and implementing clear IP policies within universities that outline the rights and responsibilities of students, faculty, and the institution regarding inventions and IP. - Simplifying the administrative processes for IP registration and protection to make it easier for inventors to secure their rights. ➢ **<u>At HEIs level</u>** - Establishing IP advisory offices within universities to provide guidance on IP issues, including patent applications, copyright, and trademark registration. - Establishing innovation hubs and technology transfer offices within universities to support the commercialization of research and inventions. - Creating funds or grants specifically for IP-related activities, helping students and staff cover the costs of IP registration and protection. - Including IP education in the university curriculum to teach students about the importance of IP rights and how to protect their inventions. - Fostering collaborations with industry partners to provide real-world insights and support for university innovations. - Offering research grants that include provisions for IP protection, encouraging researchers to consider IP from the outset of their projects. ➢ **Recommendations for RUFORUM** - Promoting knowledge exchange programs with international universities and organizations to learn best practices in IP management and innovation. - Collaborating (through its network of universities and national partners) with international organizations like the World Intellectual Property Organization (WIPO) to benefit from their expertise and resources. - Providing support for start-ups and small businesses (emerging from universities) to help them commercialize their inventions and grow. In addition, RUFORUM could initiate a study to better understand the enablers as well as the barriers of the Soth Africa **Intellectual Property Rights from Publicly Financed Research and Development Act 51 of 2008** to measure to what extent this act could

[201]Brant, J. and Sibanda, M. (2018). South Africa: IP Management and the Commercialization of Publicly Funded Research Outcomes, WIPO. Accessed 25 Nov. 2025.

	serve as a benchmark for other universities in other RUFORUM member countries. Another initiative would be to organise experience-sharing workshops between South African universities and other African universities to draw inspiration from the positive practices generated by this act in terms of impact on IP management processes and technology transfer, and even, more concretely, as an enabler for business creation.

7.6 Harnessing collaboration between HEIs, local communities and private sector

Collaboration between higher education institutions (HEIs) and the private sector and communities is crucial for fostering innovation, driving economic growth, and addressing societal challenges in Africa. The study shows a weak collaboration between HEIs and the private sector. Here are some recommendations to harness collaboration HEIs/local communities/private sector:

Table 14: Recommendations on effective collaboration between HEIS and the private sector

Issues	Recommendations
Weak collaboration between HEIs and the private sector	**Harnessing collaboration between HEIs, local communities and private sector.** *Some recommendations at national and HEIs level may overlap.* ➢ **<u>At government level</u>** - Designing and implementing policies that foster collaboration between HEIs, local communities and private sector. - Investing in upgrading digital infrastructure to support research, innovation, and collaboration between HEIs and the private sector. ➢ **<u>At HEIs level</u>** - Setting up innovation hubs and business incubators within HEIs to support entrepreneurship and innovation. These hubs can provide resources, mentorship, and funding opportunities for students and local entrepreneurs. - Establishing vocational and technical training programs in partnership with local industries and communities. This can provide students with practical skills and improve their employability while addressing the specific labor needs of the private sector. - Integrating industry experience and community service into HEIs curricula, allowing students to engage with local communities and contribute to development projects. This hands-on experience benefits both students and communities. - Building strong networks: Innovation Hubs, private sector/community engagement. - Connecting students and staff with experienced entrepreneurs and industry experts who can offer advice and support. - Regularly assessing the impact of collaborative projects to ensure they meet their objectives and benefit all stakeholders: Using feedback from communities, students, and businesses to continuously improve and adapt initiatives**.** ➢ **<u>Recommendations for RUFORUM</u>** - Advocating for policies that promote collaboration between HEIs, local communities, and the private sector. This includes supporting nitiatives th at provide funding and incentives for joint projects. - Facilitating collaborative research between HEIs and the private sector to address local community challenges. For example, agricultural universities could partner with farming cooperatives and agribusinesses to develop sustainable farming techniques.

	- Working with other private sector, non-governmental organizations and international agencies to support and fund entrepreneurship programs within universities. - Co-developing (with universities, and national/international organizations) online platforms where students and staff can collaborate with private sector and local communities to share ideas, and access resources and information.

