



# **Makerere University Research and Innovation Fund**

## **Three Year Research Agenda to Support the Government of Uganda's National Development Strategy**

**Compiled by the Makerere University Research and Innovations Grants  
Management Committee**

**February 2020**

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## **1.0 Background to the RIF Research Agenda**

### **1.1 The need for research to support development**

To transition to middle-income status, low-income countries must increasingly invest in research and innovations that provide solutions to persistent development challenges. Universities should be at the fore-front of driving this research agenda. The Government of Uganda drafted the 2<sup>nd</sup> National Development Plan (NDP) (2015-2020), specifying key areas of development investments needed to take the country to the next level. Resulting from this plan, different sectors have developed their Sectoral Development Plans (e.g. the Health Sector Development Plan 2015-2020 and the Agriculture Sector Development Plan (2015-2020)). However, the NDP and sector specific plans require research to fill evidence gaps needed to drive Uganda to middle income status.

### **1.2 The Makerere University Research and Innovation Fund**

Makerere University has received special funding from the Government of the Republic of Uganda, earmarked to support high impact Research and Innovations. This unique initiative arose after engagements between the top University Management and the Government of Uganda. The fund illustrates the increasing importance that the Government attaches to Research and Innovation as a driver of development and transformation. The objective of the fund is to increase the local generation of translatable research and scalable innovations that address key gaps required to drive Uganda's development agenda. The fund is therefore aimed at complementing available research funding to address unfunded priorities critical to accelerating development across different sectors of the economy in Uganda. Each Financial Year, Makerere University expects to receive at least 30 Billion Uganda shillings (equivalent to US\$ 8,100,000) under the Government Research and Innovation Fund (RIF). To ensure continuity, Government has committed to provide this funding for at least three Financial Years. The University Management has responded promptly: A Framework for Management of the Government Research and Management Funds has been developed. A multi-sectoral Grants Management Committee has been appointed after wide consultations with the Colleges and has received the Terms of Reference. The funded research and innovation projects are expected to generate actionable results that speak to national priorities. The Grants Management Committee therefore plans to source, vet, select and issue grants to teams that demonstrate a clear link to Government and its implementing partners' key development research gaps. The RIF GMC's terms of reference include development of an instructive research agenda as the basis for identifying funding priorities. This research agenda lays out the research priorities to be funded by the RIF over the next 3 years. It is laid out in forms of themes based on different sectors as well as subthemes within each sector.

### **1.3 Methods used to develop the Research and Innovation Fund Research Agenda**

To develop this research agenda the GMC conducted a comprehensive review of documents and conducted stakeholder consultations. The documents reviewed included the National Development Plan III, the Makerere University Strategic Plan, the Makerere University Research Agenda and the project summaries from the Research and Innovation Fund Round Grants that were issued in the Financial Year 2019-2020. The Stakeholder consultations included two workshops: One with representatives from key government ministries/sectors and semi-autonomous government agencies and the other with the private-for-profit sector and civil society. The GMC triangulated this information with that from the literature review. The information was then synthesized to develop the thematic areas for the research agenda.

## 2.0 Thematic areas of focus of the RIF Research Agenda

Fourteen sector-based themes have been synthesized from the research areas proposed by the stakeholders and the documents review. These are described as follows:

### **Theme 1: Transforming the agricultural sector to drive development**

*SDGs targeted: 2,1,3*

The overall aim of the Sector is to increase national income from agriculture as the backbone of the economy, ensure household food security and promote household nutrition from sustainable agricultural production, effective value chains and fair trade. The sector is seeking for solutions that boost the transformative potential of agriculture for Uganda's economy. Specifically, the grant is seeking ideas in the following sub-themes:

