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Shaping Uganda's STIRD Landscape: Key Actors, Functions, Influence and Partnerships

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Abstract

Despite growing political and institutional efforts, Sub-Saharan Africa continues to lag in science, technology, innovation, and research for development (STIRD). Uganda presents a critical case for understanding how domestic actors shape national STIRD ecosystems under conditions of policy fragmentation, donor influence, and regional integration. This study employs a qualitative research design grounded in document analysis to map the key domestic actors involved in Uganda's STIRD landscape. Guided by the National Innovation Systems (NIS) approach and the Triple Helix model, the research categorizes actors into five groups—government units, research institutions, think tanks, private sector actors, and regional/continental partners—and critically analyzes their mandates, influence, partnerships, and coordination dynamics. The findings reveal asymmetries in actor influence, coordination gaps across ministries and research institutions, and donor-driven research priorities that dilute domestic policy coherence. While central actors like UNCST, NARO, and MoSTI lead in shaping STI policy, peripheral actors such as CSOs and innovation hubs remain underleveraged. Regional bodies like SGCI and AAS offer technical support but are not yet fully integrated into national systems. The study underscores the need for improved coordination, domestic investment in R&D, and institutional mechanisms for knowledge translation. It contributes to the literature on national innovation systems in Africa and offers policy insights for strengthening Uganda's science and innovation governance.

Keywords: Science, technology, innovation, STIRD, Uganda, national innovation system, triple helix, science policy actors, knowledge-based economy.

Introduction

Science, Technology, Innovation, and Research for Development (STIRD) are pivotal to economic transformation and knowledge-based growth, especially in developing countries seeking to overcome structural and human capital deficits. Across Sub-Saharan Africa, regional bodies such as the African Union (AU) and initiatives like STISA-2024 have emphasized the strategic value of STI in addressing health, agriculture, energy, and industrial development challenges (African Union Commission, 2014). Despite these efforts, many national systems still suffer from underinvestment, fragmented coordination, and limited capacity to translate research into policy or commercial outcomes.

Uganda offers a compelling case for examining these dynamics. As one of the East African countries most actively institutionalizing its STI ambitions, Uganda has established a constellation of public agencies, research institutes, policy think tanks, and innovation hubs to steer its STIRD agenda. Institutions such as the Ministry of Science, Technology and Innovation (MoSTI), the Uganda National Council for Science and Technology (UNCST), and the National Agricultural Research Organisation (NARO) play central roles in shaping research policy, funding frameworks, and sectoral innovation priorities. Alongside these are influential non-governmental actors—including UNAS, ACODE, and emerging private sector innovation spaces—reflecting a diverse and evolving ecosystem.

Yet, much of the existing literature and policy analysis remains descriptive or fragmented. While studies have mapped individual actors or sectoral innovations (UNCTAD, 2021; Jjagwe et al., 2023), few have critically examined the **interactions, power relations, and coordination challenges** across institutions. There is limited understanding of **how formal mandates, informal influence, partnerships, and external funding** collectively shape Uganda's innovation performance. Moreover, Uganda's increasing engagement with regional (e.g., AAS, SGCI) and Global South actors (e.g., Türkiye, China) remains underexplored in the context of national science diplomacy and systemic transformation.

To fill this gap, this study analyzes the domestic actors shaping Uganda's STIRD landscape—not only in terms of their roles and functions, but also their institutional influence, collaborative relationships, and integration into regional science governance. The research is informed by two complementary theoretical frameworks: the **National Innovation Systems (NIS)** approach, which conceptualizes innovation as a system of interdependent institutions governed by knowledge flows, policy coordination, and feedback mechanisms (Lundvall, 1992; Nelson, 1993); and the **Triple Helix model**, which emphasizes the co-evolving roles of universities, industry, and government in fostering innovation and commercialization (Etzkowitz & Leydesdorff, 2000).

1. Which institutional actors—governmental, academic, civil society, and private—are central to Uganda's STIRD ecosystem?
2. What are their mandates, functions, and sectoral focus areas within the national innovation system?
3. How do these actors interact, coordinate, and influence science, technology, and innovation policy and implementation?
4. What systemic gaps—such as coordination failures, funding asymmetries, or knowledge translation barriers—can be identified within the STIRD ecosystem?

5. How do regional and international partnerships shape the capacity, alignment, and sustainability of Uganda's STIRD system**?**

By examining Uganda's STIRD ecosystem through a systems-based and actor-centered lens, this study makes three core contributions. First, it provides a holistic mapping of domestic actors based on institutional type, mandate, and influence. Second, it offers a comparative analysis of actor relationships, enabling a deeper understanding of how Uganda's fragmented system can be strengthened. Third, it highlights the importance of regional integration and science diplomacy, shedding light on the roles of continental and South–South collaborations in shaping Uganda's research and innovation future.

Literature Review

The existing literature on Uganda's STIRD ecosystem offers a multifaceted examination of the national and local actors shaping the country's innovation landscape. These studies provide insights into the roles, functions, and interrelations of various stakeholders, highlighting both progress and persistent challenges.

The United Nations Conference on Trade and Development's (UNCTAD) Science, Technology and Innovation Policy Review of Uganda underscores the necessity for a cohesive national innovation system. It identifies key actors, including government ministries, research institutions, and private sector entities, and emphasizes the importance of coordinated policies to enhance innovation capacity (UNCTAD, 2021).

