INNOVATION, TECHNOLOGY DEVELOPMENT AND TRANSFER PROGRAMME

SEMI-ANNUAL BUDGET MONITORING REPORT

FINANCIAL YEAR 2022/23

APRIL 2023

Budget Monitoring and Accountability Unit
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MOFPED#DoingMore

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ABBREVIATIONS

BIRDC	Banana Industrial Research and Development Centre
BMAU	Budget Monitoring and Accountability Unit
CHTC	China High-Tech Corporation
CLARF	Central Laboratory Animal Research Facility
CNC	Computer Numeric Control
COVAB	College of Veterinary Medicine, Animal Resources and Biosecurity
COVID-19	Corona Virus Disease
CDNA	Complementary DNA
DNA	Deoxyribonucleic acid
DLG	District Local Government
EAC	East African Community
ELISA	Enzyme-linked Immunosorbent Assay
GMP	Good Manufacturing Practice
GoU	Government of Uganda
HIG	Human Immunoglobulin
ITDT	Innovation Technology Development and Transfer
ISO	International Organization for Standardization
JCRC	Joint Clinical Research Centre
KMC	Kiira Motors Corporation
LGs	Local Governments
MUST	Mbarara University of Science and Technology
MDAs	Ministries, Departments and Agencies
MFPED	Ministry of Finance, Planning and Economic Development
NDP	National Development Plan
NDA	National Drug Authority
NRIP	National Research and Innovation Program
NSTEI-SEP	National Science, Technology Engineering, Innovation and Skills Enhancement Project
NSTEIC	National Science, Technology Engineering, Innovation Centre
OP	Office of the President
PRC	Polymerase chain reaction
PRESIDE	Presidential Scientific Initiative on Epidemics
PIAP	Programme Implementation Action Plan
RT-PCR	Reverse Transcription PCR
R&D	Research and Development
RNA	Ribonucleic acid
TIBIC	Technology, Innovation and Business Incubation Centre
TSC	Technical Service Company

SARS-CoV-2	Severe Acute Respiratory Syndrome Corona Virus 2
UIRI	Uganda Industrial Research Institute
UNCST	Uganda National Council for Science and Technology
USD	United States Dollar

FOREWORD

Uganda like many other countries in the world continues to be affected by the aftermaths of the Coronavirus Disease (COVID-19) pandemic, Russia's invasion of Ukraine, climate change effects, and increasing food prices among the many global shocks today. Amidst this environment, the Government has shown a strong commitment to innovatively raise and allocate resources to fund its strategic interventions, in a bid to build resilience and drive sustainable economic growth and development.

For this Financial Year 2022/23, the semi-annual programme monitoring findings show a fair performance across the board, with a few programmes on track to achieving their annual goals. This performance notwithstanding, there are still many perennial challenges that are putting many government interventions at risk of not achieving their intended objectives.

Since we are operating in an environment of scarcity, it is imperative that we expedite the processes of streamlining and strengthening our planning, implementation, monitoring and execution of Government programmes. We must harness the comparative advantages expected from operating in a programme mode. To that effect, all Ministries, Departments, Agencies and Local Governments should critically review the noted challenges and institute innovative ways of circumventing them during the remaining months.

Ramathan Ggoobi
Permanent Secretary/Secretary to the Treasury

EXECUTIVE SUMMARY

The Innovation, Technology Development and Transfer (ITDT) Programme seeks to increase the application of appropriate technology in the production and service delivery processes across the country through the development of a well-coordinated Science, Technology, Engineering and Innovation (STEI) eco-system.

The programme has three sub-programmes, namely: Research and Development; STI Ecosystem Development, and Industrial Value Chain Development. The programme activities for the period under review were coordinated by the State House (SH) and the Uganda Industrial Research Institute (UIRI). The programme has three subventions namely: Banana Industrial Research and Development Centre (BIRDC), Uganda National Council for Science and Technology (UNCST), and Kiira Motors Corporation (KMC).

This report presents monitoring findings for the period 1st July 2022 to 31st December 2022 for planned interventions under the two sub-programmes: STI Ecosystem Development, and Industrial Value Chain Development.

Overall Programme Performance

The approved budget for the ITDT Programme is Ug shs479.054 billion (bn) inclusive of Ug shs 231.377bn brought forward from FY2021/22. Ug shs329.429bn (69%) was availed and Ug shs 209.443bn (64%) was spent by 31st December 2022. The release and expenditure performance for the programme were good and fair respectively. The fair absorption was attributed to delayed budgetary releases in the first quarter of FY2022/23.

The overall programme performance was good at 73.2%. The Industrial Value Chain Development Sub-programme performed better than that of STI Ecosystem Development at 83.5% and 62.9% respectively.

STI Ecosystem Development Sub-programme

The sub-programme has 19 interventions, of which four were monitored. The overall performance of the monitored interventions was fair at 62.9%. The design and engineering specifications for the Kayoola bus seat and web frame for the Kayoola Electronic Vehicle System (EVS) were completed. The draft design, engineering and manufacturing specifications for the 3-in-1 Trike cycle were completed.