#### *Priority 1 sub-themes*

- 1 The sector seeks solutions to cost-effectively increase agricultural production of both regular food and cash crops (cereals, legumes, milk, bananas, coffee, cassava etc.), animal products (meat, dairy and poultry) and high value outputs (horticulture, aquaculture, high value crops). Solutions could include improved affordable technologies or approaches to production, plant and animal breeding for better disease, pest and drought resistance, affordable approaches to disease control, novel affordable animal feeds, novel approaches to agricultural water resource management and optimization during dry spells, affordable irrigation technologies, soil management and sustainable fertilizers, affordable mechanization for modernisation of production. Solutions could also involve natural/herbal/organic approaches to pest/disease control
- 2 Innovations in post-harvest handling and improvement of phytosanitary conditions of produce to reduce post-harvest losses but also ensure safety in the use of chemicals agricultural chemicals and drugs are needed as are approaches to reduce post-harvest losses/wastage (e.g., in the grain and poultry industries).
- 3 Post production, the sector is seeking novel affordable approaches to local value addition to agricultural produce including novel affordable technologies for local produce processing and data driven approaches to value chain analysis.

#### *Priority 2 sub-themes*

- 4 The sector also needs novel application of One Health driven approaches to prevention of animal epidemics including zoonotics of concern to human health, improved biosecurity and food source quality, and elimination of aflatoxins in food chains.
- 5 The sector would also like new solutions to bring farmer produce directly to the markets and to promote better dividends for the farmer. These may include simple technologies, approaches and platforms that increase small-scale farmer access and leverage in the markets both local and international. To meet international quality standards, the sector seeks local approaches to enhancing farmer uptake of quality assurance standards. This includes crops, beef and dairy and seeks measures during production, processing, packaging, storage, branding and transportation.
- 6 Cross cutting areas of harnessing ICT to improve agriculture and enhancing the effectiveness of policies on crop and animal production are also key.

### **Theme 2: Achieving Sustainable health as a means to sustainable development**

*SDGs targeted: 3,1,6,10*

The solutions targeted in this sector mainly aim at achieving universal health coverage through sustainable health measures. A healthy population not only reduces the strain on

household and national resources but is the driving force for economic development. The sector also acknowledges that many determinants of health are placed in other sectors, thereby necessitating a cross-sectoral approach. Evidence is needed on new measures to reduce the burden of preventable diseases, but also increase the quality of life for the population through health. Specifically, proposals are sought under the following sub-themes:

*Priority 1 sub-themes*

- 1 The sector seeks novel approaches and technologies for health promotion and prevention to change behaviour so as to reduce diseases responsible for a high burden of morbidity and mortality (especially pneumonia, diarrhoea, malaria, HIV/AIDS, TB, maternal conditions, new born and child morbidity, hepatitis, oral health conditions, cancer and injuries). Reproductive Health and adolescent health are also key areas of need, as well as new approaches to addressing neglected tropical diseases. New therapeutic approaches to treat these conditions are also of paramount importance.
- 2 With the emerging dual burden of disease due to lifestyle diseases (especially diabetes, cardiovascular disease, chronic lung disease and cancer), solutions are needed to incentivize lifestyle changes (diet, physical activity, self-care and health habits) across the lifecycle, locally appropriate chronic care models that seamlessly integrate with acute care, to address psychosocial wellbeing and the growing burden of mental health, to improve road safety and to effectively reduce morbidity and loss of life from injuries and mass-casualty incidents.
- 3 The high frequency of epidemics and pandemic threats calls for robust approaches to epidemic intelligence, forecasting, response and control as well as one-health approaches to emerging threats (especially RNA viruses). New biotechnology products for early characterization, diagnosis and pre-emptive screening for deadly threats as well as just-in-time vaccine development capacity for new disease strains are necessary. Tools and approaches for better surveillance and improved public health response to emergencies are pertinent.
- 4 Improvements in support systems for health services delivery are also very crucial and include: Effective approaches to improving health worker skills in primary care settings, improved approaches to patient management (medical, surgical or lifestyle-based), better tracking of patient harm and mismanagement, sustainable approaches to health worker incentives, but also tools to improve accountability for health workers time and increasing patient feed-back and monitoring of quality of care, innovative approaches to sustainable financing of health care especially in un-banked populations and for input-intense medical procedures but also reducing cost-escalation and inefficiencies and innovative approaches to medical waste management.
- 5 Innovative solutions are needed in improving the efficiency of the health supply chain, especially demand-based fore-casting and accountability, efficient logistics delivery systems and increasing the availability of blood. Solutions are also needed on better models of community health extension and sustainable but effective ways of motivating Community Health Workers. The sector needs evidence on how to better structure the planned National Health Institutes. There is need for platforms to support inclusion of health information from Private-for-profit health facilities into the national HIS as well as models for affordable public-private partnerships