The World Bank's analysis of the Millennium Science Initiative (MSI) provides a case study on strengthening Uganda's research and development capabilities. The MSI aimed to bolster scientific research and education by funding research projects and improving infrastructure, thereby enhancing the roles of universities and research institutions in the national innovation system (World Bank, 2013).

Jjagwe et al. (2023) delve into the dynamics of Uganda's National Innovation System (NIS), exploring the relationships among various actors and the contextual factors influencing innovation. Their study highlights the complexity of interactions between public institutions, private sector players, and civil society, and calls for a more integrated approach to policy and practice (Jjagwe et al., 2023).

The World Bank's earlier report on Science, Technology, and Innovation in Uganda provides sector-specific analyses, examining how different industries engage with and contribute to the national innovation system. It identifies barriers to innovation, such as limited funding and inadequate collaboration among stakeholders, and recommends policy interventions to address these issues (World Bank, 2010).

The Uganda National Council for Science and Technology's (UNCST) National Research Outlook Report 2023 offers a comprehensive overview of the country's research landscape. It assesses the performance of research institutions, funding mechanisms, and policy frameworks, and suggests strategies for enhancing research and innovation outcomes (UNCST, 2023).

Collectively, these studies reveal a national innovation ecosystem characterized by a diverse array of actors operating within a complex policy environment. While significant strides have been made in establishing institutional frameworks and funding mechanisms, challenges persist in terms of coordination, capacity building, and effective policy implementation. The literature underscores the need for a more integrated and strategic approach to harness the full potential of Uganda's STIRD ecosystem.

To frame this study analytically, we draw on the National Innovation Systems (NIS) approach, which views innovation as an outcome of complex interactions among public, private, and knowledge institutions within a national context (Lundvall, 1992; Nelson, 1993). This lens helps illuminate how institutional design, actor mandates, and inter-organisational linkages collectively shape science and innovation ecosystems. Additionally, elements of the Triple Helix Model are incorporated to examine the evolving roles and relationships among universities, government, and industry in Uganda's STIRD ecosystem (Etzkowitz & Leydesdorff, 2000). These complementary frameworks guide the classification of actors and the analysis of their influence, partnerships, and coordination challenges.

Methodology

This study adopts a qualitative research design, using document analysis as the primary method to investigate the organisational actors shaping Uganda's STIRD ecosystem. The approach is grounded in an interpretive paradigm, aiming to understand the functions, influence, and partnerships of international and national actors through the systematic review of textual data.

Data Collection and Selection Criteria

Data were collected from a range of publicly accessible sources, including policy documents, national development plans, institutional reports, academic publications, and media coverage. Key institutional websites—such as those of the Ministry of Science, Technology and Innovation (MoSTI), the Uganda National Council for Science and Technology (UNCST), and Makerere University—were reviewed. Media archives were also searched for reports on STIRD-related activities and institutional partnerships in Uganda.

The selection of organisations was guided by four revised criteria:

1. The organisation must be governmentally established as an agent unit specifically mandated to implement or coordinate STIRD (Science, Technology, Innovation, and Research for Development) policies in Uganda.
2. The organisation must be officially accredited by the Ugandan government as an academic institution actively involved in STIRD-related research, education, or innovation initiatives.
3. The organisation must be a Uganda-based civil society organisation (CSO) with a demonstrable focus on, and measurable impact in, STIRD-related policy engagement or programmatic work.
4. The organisation must be a private entity registered by the Ugandan government that engages in STIRD-related initiatives, services, or collaborations within Uganda.

These criteria were applied to ensure that only organisations with a recognized role and tangible contributions to the STIRD ecosystem in Uganda were included in the analysis.

Data Analysis

The analysis is informed by the National Innovation Systems (NIS) framework, which provides a conceptual basis for mapping institutional actors, their functions, and systemic linkages within the STIRD ecosystem (Lundvall, 1992; Nelson, 1993). Complementarily, the Triple Helix Model is employed to explore the interaction dynamics among academic, governmental, and private-sector actors, particularly in areas of policy development, knowledge production, and innovation commercialization (Etzkowitz & Leydesdorff, 2000). These frameworks support a relational understanding of Uganda's STIRD landscape.

The collected documents were thematically coded based on four organisational categories: (1) Government Units, (2) Research and Science Institutions, (3) Think Tanks and Policy Research Centres, and (4) Regional and Continental Actors. Within each category, further coding focused on the organisation's mandate, sectoral focus (e.g., health, agriculture, education, ICT), type of partnerships (bilateral, multilateral, NGO, academic), and evidence of influence (policy inputs, funding, institutional collaborations, training, infrastructure support).

A combination of manual coding and content mapping was used to trace the relationships among actors, identify thematic concentrations, and assess the depth of institutional engagement. Special attention was given to triangulating data across sources (e.g., aligning media reports with institutional publications and policy references) to ensure validity and reliability.

Government Units Driving Science, Technology and Innovation Policy

Uganda's STIRD ecosystem is underpinned by a constellation of government entities, each playing a distinct yet interconnected role. These institutions collectively shape the national innovation landscape through policy formulation, regulatory oversight, infrastructure development, and capacity building.