The BIRDC processed a total of 274.2metric tonnes (MT) of raw bananas against an annual target of 1,820MT, and Ug shs 0.456bn in revenue was realised from the sale of Tooke products against an annual target of Ug shs 9.03bn. A total of 12 Tooke secondary products were developed. The BIRDC performance was poor and this was attributed to the rise in the price of raw bananas during the period under review; the late release of operational funds and the lack of a governance board. The BIRDC was at risk of not running commercially as planned for FY2022/23.

The various prototypes were registered by the National Research and Innovation Program (NRIP), Presidential Scientific Initiative on Epidemics (PRESIDE) and Crop value chains funded projects (grants) under the Science Technology and Innovation (STI) Secretariat. A bio-cell prototype for waste water treatment and bio-electricity generation was developed at Gulu University; however, the electricity generated was still low at 2W. The value-added product prototypes from sweet potato were developed although the level of expenditure was not commensurate with the developed products. An upgrade of the Kanyarusoke-Musinguzi day and night solar dryer was developed whose loading capacity was increased six fold while maintaining the drying time (24 hours). A prototype of the Kawu smart card was developed and piloted to enable access to digitized financial services without the use of a phone.

Three vaccine candidate prototypes were developed by the Uganda Virus Research Institute (UVRI) and College of Veterinary Animal Resources and Biosecurity (COVAB) and are ready for preclinical trials. A lateral flow kit for the diagnosis of SARS-COV-2 using biomarkers was developed. A therapeutic product (UBV-01N) for the treatment of respiratory diseases was approved by National Drug Authority (NDA) for use in humans. A nano adjuvant as a carrier for the COVID-19 vaccines was developed and ready for preclinical trials. The renovation and re-modelling of the central laboratory animal research facility at Makerere University was at 90% physical progress. However, the intended purpose of the facility was yet to be realised. Most of the research studies experienced delays in the acquisition of critical equipment and consumables as well as a shortfall in funding during the period under review.

The construction of the Technology, Innovation and Business Incubation Centre (TIBIC) and the National Science, Technology Engineering, Innovation Centre (NSTEIC) was ongoing at 94% and 76% physical progress respectively. A total of 78 pieces of road construction equipment were leased to M/s Rohi Investments Limited and National Enterprise Corporation (NEC); however, 141 remained unused for over a year. The Mpoma Satellite Ground Station was renovated and the geospatial data centre and space laboratory were equipped. The Pearl of Africa Sat-1 satellite designed by Ugandans was launched into the low earth orbit during the period under review however full functionality of the centre was awaiting calibration of the installed equipment.

Industrial Value Chain Development Sub-programme

The sub-programme performance was good with 83.5% of the planned targets achieved. The construction of the Kiira Motors Corporation (KMC) manufacturing and assembly infrastructure (phase 1) in Jinja Industrial and Business Park stood at 99.8% against a time progress of 100%, whereas phase II was at 35% physical progress. The overall project progress was at 67% and the facility is anticipated to be complete by 30th June 2023. The contract for the supply, installation and commissioning of the Kiira vehicle plant production and assembly line was awarded to M/s CHTC from China. The KMC cited a challenge of transaction loss due to variations in currencies for the Kiira Vehicle Production System and other imported production parts and materials.

Conclusion

The programme performance was good at 73.2% with subventions and research grants at varying levels of progress. Good progress for civil work was observed at the NSTEI-SEP at both Namanve and Rwebitete and the KMC assembly plant in Jinja. Several research projects had developed prototypes for use in health, agricultural and ICT applications. It was observed that some of the project deliverables especially for COVID-19-related interventions were overtaken by events

owing to the development of test kits, procedures; and vaccines by other scientists that were already in the country. The BIRDC performance was poor owing to the late release of funds which affected the procurement of critical equipment. This was further exacerbated by the spike in prices of matooke between October and December 2022 which affected the processing through put.

Most of the studies experienced delays in the acquisition of critical equipment and a shortfall in funding. None of the vaccine development projects moved to the clinical trial stage owing to the lack of an approved facility for preclinical efficacy studies and the lack of a certified Good Manufacturing Plant (GMP) facility for the production of human vaccines in the country. The KMC cited a challenge of transaction loss due to variations in currencies for the Kiira Vehicle Production System and other imported production parts and materials.

Recommendations

i. The STI secretariat should track the approval of a governance and management framework for the BIRDC.

ii. The project principal investigators (PIs) and PRESIDE secretariat should establish sustainable collaborations with research institutions for knowledge and resource sharing to ease the next steps in research and development.

iii. The STI secretariat should quickly invest in establishing a central GMP facility at one of the collaborating institutions such as the COVAB to bridge the gap and increase efficiency in pathogen economy investments.

iv. The KMC should seek special authorisation to use USD currency for the procurement of the Kiira Vehicle Production System to avoid any further delays.