*Priority 2 sub-themes*

- 6 Research that addresses emerging challenges including refugee health, urban health (including the health effects of air pollution and environmental pollution with heavy

metals), and health issues of ageing populations, human trafficking, and gender-based violence is needed.

- 7 The sector is also searching for more effective ways of re-orienting and re-imagining the health service delivery system from curative to preventive services. Approaches to improved nutrition and nutritional supplementation especially for vulnerable groups are also needed. Novel approaches to expanding school health are needed to build a health conscious generation.
- 8 With the increasing availability of ICT tools, solutions are needed to ease electronic capture and sharing of patient data, decision support systems for health workers especially in critical areas like maternal and child health, mobile-health, behaviour change communication, training and skills building, telemedicine and big-data and its use for improving health planning, accurate point-of-care tests, and accurate algorithms for early identification of disease or high risk cases.
- 9 The sector also needs novel bio-technology and basic science products and approaches to build new knowledge, to a better understanding of disease mechanisms and immune processes and to identify novel therapeutic agents and biomarkers with promising efficacy in disease control when translated from ‘cell to society’

### **Theme 3: Re-imagining Education to unlock capacity for economic development**

*SDGs targeted: 3,8,5,10*

Education is the driving force for capacity development to develop the skills necessary to drive enterprise and innovation. The main expressed need of the sector is how to leverage the advantages of Uganda’s demographic dividend by providing education that imparts skills crucial for productivity in the 21<sup>st</sup> Century and for the world of work. The priority subthemes for the sector are laid out as follows:

#### *Priority 1 sub-themes:*

- 1 The sector needs a current and futures-based analysis of skills requirements for a transitioning economy and when and how these skills should best be delivered in the education life-cycle to maximize their impact on the economy. Cross-sectoral solutions are needed to address the growing problem of youth unemployment. The sector needs novel approaches for skilling of youth to increase gainful employment as well as attitude building to drive agency for change among youth. Ways to up-scale the skills needed for the 21<sup>st</sup> Century job-environment
- 2 Innovative ways of tracking curriculum performance to support real-time improvements in formal education are needed. Research that unpacks how to improve early childhood learning, science education and the gender gap in STEM, vocational education, informal apprenticeship based education. The sector also needs innovative approaches to integrating design science into training from early in the education process.
- 3 The sector needs evidence to improve support systems for education service delivery including: Novel ways of financing education, innovative ways of improving infrastructure to support education, better ways of monitoring delivery of education at lower levels as well as accounting for teacher time, ways of enhancing public-private partnerships in education, enhancing regulatory frameworks.

#### *Priority 2 sub-themes:*

- 4 Research is also needed on how to leverage the informal sector as a source of skills for youth and mechanisms through which such education opportunities can be enhanced.
- 5 Research on ways to increase education participation of girls, refugees and other vulnerable populations is also needed, including keeping children in schools (especially

the girl-child), incentivizing parent participation in supporting the welfare of children in schools. Research that elucidates approaches for increasing the utility of higher education in improving performance of the private sector and industry is much needed. Given that the education sector is at the cross-roads for influencing many other SDGs in other sectors, evidence is needed on better models for integration of sector needs into formal education processes.

- 6 The increasing availability of ICT platforms should be opportunistically leveraged to develop cutting edge tools to improve the effectiveness of education delivery and participation but also determinants of technology adoption in education. Approaches to taking digital education and digital education resources to the rural poor are also welcome.