Table 1. Government Units Responsible for Higher Education, Science, Technology, and Innovation in Uganda

Name	Description	Website
Ministry of Education and Sports (MoES)	Oversees national education policy, including higher education, TVET, and skills development. Formerly incorporated MoSTI functions.	education.go.ug
Ministry of Science, Technology and Innovation (MoSTI)	Formerly an independent ministry (2016–2021) dedicated to STI policy and innovation integration. Now a Department under MoES but still operationally distinct in STI coordination.	mosti.go.ug
National Council for Higher Education (NCHE)	Accredits and monitors universities and tertiary institutions to ensure quality and relevance.	unche.or.ug
Uganda National Council for Science and Technology (UNCST)	Coordinates science policy, regulates research ethics, and manages grants and STI statistics.	uncst.go.ug
Uganda Industrial Research Institute (UIRI)	A government-funded research and development institute supporting industrialisation through applied research.	uiri.go.ug
Research and Education Network for Uganda (RENU)	Provides ICT infrastructure and internet services to research and academic institutions; crucial for STI digitalisation.	renu.ac.ug
Ministry of ICT and National Guidance	Oversees Uganda's ICT policy and supports innovation hubs and digital transformation.	ict.go.ug

Ministry of Education and Sports (MoES): The Ministry of Education and Sports (MoES) serves as the cornerstone for human capital development in Uganda. Its mandate encompasses the formulation and implementation of policies aimed at delivering quality education across all levels, including higher education and technical vocational education and training (TVET) . By overseeing curricula and accreditation through bodies like the National Council for Higher Education (NCHE), MoES ensures that educational programs align with national development priorities, particularly in Science, Technology, Engineering, and Mathematics (STEM) fields.

MoES has been instrumental in coordinating donor-funded initiatives to bolster science and technology training infrastructure. Notably, the Higher Education, Science and Technology (HEST) project, supported by the African Development Bank, invested over US$100 million in upgrading science laboratories and expanding access to science programs

in public universities. Additionally, MoES has facilitated international partnerships, such as the collaboration with Türkiye to enhance knowledge exchange in health sciences and technology.

Ministry of Science, Technology, and Innovation (MoSTI): Established in 2016, the Ministry of Science, Technology, and Innovation (MoSTI) was tasked with integrating science and innovation into Uganda's development agenda. Although restructured under the Office of the President in 2021, MoSTI's core functions continue through the Science, Technology, and Innovation Secretariat. MoSTI has been pivotal in developing and coordinating policies to drive scientific research, technology adaptation, and innovation across sectors.

Under MoSTI's guidance, Uganda updated its Science, Technology, and Innovation (STI) Policy and launched initiatives to commercialize research outputs. The ministry also championed funding mechanisms like the National Innovation Fund to support startups and scientific entrepreneurs. International collaborations have been central to MoSTI's strategy, exemplified by partnerships with China on peaceful nuclear technology cooperation and with the Response Innovation Lab to promote socially-oriented innovation for humanitarian challenges.

Uganda National Council for Science and Technology (UNCST): UNCST, established by statute in 1990, serves as the national science council. Its mandate includes advising the government on STI policy matters, coordinating research and development activities, and regulating research ethics . UNCST oversees research regulations, maintains data on research output and R&D investments, and administers competitive research grants.

UNCST's role extends to international partnerships aimed at enhancing its capacity and resources. Participation in the Science Granting Councils Initiative (SGCI) has enabled UNCST to strengthen grant management, research funding, and policy advisory capabilities. Through SGCI support, UNCST developed an online technology matchmaking platform, TECHNOMART, to link researchers with investors and entrepreneurs, fostering the commercialization of local innovations.

Uganda Industrial Research Institute (UIRI): UIRI is a government-funded research and development institute focused on supporting industrialization through applied research . UIRI undertakes applied industrial research, develops optimal production processes, and provides platforms for innovation and technology transfer. The institute has been at the forefront of creating and managing industrial parks and incubation centers, mentoring startups, and developing prototypes for commercialization.

UIRI actively engages in international collaborations to enhance Uganda's technological capabilities. Partnerships with countries like Malaysia and China have facilitated technology transfer projects aimed at upgrading Uganda's manufacturing processes and establishing local production of electronics.

Research and Education Network for Uganda (RENU): RENU provides high-speed internet connectivity and a range of ICT solutions to research organizations, health facilities, universities, schools, and other tertiary institutions . As a community-driven, non-profit organization, RENU plays a crucial role in nurturing collaboration among member institutions and global partners, thereby overcoming barriers to information and knowledge exchange.

RENU's initiatives include the deployment of eduroam hotspots across the country, enhancing connectivity for students and staff in educational institutions. By providing affordable ICT solutions, RENU supports the digitalization of Uganda's STI landscape, facilitating research and education activities.

Ministry of ICT and National Guidance: The Ministry of ICT and National Guidance oversees Uganda's ICT policy and supports innovation hubs and digital transformation initiatives. The ministry has been instrumental in establishing ICT innovation hubs, such as the National ICT Innovation Hub in Nakawa, Kampala, designed to promote ICT research and innovation, startup acceleration, and capacity building for developers and youth.

Through programs like the National Innovation Initiative Support Program (NIISP), the ministry aims to equip the youth with innovation spaces, digital skills, and connectivity, thereby fortifying the country's digital transformation agenda.

The synergy among these government units—MoES, MoSTI, UNCST, UIRI, RENU, and the Ministry of ICT and National Guidance—forms the backbone of Uganda's STIRD ecosystem. Their collaborative efforts in policy formulation, research coordination, infrastructure development, and capacity building are pivotal in advancing Uganda's science and innovation agenda. By leveraging international partnerships and fostering an environment conducive to innovation, these institutions collectively contribute to the nation's socio-economic development through science and technology.