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Annexes

Annex 1: List of additional business cases

Cameroon

Business Cases & Description	Affiliated university / university incubator	Sector / Areas	Size and stage of development	Year/Founder and other information
LUNAS FOODS Ltd is an Agribusiness food company that adds value to choicest African traditional meals by making them convenient to handle and prepare, available an affordable for people with active/busy lifestyles.	University of Bamenda	Agribusiness Food	Start-up	Jelah Christiane http://www.lunasfoodsltd.com/
Grace Family A brand of instant corn-, soy-, vegetable- and rice-based flours for infants, adults and seniors.	University of Dschang/ Fonds Pierre Castel/ Chaire Systèmes alimentaires et Entrepreneuriat en Afrique	Agribusiness Food	Start-up	Keliane TSAYEM SELABI (2023)
Livestock Master Enterprises	The University of Bamenda - 121 - Technology, Innovation and Incubation Center	Agribusiness	Start-up	Leinyuy Leonard Lavwir

Senegal

Business Cases	Affiliated university/university incubator	Sector/Areas	Size and stage of development	Year/Founder and other references
Cactus Innovation	Higher Institute of Agricultural and Rural Training, Bambey	Agri-business, Animal agriculture, Crop production	Start-up	Elhadji Malick Sagne
Arraw Tech SARL is a company specializing in the manufacture of food processing machinery.	Ecole Suérieure Polytehcnique (ESP, UCAD)	- Sector: Manufacturing of industrial machinery Company - Areas: Agri-food, agro-industry	Start-up: 2-10 employees	Head office: DakarType: - Founded in 2021 by 2 students
Tolbi Sustainable Agriculture and Nature Restoration using AI and Geospatial	**ESP (UCAD) Dakar**	Smart agriculture, precision agriculture, digital monitoring reporting and verification, Yield Estimation &	Start-up: a team of 14 collaborators	2018, co-founders including M. Kebe, a former student from ESP Dakar).

		Harvested Area Assessment		
Sesame+	**UCAD/ISRA**	Sesame-based food products (oil), non-food products (cosmetics, massage oil).	Start-up	2002 by 4 students

South Africa

Business Cases	Affiliated university / university incubator	Sector/Areas	Size and stage of development	Year / Founder and other references
K'saselihle Fresh Vegetables	DUT DUT Midlands Entrepreneurship Centre	agribusiness	Start-up: 6-15 employees	2019, Mbali Bengu,
TerraClim (Pty) Ltd uses pioneering integrated data resources to give you access to detailed climate and terrain information that will help you navigate the increase in seasonal changes. TerraClim offers precise climate and environmental insights, helping you optimise planting, harvesting and resource management.	**Stellenbosch University, Innovus**	Climate Resilience. Food Security. Data driven Solutions.	Start-up	Dr. Tara Southey, Founder TerraClim
Innovative Food Products A collection of creative and diverse research-driven food-developed products for licensing/partnership with food industry.	**Stellenbosch University**	Food and Nutrition	Stellenbosch University is seeking collaborations with food industry partners interested in development / commercial partnerships to further refine and commercialize student-developed products.	
SoilTrac	Stellenbosch University	Soil Health Monitoring	Start-up	
Immobazyme products range from growth factors, a primary ingredient in cell-cultured meat, to enzymes like dextranase, which is used to break down contaminants in sugar.	**Stellenbosch University LaunchLab**	Ingredient in cell-cultured meat;enzymes Immobazyme also ventured into the food and beverage industry, recently, with a variety of novel food ingredients created using its precision	Start-up: 3 founders and 9 employees.	Founded in 2019 by Dominic Nicholas, Ethan Hunter, and Nicholas Enslin

		fermentation platform.		
ButtaNutt	Former SU LaunchLab Company	Agribusiness, Food and Nutrition	Company During 2017 ButtaNutt started exporting and can be found in Singapore, Malaysia, Mauritius, Taiwan and the UAE.	2014, Founder, Antoine van Heerden
Revolute Systems provides technology solutions like EMI soil scanners, production monitoring, satellite imaging and precision agriculture.	Former SU LaunchLab Company	Agriculture precision	Start-up (1-10 employees)	
Ulibo Lokuqala Agricultural Enterprise– Leaders in Great Harvest – is crop farm situated in Ncera	University of Fort Hare	Agribusiness, a food security initiative focusing on crop and piggery farming that is aimed at addressing the country's food insecurity and unemployment crisis.	**Start-up**	Established in April 2020 by a group of graduates from the University of Fort Hare.
Phyenti **Nature +Science**	USENTERPRISES Stellenbosch University	Phyenti is a South African phytopharmaceutical and natural medicines company, founded in 2021 by a team of scientists from Stellenbosch University. Phyenti is a proud member of the Stellenbosch University group of companies.		Founded in 2021 by a team of scientists from Stellenbosch University.

In addition to start-ups, two case studies from community development initiatives (indigenous communities) might be considered:

- **PROLINNOVA Project**: a partnership with Limpopo Department of Agriculture and Rural Development (LDARD) and University of Limpopo (UL) to capacitate farmers to drive their own product.
- **Setšong Tea Crafters**: an Award-Winning Agri-business that produces indigenous knowledge-based teas and health infusions from wild South African indigenous plants.