#### **Theme 4: Water, sanitation and the environment: A pre-requisite to sustainable development**

*SDGs targeted: 6,3,12,13*

The main aim of the sector is to increase access to safe water for domestic use and water for production, and to safeguard the environment through sustainable development approaches. This is in a context where inadequate coverage with safe-water sources and water stress from recurrent dry spells abound leads to a high burden of sanitation related diseases, but also recurrent agricultural losses due to insufficient water. There are major gender disparities in the consequences of inaccess to safe water. The sector seeks solutions under the following sub-themes:

*Priority 1 sub-themes:*

- 1 Solutions are needed to increase safe water availability in homes. Novel water treatment/purification technologies and cost effective approaches to municipal water treatment are needed. New approaches to collection and storage of water at household and community level are needed. Novel solutions to increase household and community WASH are also needed. Approaches to elimination of water contamination and characterization of water impurities are paramount.
- 2 The increasing threat of climate change, scalable models for climate change mitigation and adaptation as well as scenarios-setting studies to quantify future water demand are necessary. There a need for better conservation technologies and approaches as well as behaviour change and leadership models to drive their uptake. Novel community driven approaches to increasing tree-planting on a large scale, carbon sink development and conservation of forest cover amidst growing pressure from development initiatives should be explored, as should social-behavioural incentives to increase the agency for local actions against climate change. In general, the sector needs evidence on how to achieve a balance between economic development and environmental protection (sustainable development).
- 3 Evidence on how to reduce damage to the environment from industrial and domestic pollutants is needed, including those from the Petroleum industry, plastics and domestic refuse. Researchers may also provide insights into why climate policies fail and what needs to be done to get full policy buy-in. Innovations in effective response to adverse climate events and disaster response is also necessary. The use of ICTs for better climate risk communication and environmental monitoring is a key gap area as well as the use of ICTs to monitor environmental pollution and air quality.

*Priority 2 sub-themes:*

- 4 Improvements in water availability for production (including medium and large scale water catchment, reduction of evaporation, irrigation technologies, and rationalization of water are welcome.
- 5 The sector needs new and innovative approaches to provision of accurate weather prediction and outlooks so that farmers know when to plant and to plan for adverse weather/climate events. New approaches to management of solid and water waste including those that promote recycling, as well as new value chains from waste are welcome.

### **Theme 5: Harnessing the social sector, culture and arts to drive development**

*SDGs targeted: 8,10,5*

The most pertinent challenge faced by the country regarding social development is youth unemployment partly driven by lack of job and lack of skills. Other challenges relate to a lack of community agency to drive self-reliance as well as socio-cultural disparities that drive marginalization of some populations. Solutions are requested in the following subthemes:

#### *Priority 1 sub-themes:*

- 1 The sector requests for evidence on how to stimulate jobs from a predominantly informal economy and also how to rapidly skill the youth to meet the needs of the job market (including soft and hard skills). New approaches to job-creation are needed while the youth need appropriate skilling to be employment ready. Research and innovation are needed on how to get Ugandan youth to benefit from new forms of job opportunities e.g. digital jobs, including out-sourcing opportunities and coding.
- 2 The sector needs novel approaches to leveraging the creative arts as a force for development, a source of jobs for youth and as a source of increased contribution to the country's revenue. Approaches to harnessing indigenous knowledge to address development challenges are necessary as are approaches to harnessing our culture and heritage to improve community agency for change.
- 3 Solutions are needed to reduce the marginalization gap faced by vulnerable groups in society. For example research is needed on how to overcome gender barriers to the advancement of society including gender-based violence, gender and aging, and mainstreaming of gender into operational plans. Given Uganda's position as one of the largest refugee hosting populations, research is needed on how to improve refugee service delivery.

#### *Priority 2 sub-themes:*

- 4 Tools, technologies and approaches to improving accountability and value for money among NGOs/Civil society are needed. Evidence on sustainable approaches to improving service delivery among vulnerable people (orphans, vulnerable children, women, refugees, very poor people) are needed.
- 5 Emerging issues in the sector include: Occupational and ergonomic safety, including in the informal sector. Studies on population dynamics that inform planning, urbanization trends and emerging behaviours are important in shaping anticipatory programming for the society. New tools and approaches on how to positively harness the power of social media for positive behavioural outcomes are necessary. Novel financing modalities for social development need to be explored e.g. Development Impact Bonds.