Key Research and Science Institutions in Uganda

Uganda’s science, technology, innovation, research, and development (STIRD) ecosystem is anchored by a core group of national institutions that both generate knowledge and shape public policy. Among the most influential are the Uganda Virus Research Institute (UVRI), the National Agricultural Research Organisation (NARO), and the Uganda National

Academy of Sciences (UNAS). These institutions serve distinct but complementary functions within the ecosystem.

Table 2. Key Science & Research Institutions in Uganda

Institution	Origin	Focus Area	Website
Uganda Virus Research Institute (UVRI)	Uganda	National biomedical research institute specialising in virology and public health.	uvri.go.ug
Makerere University Walter Reed Project (MUWRP)	USA–Uganda	Health research partnership with U.S. Department of Defense; focuses on HIV, Ebola, and emerging diseases.	muwrp.org
Uganda Cancer Institute (UCI)	Uganda	National cancer research, training, and treatment institution.	uci.or.ug
National Agricultural Research Organisation (NARO)	Uganda	Oversees agricultural research centres, focusing on food security and crop science.	naro.go.ug
Institute of Tropical Forest Conservation (ITFC)	Uganda	Conservation and biodiversity research in protected areas like Bwindi.	itfc.org
Budongo Conservation Field Station (BCFS)	Uganda	Research and conservation of forest ecosystems and chimpanzees in Budongo Forest.	budongo.org
Uganda National Academy of Sciences (UNAS)	Uganda	Promotes scientific excellence and offers policy advice based on evidence.	unas.org.ug
Uganda National Health Research Organisation (UNHRO)	Uganda	Coordinates national health research and policy, under the Ministry of Health.	unhro.org.ug
ResilientAfrica Network (RAN)	Uganda	USAID-funded innovation lab hosted at Makerere University, supporting resilience-building innovations.	ranlab.org
College of Engineering, Design, Art and Technology (CEDAT), Makerere University	Uganda	STI education and research hub with emphasis on product innovation and entrepreneurship.	cedat.mak.ac.ug

Uganda Virus Research Institute (UVRI): UVRI is a national biomedical research institute under the Ministry of Health, established in 1936 and based in Entebbe. It has emerged as a regional leader in virology and immunology, focusing on infectious disease surveillance, diagnostics, and outbreak response. UVRI's key contributions include pivotal research on HIV/AIDS, Ebola, Marburg, and COVID-19. Its designation as a WHO Collaborating Centre for arboviruses and viral hemorrhagic fevers underscores its global stature and technical capacity (UVRI, 2023).

UVRI supports national health policy through evidence-based advice and serves as the reference laboratory for several diseases, including influenza and SARS-CoV-2. Its scientific influence is amplified by extensive domestic and international collaborations. One of the most

notable partnerships is with the UK's Medical Research Council (MRC) and the London School of Hygiene & Tropical Medicine (LSHTM), formalised through the MRC/UVRI & LSHTM Uganda Research Unit. This collaboration, which began in 1988 and was integrated into LSHTM in 2018, enables large-scale clinical trials, longitudinal cohort studies, and genomic surveillance (LSHTM, 2023).

UVRI also partners with the U.S. Army Medical Research Directorate-Africa through the Makerere University Walter Reed Project (MUWRP), focusing on HIV vaccine development and disease surveillance. The CDC, IAVI, and the UK's UKRI/MRC have also supported UVRI's work, including a £2.7 million COVID-19 genomics project (UKRI, 2021). Such initiatives have boosted Uganda's research infrastructure and testing capacity, especially during public health crises.

UVRI's strength lies in its ability to link national priorities with global scientific agendas. Its dual role in policy influence and high-impact research makes it a linchpin in Uganda's biomedical STIRD framework.

National Agricultural Research Organisation (NARO): NARO is Uganda's leading public agricultural research agency. It was established by statute in 2005 and operates under the Ministry of Agriculture, Animal Industry and Fisheries. NARO coordinates 16 institutes—seven focused on commodities like crops or livestock and nine zonal centres serving agro-ecological regions. It conducts research to enhance productivity, food security, and value addition, addressing areas such as crop breeding, pest control, fisheries, and agro-processing (NARO, 2023).

NARO's scientists have developed and disseminated a range of improved crop varieties (e.g., cassava, maize, beans) and livestock breeds, as well as a tick vaccine and faster-growing fish strains. Its work directly impacts farming practices and rural livelihoods, placing it at the heart of Uganda's innovation in agriculture (UNCTAD, 2020). NARO also informs government policy on biotechnology, biosafety, seed systems, and climate-smart agriculture.

Despite its success, NARO faces challenges. UNCTAD (2020) notes that some of its research priorities are donor-driven, and end-user feedback mechanisms remain weak. Strengthening linkages with farmers and private-sector actors is essential to increase the relevance and uptake of innovations.

NARO's capabilities are supported by robust international partnerships and donor funding. The World Bank has financed several multi-year initiatives, including the Agricultural Technology and Agribusiness Advisory Services Project and the Agricultural Cluster Development Project. These have enabled infrastructure upgrades and human capital

development, with NARO now employing close to 300 scientists, including 100 with PhDs (UNCTAD, 2020).

NARO collaborates with CGIAR centres such as IITA (for cassava) and CIMMYT (for maize), private enterprises like East African Breweries, and regional networks like ASARECA. It also contributes data to the Agricultural Science and Technology Indicators (ASTI) and participates in the African Union's Science Agenda for Agriculture in Africa. Through these channels, NARO supports both domestic policy goals and continental research priorities.