Uganda

Business Cases	Affiliated university/university incubator	Sector/Areas	Size and stage of development	Year/Founder and other references
 **Gordon's Agricultural Organization Uganda Limited (GAO-UG)** GAO-UG supports farmers by providing market access, climate-smart agricultural inputs, and technical services, including borehole drilling, extension services, and credit support.	Kampala University/Gulu University/TAGDEV 1.0	Agriculture: market access, climate-smart agriculture; credit support	Employs over 40 young men and women. Start-up.	Susan Adong (Cofounder)
--**Summary of Companies and products in the Agribusiness Incubation Hub (AIH) at BSU.**	Bishop Stuart University Agribusiness Incubation Hub (AIH)	Agribusiness	Start-ups, students' projects	The project to establish an Agribusiness Incubation Hub (AIH) started in March 2018 with a two-year funding arrangement from Master Card Foundation, through the Regional Universities Forum (RUFORUM).
Makerere Innovation & Incubation Center	**University of Makerere**	Start-ups incubated (agriculture sector), not available.		

Annex 2: Interview Guide

Interview Guide (Adaptable to different categories of key informants)

The overall objective of the assignment is to generate knowledge for supporting agribusiness incubation and entrepreneurship in African universities targeting faculty and students as entrepreneurs, innovators, and job creators.

The specific objectives of the collaboration between RUFORUM and DeSIRA are to:

- Identify examples of innovative business cases and/or mechanisms for transforming research
- results into economic activities that strengthen existing enterprises (especially SME) and/or create new enterprises and decent youth employment in sustainable agriculture and food systems.
- Analyze the different models and mechanisms used by universities, research centres and private companies with a focus on among others, enabling/constraining factors, funding mechanisms, services and support provided,
- Suggest, based on these cases, how universities' capacity could be strengthened to support
- responsible innovation and job creation from research processes, and
- Provide practical recommendations on the procedures for the universities to translate research products into enterprises.
- Widely disseminate the outputs of the study to various stakeholders using various channels
- The assignment encompasses the following elements:
- The study will review the mechanisms, policies, and processes in support of or against the
- Translation of research products into enterprises or strengthen existing enterprises at national level in Cameroon, Senegal, South Africa, Uganda. These countries were selected for different reasons. Cameroon has a mixed anglophone and francophone education system hence important to obtain cases in this context. Uganda and Senegal are from purely anglophone and francophone education systems respectively and have dedicated government efforts to invest in commercialisation of academic research. Government of Uganda has invested in this area and given RUFORUM to build on earlier pilots. South Africa is relatively advanced in this area hence will be useful in providing homegrown solutions to the challenges based on its own experience.

The review will look at:

a) Different mechanisms to support entrepreneurship making use of research results,
   i. enabling factors and constraints to strengthen the innovation ecosystem useful for
   ii. entrepreneurship, and capacities of universities to support such entrepreneurship.
b) Document examples of innovations developed by actors with contributions of research and how research outputs have been translated to enterprises through business incubation in Cameroon, Senegal, South Africa, and Uganda.
c) The relevant cases identified will highlight different models (processes and conditions that make the research products and services scalable through entrepreneurs) such as innovation platforms, mentoring/networking with experienced entrepreneurs.
d) Document models for financing this innovation (mechanisms and partnerships) and how scaling within the enterprises and across geographies was financed.
e) Organise a hybrid session at the RUFORUM Triennial Conference in Namibia between 12th and 18th August 2024 in Windhoek, Namibia allowing virtual participation to share the lessons learned from the various processes and scaling models.

f) Hold national level webinars in partnership with the RUFORUM member universities in each country to widely disseminate the findings at national level.
g) Prepare a report with the summary of the webinar discussions and learning processes which will be disseminated amongst DeSIRA-LIFT and RUFORUM networks.

Interview guide

1. Introducing your organization/start-up

2. Different initiatives undertaken by your University to foster the commercialization of research outputs.

3. Business cases (successful) and lessons learned: Please, add any successful business cases (start-ups, SMEs, initiative, project) that emerge from your university research or students' projects.

4. Different models and mechanisms: Please, add relevant political, financial, legal or even social mechanisms and/or models at national level or university level to support academic entrepreneurship (or the entrepreneurial university), student entrepreneurship and the translation of research into sustainable businesses capable of creating jobs for young people and women.

5. Enabling/constraining factors; From your perspective, what are the enabling or constraining factors that support or hinder the commercialization of academic research.

6. Practical recommendations on how to leverage the commercialization of university based research and university-generated intellectual property etc.

7. Contacts: Please, refer me to key informant, resource person or relevant organization/institution in your country who/that might contribute to this study.

8. Additional Resources : articles, blogs, videos, websites etc.

Contact

Website:
www.desiralift.org

LinkedIn:
www.linkedin.com/company/desira-lift

Address:
Wageningen Centre for Development Innovation
P.O. Box 88
6700 AB Wageningen
The Netherlands

Email:
info@desiralift.org

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