### **Theme 6: Harnessing tourism, wildlife and heritage to drive development**

*SDGs targeted: 15,14,13,8,1,12*



Uganda's tourism sector is growing and the country is well positioned to be the leading tourist destination for the region. However, much more still needs to be done to unleash the country's untapped tourism potential which is much higher than it is currently, and which can be a major source of revenue. Research and innovations are sought in the following priority sub-themes:

*Priority 1 sub-themes:*

- 1 Research is needed on approaches to boost Uganda's current tourism potential by increasing visibility and demand for the available tourism products. Solutions are also needed to reduce the cost of accessibility to Uganda's tourism destinations, novel ways in which local communities can benefit from local tourism, and how to increase domestic tourism by Ugandans.
- 2 Approaches to diversification of Uganda's tourism product range are needed (e.g. expansion of water-based tourism, hills as a tourism product, cultural tourism and religious tourism. The sector also calls for models for value addition to wild-life goods and services. The sector also needs approaches for preservation of positive cultural practices and heritage that promote tourism. Solutions are also needed for value addition to local art products to increase their international competitiveness as well as standards for ensuring quality these products.

*Priority 2 sub-themes:*

- 3 The sector needs innovative approaches for growing and maintaining the wild-life ecosystems that support tourism including: Invasive species management, wild-life forensics, captive breeding of wildlife. Innovations are also needed in reducing human-wildlife conflict and the diseases that emerge from it (hence a one health approach to zoonotic.
- 4 Solutions are also needed for better wild-life conservation to protect the country's wild-life diversity. Evidence of better approaches to wild-life disease management and epizootics is also needed. The sector also needs new tools, technologies and approaches to eliminate illicit trade on wild-life products.

**Theme 7: Sustainable Planning, finance and monitoring as catalysts for growth**

*SDGs targeted: 1,8,11,12*

Planning and finance are key cross-cutting sectors affecting development. Successful attainment of development goals need adequate monitoring of national plans as well as sustainable financing methods including a progressive tax base. Solutions are needed in the following sub-themes:

*Priority 1 sub-themes:*

- 1 The sector expressed the need for research and innovations that foster effective implementation of the National Development Plan and the Vision 2040. They need novel tools for collection of routine data from informal sectors of the economy including crowd-sourcing of economic data as well mining and visualization of big data to predict economic trends. Tools that support dynamic tracking of development initiatives and geo-location of development projects are welcome. There is also a need for new approaches for increasing the ability of communities to demand for better accountability from public programs.
- 2 There is a need for solutions to promote better urban planning in an already congested city (Kampala) as well as other up-coming cities.

- 3 The revenue management sub-sector needs better tools and evidence to enhance tax compliance and increase the tax base especially from the informal sector. Approaches to expanding e-commerce and trade are welcome. Targeted studies are needed to establish the medium to long term effects of new taxes like the social media tax and mobile money taxes to the economy as well as best practices in tax exemptions and tax holidays.
- 4 New approaches to Financial Inclusion (access to credit, better savings, and affordable banking and money transactions) are needed especially for the rural poor. Research on new banking products and their reach to the unbanked population is pertinent.

*Priority 2 sub-themes:*

- 5 Case studies are needed in best practices for oil revenue management, demonstrating the best pathways to accelerating development.
- 6 Research on new forms of currency (especially cyber-currencies), their effects on the economy and how to best regulate them while leveraging their advantages is necessary. In addition, research on how to prevent financial crimes (especially electronic fraud) is also needed.
- 7 Novel approaches to strengthening the budget process are needed as are approaches to sustainable government debt. Tracking the efficiency of financial reforms to the lowest levels of governance is also crucial.