Uganda National Academy of Sciences (UNAS): UNAS, established in 2000, functions as Uganda's primary scientific society, comprising elected fellows from diverse scientific disciplines. Its mandate includes promoting research excellence and offering science-based policy advice. UNAS plays a bridging role between the scientific community and government, influencing policy through commissioned studies, consensus reports, and national consultations (UNAS, 2023).

UNAS's work spans a broad spectrum of STI-related issues. It has produced influential policy reports on biosafety, biotechnology, climate resilience, and health systems. Its activities are not regulatory but advisory, and its power stems from intellectual credibility and convening authority. UNAS contributes to national science debates, often advocating for increased R&D funding and evidence-based governance.

The Academy's work is bolstered by regional and global networks. It is a member of the Network of African Science Academies (NASAC) and collaborates with the African Academy of Sciences (AAS) and the InterAcademy Partnership. These alliances enable participation in multi-country initiatives and facilitate small research grants, capacity building, and science diplomacy.

UNAS has also benefited from key donor-funded initiatives. A landmark programme was the Africa Science Academy Development Initiative (ASADI), supported by the U.S. National Academies and the Gates Foundation, which helped institutionalise its policy advisory functions. More recently, support from IDRC, the Carnegie Corporation, and the Wellcome Trust has enabled UNAS to focus on thematic areas such as gender in science, parliamentary use of research evidence, and immunisation policy.

Domestically, UNAS maintains strong links with UNCST and line ministries. During the COVID-19 pandemic, UNAS fellows served on the national scientific task force. The Academy's annual symposia provide platforms for science-policy dialogue, and its work has contributed to Uganda's adoption of critical policies, such as the Biosafety Act.

UVRI, NARO, and UNAS play distinct yet synergistic roles in shaping Uganda's STIRD ecosystem. UVRI leads in biomedical research and public health preparedness, NARO anchors agricultural innovation and food security, while UNAS ensures science informs policy at the highest levels. These institutions exemplify how domestic actors can drive science and technology agendas when supported by clear mandates, strong partnerships, and sustained investment.

Their success also highlights the importance of international collaboration. Whether through joint research, funding, or capacity-building, global partnerships have significantly enhanced the reach and relevance of Uganda's research institutions. Moving forward, consolidating these partnerships while strengthening domestic ownership and stakeholder engagement will be critical to ensuring the sustainability and inclusiveness of Uganda's science and innovation system.

Think Tanks and Policy Research Centres

Independent think tanks in Uganda play a pivotal role in complementing governmental and academic efforts by providing research-based policy analysis and advocacy. Notably, the Advocates Coalition for Development and Environment (ACODE) and the Economic Policy Research Centre (EPRC) have significantly contributed to the discourse on STIRD.

Advocates Coalition for Development and Environment (ACODE): Established in 1999, ACODE is an independent public policy think tank recognized among East Africa's top institutions. While its broad focus encompasses governance, environment, and development, ACODE has developed a dedicated Science, Technology, and Innovation (STI) Programme over the past decade, acknowledging STI's critical role in sustainable development. The programme aims to strengthen the evidence base for Uganda's STI policies and promote the adoption of appropriate technologies, especially in agriculture—a sector central to Ugandan livelihoods.

ACODE's core functions include policy research and analysis, such as assessing the implementation of Uganda's existing STI Policy and identifying gaps. It also engages in outreach and advocacy to ensure that research findings inform decision-makers. For instance, ACODE has produced policy briefs on topics like intellectual property rights in agriculture, biotechnology, and the governance of innovation in East Africa. Additionally, it has convened multi-stakeholder dialogues on technology adoption to bridge gaps between innovators, regulators, and end-users.

The organization's influence is bolstered by its credibility and partnerships. ACODE prides itself on evidence-based advocacy and often collaborates with civil society groups and

the media to amplify messages on investing in science and technology. Over the past decade, ACODE has engaged in notable partnerships. Regionally, it contributed to the "Governance of STI in the EAC" report alongside partners in Kenya and Tanzania, highlighting how East African Community policies could better foster innovation. Internationally, ACODE benefited from the Think Tank Initiative (TTI), managed by IDRC and funded by donors like the Gates Foundation, which provided core funding and capacity-building support, enhancing its research quality and sustainability.

Beyond TTI, ACODE's projects have attracted funding from the European Union, USAID, and UN agencies for specific research themes, such as climate change innovation and urban governance. For example, ACODE collaborated with the International Budget Partnership on fiscal policies for environmental sustainability and with the Open Society Foundations on access to information in science policy. These collaborations have not only provided resources but also connected ACODE to global debates, allowing its researchers to contribute to international conferences on development and innovation policy.

Domestically, ACODE maintains close engagement with Parliament and ministries. Its annual local government scorecard reports, while focused on governance, indirectly support STIRD by recommending improvements in local service delivery using innovative approaches. Through its analytical output and partnerships, ACODE has become an important actor pushing Uganda's policy environment to be more conducive to innovation and scientifically informed decision-making.

Economic Policy Research Centre (EPRC): Founded in 1993 and based at Makerere University, EPRC is Uganda's leading economic policy think tank. While its primary remit is economic research—including macroeconomics, finance, and poverty analysis—EPRC has significantly contributed to policies on education, skills development, and science funding, recognizing that innovation and human capital are key drivers of economic transformation. The Centre's core mandate is to provide rigorous research evidence to support the formulation, implementation, and evaluation of government policies.