**Theme 8: Leveraging public service and local administration for efficient service delivery**

*SDGs targeted: 12,8,16,17*

The mandate of the Public Service sector is to deliver effective and efficient social services to the people in a way that effectively reaches the last mile with a professional and competent civil service. The sector seeks solutions in the following sub-themes:

*Priority 1 sub-themes:*

- 1 The sector expressed the need for better tools and approaches to ensuring an efficient civil service that is accountable to the people in implementing government programs. Approaches to digital transformation of public service delivery including strengthening of e-governance for better efficiency are needed. Evidence is also needed on how to better account for public servants' time, especially in peripheral service delivery workplaces and how to ensure better provision of value for money.
- 2 At the local government level, the sector expressed a need for approaches to sustainable finance for local governments including increasing their self-reliance. These avenues could include increasing their potential for local income generation but also using their autonomy, corporate stature and credibility to solicit for bilateral donors, and development impact investors.

*Priority 2 sub-themes:*

- 3 Better approaches to engagement of communities to mobilize them for development initiatives in ways that contribute to self-reliance are also needed. Ways to optimize the use of digital identification to improve accountability and citizen services are needed.
- 4 Local governments also need better tools for disaster preparedness and disaster risk management.

**Theme 9: Defence and security: Achieving sustainable peace and stability**

*SDGs targeted: 16*

The defence and security sector has the mandate to ensure peace, security and the rule of law for citizens. A stable secure country is not only crucial for economic investment but is key to a good quality of life for the citizens. This is coordinated through the armed forces, and other support systems for a secure country. The sector seeks research and innovation ideas in the following sub-thematic areas:

*Priority 1 sub-themes:*

- 1 The Sector has interest in research and innovation outputs that improve the livelihoods of the men and women in uniform. Areas of interest to combatants' livelihoods include: Strategies for addressing gender-based violence among combatants' households, addressing post-traumatic stress disorder, improving food-security for combatant families and re-imagining the food rations for active combatants. The Sector is also interested in solutions that lead to better livelihoods for veterans of the armed forces including sustainable models for their economic empowerment.
- 2 The sector is interested in technologies and approaches to preserve peace and improve security of the population and their property including data driven approaches and artificial intelligence, ICT tools and GIS mapping. Approaches to improving urban security and early identification and elimination of terrorist threats are needed. The sector also needs proposals on how to better engage communities in contributing to security through community policing and security vigilance.

*Priority 2 sub-themes:*

- 3 The emergence of new ICT tools has brought more challenges to the sector. More efficacious approaches to mitigating cybercrime are needed.
- 4 The sector would like to understand and monitor the environmental impact of pollution by military equipment. The sector would also like tools to improve information and records management.

**Theme 10: Strengthening law, governance, human rights and international cooperation as pre-requisites for development**

*SDGs targeted: 16,17,10*

This sector is vested in ensuring that justice is accessible to everyone, and that democracy and protection by the law are ubiquitous. The sector also seeks to ensure adequate protection of human rights. The diplomacy sub-sector aims to promote regional and international cooperation for peace and mutual development. Solutions are needed in the following sub-thematic areas:

*Priority 1 sub-themes:*

- 1 Evidence and innovations are needed to increase awareness about the laws of Uganda and accessibility to justice. The sector would like evidence on models for better coordination and collaboration with other sectors on litigation. They also need approaches to increasing efficiency and performance outputs to drastically reduce the case backlog. Innovations are needed to increase out-of-court settlements. Mechanisms to increase land justice and to improve land-rights are also welcome. Legal and regulatory frameworks should be responsive to innovation. The sector also wants solutions that increase the ability to protect intellectual property.
- 2 Mechanisms to improve legal services for vulnerable populations (including refugees, victims of sexual and gender-based violence, and very poor people) are welcome. The sector also requested for innovations in civil society accountability, including tools that can make NGOs more accountable to the communities.

- 3 The regional and foreign affairs sub-sector needs more evidence on how to structure international and regional development aid to be more effective. They also need advice on improving resource mobilization for development including mobilization of the diaspora for active participation in national development. Quantification of the economic benefits of investments in regional peace efforts (including military interventions), regional integration, and membership to regional organizations and conventions on development are needed.

*Priority 2 sub-themes:*

- 4 Ideas are also needed on how to apply emerging technologies (e.g. digital technology, artificial intelligence and big-data) to improve the process of delivering justice. Approaches to increased use of ICTs in the courts are also needed.
- 5 Novel approaches to peace building are welcome. New forms of democratic consultation of communities and getting communities to better participate in policy processes are also welcome.

**Theme 11: Harnessing Information and Communication Technology to drive development**

*SDGs targeted: 9,8,10*

Information and Communication Technology is a cross-cutting sector that supports other sectors. The sector provides a backbone for communication to support service delivery but also promotes the use of ICT tools for more efficiency. The Sector is in the process of building an ICT backbone to support other sectors and to facilitate economic transformation. Research and innovations are needed in the following sub-themes:

*Priority 1 sub-themes:*

- 1 Research on how to increase citizen participation in national programs using ICT tools and how to estimate this participation, innovative digital media to mobilize citizen participation in national programs, and approaches to expansion of E-Governance. Mechanisms to strengthen digital identification and to transform all Ugandans into active digital citizens are also welcome.
- 2 The sector would also like to increase capacity for use of data (including big data and artificial intelligence) for development including fore-casting, planning, monitoring of programs and for development of applications that can improve service delivery. The sector would like innovations that increase the capacity of other sectors to develop and use electronic records.

*Priority 2 sub-themes:*

- 3 The sector would like to expand the innovative use of digital media and emerging technologies in economic activities and professional service delivery (e.g. mobile phones, drones, nano-technology, and robotics).
- 4 The sector would like approaches to increasing the capacity of youth to benefit from digital jobs by acquiring digital work skills and learning to code. The sector is also interested in local development of computer applications (Apps) that can expand Uganda's share in the digital economy. The Sector is also interested in innovations to increase access to cloud computing and solutions that can increase technology use in education and health service delivery. The ICT sector also calls for solutions in the area of enterprise software to support informal businesses.

## **Theme 12: Works, manufacturing, science and technology as tools to accelerate development**

*SDGs targeted: 9,11,13,10*

The works Sector is a services sector that supports other sectors through infrastructure development. The sector also includes the industrial and manufacturing sub-sector which is the engine for national development. The sector therefore relies on technology, investments in industrial development and a major national focus on industry driven economic transformation. Evidence is needed in the following priority sub-themes:

### *Priority 1 sub-themes:*

- 1 There is also need for innovations in waste management for urban areas, including low cost solutions for urban slum areas and solutions for better end-of-life management for batteries and other such waste items that contain toxic heavy metals. There is need for innovations in waste water drainage and management, to reduce clogging, flooding and pollution.
- 2 The sector expressed the need for research and innovations in form of technologies and approaches to improve and optimize transport services, both between districts and in the urban areas especially Kampala. Approaches to reducing traffic congestion in Kampala City are welcome including ICT based technologies for real-time monitoring of traffic. Innovations to increase transportation safety on land and water are necessary. There is also a need for technologies to reduce transport related carbon emissions and the resulting pollution. Approaches to reduce the cost of road construction are needed, as well as measures for better maintenance of roads and other infrastructure. Innovations in infrastructure to support industrial development are much needed. Research on road designs that can allow an increase in the weight of goods-vehicles on the roads is also needed so as to reduce long distance transportation costs.
- 3 Technologies and innovative solutions are needed for better and more efficient manufacturing processes to drive industrial production, especially those that use locally available raw materials. Adaptation and industrialization of local informal manufacturing technologies is also desirable. Innovations of new commercially viable machines for various production processes are needed.
- 4 Innovations are needed in production of low cost but quality construction materials to boost the construction industry but also position Uganda as a leader in appropriate construction technology. Solutions are also needed in miniaturization of engineering solutions (e.g. robotics and 3-D printing).