Over three decades, EPRC's analysis has informed major national strategies, from structural adjustment in the 1990s to the Poverty Eradication Action Plan and the current National Development Plans. In the context of STIRD, EPRC has studied issues such as public expenditure on R&D, the effectiveness of education investments—especially in higher education and vocational training—and the links between innovation and enterprise performance. For instance, EPRC economists have examined how Uganda's budget allocations to science and technology compare with needs and how university research output

can be better commercialized. By quantifying and articulating the economic returns to research and innovation, EPRC provides a persuasive evidence base to increase support for STIRD initiatives.

A concrete example of influence is EPRC's involvement in designing the Plan for Modernisation of Agriculture (PMA) in the early 2000s, ensuring that research and technology dissemination through NARO and advisory services were cornerstones of that plan. More recently, EPRC's policy briefs on Uganda's low level of R&D investment—hovering around 0.1% of GDP—have been cited in parliamentary debates on raising funding for science.

EPRC's influence is further reflected in its close working relationship with the government, especially the Ministry of Finance, Planning and Economic Development. Senior government officials often collaborate with EPRC on studies, and the think tank's researchers are routinely called upon to serve on technical working groups for policy formulation. EPRC has cultivated an approach of engaging stakeholders throughout the research process—"walking with them from inception to ensure uptake," as noted in EPRC's self-reflection on its 30-year journey. This approach has resulted in many EPRC recommendations being implemented, such as adjustments to taxation on agricultural inputs and the creation of social protection programs like a senior citizens grant that were piloted with EPRC input.

In terms of partnerships and funding, EPRC has been supported by both the Ugandan government and international donors. Throughout the 2000s, the African Capacity Building Foundation (ACBF) was a core funder, providing multiple grants that helped institutionalize EPRC as a robust think tank, including establishing a research communication department. When ACBF support tapered off around 2014, EPRC's primary funders became the Ministry of Finance through a government subvention and Canada's IDRC. Indeed, EPRC was also part of the Think Tank Initiative alongside ACODE, which provided flexible funding in the 2010s. This blend of support has allowed EPRC to maintain independence while staying policy-relevant.

Donor-funded projects at EPRC over the last 5–10 years have covered a range of development issues. For example, the World Bank engaged EPRC in 2015 to conduct large household and business surveys on the investment climate. The UK's DFID, now FCDO, supported studies on agricultural finance, resulting in the annual Agricultural Finance Yearbook published by EPRC in partnership with the Bank of Uganda. EPRC has also partnered with universities and regional networks, participating in comparative research with other East African think tanks on trade and regional integration. Its communication of

research is notable—shifting to e-publications and open access dissemination to reach broader audiences since 2014. As a result, its work on innovation, such as analyzing Uganda's informal sector innovations or digital financial inclusion, is accessible to entrepreneurs and academia alike.

In summary, EPRC stands out as a policy research centre that, through rigorous analysis and strategic partnerships, has tangibly influenced the environment for science and innovation. By convincing the government of the economic importance of investing in human capital, shaping education and R&D funding policies, and holding authorities accountable on implementing evidence-backed programs, EPRC plays a crucial role in Uganda's development agenda related to STIRD.

Both ACODE and EPRC exemplify how independent think tanks can bridge the gap between research and policy, fostering an environment conducive to science, technology, innovation, and research for development in Uganda. Their sustained efforts in policy analysis, advocacy, and stakeholder engagement continue to shape the country's trajectory towards sustainable development.

Private Sector Actors in Uganda's STIRD Ecosystem

The private sector in Uganda plays a pivotal role in shaping the country's STIRD landscape. This sector encompasses a diverse array of actors, including innovation hubs, technology firms, agribusiness enterprises, and manufacturing companies, all contributing to the advancement of STIRD initiatives.

Innovation Hubs and Technology Firms: Innovation hubs such as Hive Colab and Outbox Hub have emerged as critical incubators for tech startups and innovators in Uganda. These hubs provide co-working spaces, mentorship, and access to funding opportunities, fostering an environment conducive to technological innovation and entrepreneurship . They have been instrumental in nurturing startups that address local challenges through technology-driven solutions. Technology firms, including Kiira Motors Corporation, have also made significant strides in Uganda's STIRD ecosystem. Kiira Motors, a state-owned enterprise, focuses on the development of electric vehicles, contributing to sustainable transportation solutions and technological advancement in the automotive industry.

Agribusiness Enterprises: Agribusiness enterprises form a substantial part of Uganda's private sector involvement in STIRD. Companies like Pearl Dairy Farms and Mukwano Industries have invested in research and development to improve agricultural productivity and value addition. These enterprises collaborate with research institutions to develop high-yield

crop varieties and efficient farming practices, thereby enhancing food security and economic growth.

Manufacturing and Industrial Sector: The manufacturing sector, encompassing industries such as pharmaceuticals, textiles, and construction materials, contributes to STIRD through product development and process innovation. Pharmaceutical companies, for instance, engage in research to develop affordable medicines tailored to local health needs. Additionally, the construction industry adopts innovative materials and techniques to improve infrastructure development.

Despite the contributions of the private sector to Uganda's STIRD ecosystem, several challenges persist. Limited access to financing, inadequate infrastructure, and regulatory hurdles often impede the growth and innovation capacity of private enterprises. Addressing these challenges requires concerted efforts from both the government and private stakeholders to create an enabling environment for innovation.