### *Priority 2 sub-themes:*

- 5 There is also a need for economic modelling around factors that affect mobility of people around Kampala, urbanization tracts and factors affecting residential trends, as well as futures analyses on urbanization trends around Kampala and other cities. Research on how to leverage public-private partnerships in urban development is also needed. In addition, evidence to strengthen urban resilience in the era of rapid urbanization is needed.
- 6 The sector also needs more research evidence on how power outages can be eliminated.
- 7 The sector also needs novel bio-technology and basic science approaches to understanding key science-based processes and contribute new knowledge of industrial potential

## **Theme 13: Solutions to catalyse business and enterprise**

*SDGs targeted: 1,8,9,12*

The business sector drives the economy. Uganda is ranked as the most entrepreneurial country in the world and the majority of start-ups and business are informal. However, the rate at which new businesses fail is high. Innovations are needed to develop a robust business sector that can survive strong economic head-winds to create a sustainable economy.

*Priority 1 sub-themes:*

- 1 There is need for research evidence and innovations to support the growth of small and medium enterprises to become more sustainable, profitable and resilient. Approaches to skilling of entrepreneurs and innovative finance models to make businesses more resilient are needed. Research is also needed on innovative ways to increase access to finance and capital for small businesses, as well as reducing risk from lending to them. Novel commercial banking services and products that reduce the burden on businesses in a viable way are welcome. New models for private equity and impact investments by Ugandans in the diaspora are also welcome. Approaches to increasing the registration of small and informal businesses are needed. There is also a need for evidence on how taxation can best be structured to foster business development while optimizing the tax base. Innovations in the distribution and marketing chain for local products is needed, as is the need to increase the presence of locally produced materials on supermarket shelves. There is need for infrastructure to support business innovations.
- 2 Innovations to increase e-commerce are necessary. Approaches to empowering small business owners to grow brands, and better market their products are also necessary as is the need to develop small-medium business owners' capacity for succession planning for the sustainability of their businesses. Research and innovations to foster efficient distribution mechanisms for small scale producers (affordability and sustainability) is needed as is evidence on how to increase access to simple and affordable technology for small scale producers. There is also need for research on how to expand external markets for Ugandan manufacturers.
- 3 The sector also expressed the need for exploration of how to expand 'work at home' as a viable source of income for people, in this area include digital jobs. There is a need for innovations to reduce financial constraints for women in business. Measures to increase the economic productivity of refugees are needed.

*Priority 2 sub-themes:*

- 4 Innovations are needed to increase Public-Private business partnerships in ways that are economically viable for both government and private business owners.
- 5 Research and evidence on how to reduce the cost of the factors of production (e.g. transport) is needed. Research that models the effects of climate change on business is needed, including long term scenarios as a means to long-term mitigation and adaptation measures for businesses. Innovations to foster a green economy are needed. Innovations to foster import substitution are also welcome.

**Theme 14: Energy and Minerals as drivers of rapid economic development**

*SDGs targeted: 7,1,8,12*

Energy drives production in the economy while minerals are a source of wealth that can accelerate national development. There is need for more innovations in the energy and mineral sector as a direct link to increased revenue and jobs. Solutions are needed in the following priority sub-themes:

*Priority 1 sub-themes:*

- 1 There is also need for research on novel clean/renewable energy sources as well as research on effective models to increase rural electrification. Study the most cost effective and safe technology option to support industrialization (study on all the possible available technologies that are environmentally friendly. Research is needed on how to better dispose of solar batteries, how their components can be recycled.
- 2 The sector requires a detailed analysis to establish the mineral wealth potential of the country, and to map this potential. This will enable the country to develop a strategic plan for development of its mineral wealth. The sector also needs solutions for better use of data and informatics to inform better planning. Research on health issues arising from local mining operations is also needed.
- 3 Research is needed on models for proper use of Oil and Gas resources for economic development as well as better mechanisms for accountability in this emerging sub-sector of the economy. The impact of the policies/Laws on the Oil and Gas sector to the economy should be understudies so as to propose better policy approaches.

*Priority 2 sub-themes:*

- 4 Innovative solutions to reducing the cost of electricity are needed as a pre-requisite to boosting industrialization.
- 5 Micro-grid solutions to expand local electricity generation and to integrate off grid electricity into the national grid are also necessary.

## Appendices

### Participants of the Research Agenda consultative workshop with Private companies and Development partners, 31<sup>st</sup> January 2020

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