Opportunities for enhancing private sector participation in STIRD include the establishment of public-private partnerships, investment in research and development, and the creation of innovation-friendly policies. By leveraging these opportunities, Uganda can harness the full potential of its private sector to drive scientific and technological advancement.

The private sector in Uganda is a dynamic and integral component of the country's STIRD ecosystem. Through innovation hubs, technology firms, agribusiness enterprises, and manufacturing industries, private actors contribute significantly to research, development, and the application of science and technology. To maximize this potential, it is imperative to address existing challenges and foster an environment that supports private sector-led innovation.

Discussion and Conclusion

This study systematically examined the key domestic actors shaping Uganda’s STIRD ecosystem, focusing on four principal categories: government units, research institutions, think tanks, and private sector actors. The analysis revealed a complex yet collaborative network where each actor contributes distinctively to policy formulation, knowledge generation, policy analysis, and innovation implementation. Government entities such as the Ministry of Science, Technology, and Innovation (MoSTI) and the Uganda National Council for Science and Technology (UNCST) provide strategic direction and regulatory frameworks. Research institutions like the Uganda Virus Research Institute (UVRI) and the National Agricultural Research Organisation (NARO) drive scientific inquiry and technological

advancements. Think tanks, including the Advocates Coalition for Development and Environment (ACODE) and the Economic Policy Research Centre (EPRC), offer critical policy analyses and recommendations. The private sector, exemplified by innovation hubs like HiveColab, plays a pivotal role in translating research into market-ready solutions.

Discussion

This study set out to identify and analyze the domestic actors shaping Uganda's STIRD ecosystem, examining their functions, influence, and partnerships. Drawing on the *National Innovation Systems (NIS)* and Triple Helix frameworks, this discussion explores systemic dynamics, actor interdependencies, and coordination challenges within the innovation landscape (Etzkowitz & Leydesdorff, 2000; Lundvall, 1992; Nelson, 1993).

Actor Roles: Formal Authority vs. Informal Influence: A key insight is the diversity of institutional mandates and the range of roles actors perform—ranging from regulatory authority (e.g., MoSTI, UNCST), to operational research (e.g., NARO, UVRI), and advisory influence (e.g., UNAS, ACODE). MoSTI and UNCST define national STI policy and funding architecture, reflecting the NIS emphasis on state coordination of systemic functions (UNCTAD, 2021; Jjagwe et al., 2023). UNAS, as a non-regulatory but expert-driven academy, contributes policy legitimacy and convening capacity—highlighting how informal scientific authority can shape national agendas (UNAS, 2023; AAS, 2023). This is consistent with the Triple Helix model, where hybrid roles emerge at the interface of science, government, and society (Etzkowitz & Leydesdorff, 2000). However, role fragmentation is evident. For example, both MoSTI and UNCST have STI mandates but operate under different administrative umbrellas, creating institutional misalignment—a weakness also noted in the World Bank's MSI review (World Bank, 2013) and UNCST's 2023 Outlook Report. Similarly, think tanks like ACODE and EPRC contribute valuable policy analysis, but their outputs are not routinely institutionalized in formal STI planning, limiting uptake and feedback loops within the innovation system (ACODE, 2025; EPRC, 2023).

Actor Influence: Central and Peripheral Players: Influence within Uganda's STIRD system is uneven. Central actors like UNCST, MoSTI, and NARO wield formal mandates, consistent budgetary flows, and international legitimacy (UNCST, 2023; NARO, 2023). UNCST's participation in the SGCI, for instance, positions it as a national focal point for research governance, data systems, and grant disbursement (IDRC, 2024). In contrast, civil society actors (e.g., ACODE) and innovation hubs (e.g., Hive Colab) are peripheral yet dynamic, innovating in digital, environmental, and agricultural spaces but often lacking policy leverage and stable funding (Amanya, 2023). This central-peripheral differentiation aligns

with NIS literature, which warns that innovation systems can become overly dependent on core bureaucracies while sidelining smaller but agile actors (Lundvall, 1992). Uganda's pattern reflects what Jjagwe et al. (2023) describe as a fragmented innovation system with disconnected sub-networks**.**

System Coordination: Fragmentation and Policy Gaps: Uganda's STIRD ecosystem suffers from fragmented governance and overlapping mandates, which hinder effective coordination and policy implementation. The absorption of MoSTI into the Office of the President, while politically strategic, introduced institutional ambiguity, despite the STI Secretariat continuing operations (UNCST, 2023; World Bank, 2021). Meanwhile, research institutes (e.g., NARO, UVRI) often operate in silos, with limited formal mechanisms to collaborate with each other or with policymaking bodies. These weaknesses exemplify the coordination failures that NIS scholars identify as structural bottlenecks in developing-country innovation systems (Nelson, 1993; UNCTAD, 2021). As the UNCTAD STI Policy Review argues, Uganda's innovation institutions would benefit from shared performance indicators, formalized actor linkages, and coordinated sectoral strategies. This is particularly relevant given the tendency for short-term project-based alignment, rather than sustained institutional collaboration (UNCST, 2023; Jjagwe et al., 2023).

Donor Dynamics: Asymmetrical Influence and Sustainability Risks: Donor engagement has undeniably strengthened Uganda's STIRD infrastructure—UVRI's partnerships with the UK's MRC and US NIH, or NARO's collaborations with CGIAR centers and the World Bank, have brought world-class research capacity and infrastructure (UVRI, 2021; NARO, 2023; Guiman, 2013). Think tanks like ACODE and UNAS have benefited from flexible donor funding (e.g., IDRC's Think Tank Initiative, ASADI), which allowed them to grow and professionalize (IDRC, 2018). However, the system is vulnerable to donor-dependence. Donor-driven agendas sometimes shape research priorities more than domestic needs—as seen in NARO's focus areas or UVRI's disease surveillance emphasis (UNCTAD, 2021; Amanya, 2023). This power asymmetry mirrors findings from broader STI systems literature, which cautions that over-reliance on external actors can distort national agendas and weaken long-term sustainability (World Bank, 2010; Nelson, 1993). According to Jjagwe et al. (2023), Uganda must develop indigenous financing mechanisms and clearer national priority-setting processes to counterbalance donor influence.

Regional and Continental Integration: Uganda is increasingly embedded in regional and continental STI structures—especially via UNCST's role in SGCI and UNAS's membership in AAS and NASAC (IDRC, 2024; AAS, 2023). These platforms offer technical

assistance, peer learning, and co-funding opportunities that align Uganda with continental frameworks such as STISA-2024 (African Union Commission, 2014). NARO's involvement in ASARECA and the AU's Science Agenda for Agriculture also reinforces Uganda's regional agricultural research role (UNCTAD, 2020). Nevertheless, Uganda's operational integration into AU or EAC STI programs remains shallow. Participation is often project-based rather than strategic or institutionalized. For example, the EAC's regional innovation harmonization agenda is under-leveraged by Uganda's STI ministries (NASAC, 2012). This underutilization represents a gap in the NIS model's emphasis on international learning and horizontal coordination across systems (Lundvall, 1992).

Knowledge Flow and Translation: Institutions such as UVRI and NARO are central to knowledge production in public health and agriculture. UVRI has conducted high-impact studies on infectious diseases (e.g., HIV, Ebola, COVID-19), while NARO has generated improved crop varieties and livestock innovations (UVRI, 2021; NARO, 2023). Yet, research translation into policy or market impact remains weak. According to UNCST (2023), Uganda lacks effective knowledge intermediaries—e.g., tech transfer offices, IP management agencies, or commercialization pipelines. This weak linkage between research and utilization is a well-documented limitation in African innovation systems. The World Bank (2013) and UNESCO (2015) have both identified Uganda's technology transfer infrastructure as underdeveloped. While initiatives like Makerere University's CEDAT and ResilientAfrica Network (RAN) are promising, they are still exceptions rather than the norm in institutional design. From a Triple Helix perspective, this points to insufficient university–industry–government integration, which limits Uganda's capacity to derive socioeconomic value from its scientific enterprise (Etzkowitz & Leydesdorff, 2000).

Conclusion

This study has provided a comprehensive analysis of the domestic actors shaping Uganda's STIRD ecosystem, categorizing them across government institutions, research and science organizations, think tanks, and private sector actors. By employing the NIS and Triple Helix frameworks, the research offers a relational and systemic understanding of how institutional mandates, partnerships, and influence interconnect to drive or constrain innovation in Uganda. The findings underscore that Uganda's STIRD landscape is not shaped by a single institution but by a network of actors with varying degrees of authority, resources, and functional focus. Central actors such as UNCST, MoSTI, and NARO have strong mandates and access to resources, but coordination with peripheral actors—including think

tanks, civil society, and innovation hubs—remains limited. This lack of institutional alignment impedes the full realization of national innovation goals.

From a policy perspective, the study highlights the urgent need for stronger coordination mechanisms, particularly among government ministries, research institutions, and non-state actors. There is also a pressing call for increased public investment in R&D, the strengthening of public-private partnerships, and the formalization of knowledge transfer pathways between universities, industry, and government. These shifts would help reduce duplication, enhance systemic efficiency, and accelerate the translation of research into development outcomes.

This research contributes to the growing body of literature on national innovation systems in Sub-Saharan Africa by offering an empirically grounded case study of Uganda. It expands the focus beyond donor-centric narratives to emphasize the agency, capacity, and interdependence of domestic actors. Moreover, by incorporating newer international actors like Türkiye into the analysis, it reflects the evolving dynamics of South–South cooperation in science diplomacy. The integration of both NIS and Triple Helix perspectives offers a nuanced theoretical contribution, bridging system-level and actor-level analyses.

While the study offers valuable insights, it is primarily based on document analysis and secondary data. As such, it may not fully capture the informal networks, tacit knowledge flows, or emerging dynamics within the STIRD ecosystem. In addition, while regional and continental actors are discussed, their influence was not explored through direct institutional data or stakeholder interviews. These limitations may restrict the depth of insight into actor motivations, lived experiences, and dynamic feedback mechanisms.

Future studies should employ mixed-methods approaches, including interviews, surveys, and participatory mapping with key stakeholders, to capture deeper institutional perspectives and real-time dynamics. Longitudinal research would also be beneficial to track how partnerships, funding patterns, and policy mandates evolve over time. Furthermore, comparative studies across East African or African Union member states could contextualize Uganda’s experience within broader continental science diplomacy and policy frameworks.

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Ethical Considerations

This research adhered to ethical standards, including respect for participants' rights and confidentiality. The study was ethically approved by the IMU Social and Humanities Ethics Board.

AI Use Disclaimer

The author discloses the use of AI in the research process, manuscript preparation, and data analysis. Specifically, ChatGPT 4.5 was used as a tool to assist with proof reading of the research. The authors take full responsibility for the accuracy, integrity, and ethical considerations of any AI-generated content included in the manuscript.

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