CHAPTER 1: INTRODUCTION

1.1 Background

The mission of the Ministry of Finance, Planning and Economic Development (MFPED) is, "*To formulate sound economic policies, maximize revenue mobilization, and ensure efficient allocation and accountability for public resources so as to achieve the most rapid and sustainable economic growth and development*."

The MFPED through its Budget Monitoring and Accountability Unit (BMAU) tracks the implementation of programmes/projects by observing how values of different financial and physical indicators change over time against stated goals, indicators and targets (how things are working). The BMAU work is aligned with budget execution, accountability, service delivery, and implementation of the Domestic Revenue Mobilisation Strategy (DRMS).

Starting from FY 2021/22, the BMAU shifted to Programme-Based Monitoring to assess performance against targets and outcomes in the Programme Implementation Action Plans (PIAPs) of the third National Development Plan (NDPIII). The Semi-Annual and Annual field monitoring of government programmes and projects is undertaken to verify the receipt and application of funds by the user entities and beneficiaries, the outputs and intermediate outcomes achieved, and the level of gender and equity compliance in the budget execution processes. The monitoring also reviews the coherency in implementing the PIAP interventions; the level of cohesion between sub-programmes; and the challenges of implementation.

The monitoring covered the following Programmes: Agro-Industrialization; Community Mobilisation and Mindset Change; Digital Transformation; Human Capital Development; Innovation, Technology Development and Transfer; Integrated Transport Infrastructure and Services; Private Sector Development; Mineral Development; Natural Resources, Environment, Climate Change, Land and Water Management; Public Sector Transformation; Sustainable Development of Petroleum Resources; and Sustainable Energy Development.

This report presents findings from monitoring the Innovation, Technology Development and Transfer (ITDT) Programme for the budget execution period from 1st July to December 31st 2022.

1.2 Programme Goal and Objectives

The goal of the ITDT Programme is to increase the application of appropriate technology in the production and service delivery processes through the development of a well-coordinated STI ecosystem.

The objectives of the programme are:

i. To develop requisite STI infrastructure;
ii. To build human resource capacity in STI;
iii. To strengthen Research and Development (R&D) capacities and applications;
iv. To increase development, transfer and adoption of appropriate technologies and innovations;
v. To improve the legal and regulatory framework.

1.3 Sub-programmes

The ITDT Programme is implemented through the following sub-programmes:

i. Research and Development (R&D)
ii. STI Ecosystem Development
iii. Industrial Value Chains Development

1.4 Programme Outcomes

The third National Development Plan (NDPIII) ITDT Programme outcomes are:

i. Increased innovation in all sectors of the economy,
ii. Enhanced development of appropriate technologies,
iii. Increased R&D activities in the economy,
iv. Increased utilization of appropriate technologies,
v. An enabling environment for Science, Technology, Engineering & Innovation created.

The key targets to be achieved by this programme over the NDPIII period include:

i. Increase the Global Innovation Index from 25.3 to 35.0;
ii. Increase Gross Expenditure on R&D as a percentage of GDP (GERD) from 0.4 percent to 1 percent;
iii. Increase business enterprise sector spending on R&D (percent of GDP) from 0.01 percent to 0.21 percent; and
iv. Increase the number of Intellectual Property Rights registered per year from 2 to 50.

CHAPTER 2: METHODOLOGY

2.1 Scope

This monitoring report is based on selected interventions in the ITDT Programme during the FY2022/23 (1st July 2022- 31st December 2022). Implementation of the programme is spearheaded by the Science, Technology and Innovations Secretariat under Statehouse (Vote 002), Uganda Industrial Research Institute (Vote 110) and the subventions of Uganda National Council for Science and Technology (UNCST), Kiira Motors Corporation (KMC), and Banana Industrial Research and Development Centre (BIRDC).

Monitoring involves analysis and tracking of inputs, activities, processes, outputs and in some instances intermediate outcomes as identified in the Programme Implementation Action Plan (PIAP), Ministerial Policy Statements and Annual, and Quarterly work plans, progress and performance reports of MDAs and Local Governments.

A total of five funded interventions out of 23 (22%) under the Programme Implementation Action Plan were monitored[1]. The selection of the interventions to monitor was based on the following criteria:

i. A significant contribution to the programme objectives and national priorities.

ii. Level of investment, interventions that had large volume of funds allocated were prioritized.

iii. Planned outputs whose implementation commenced in the year of review, whether directly financed or not. In some instances, multiyear investments or rolled-over projects were prioritized.

iv. Interventions that had clearly articulated gender and equity commitments in the policy documents

v. Completed projects to assess beneficiary satisfaction, value for money and intermediate outcomes.

2.2 Approach and Methods

Both qualitative and quantitative methods were used in the monitoring exercise. The physical performance of interventions, planned outputs and intermediate outcomes were assessed by monitoring a range of indicators. The progress reported was linked to the reported expenditure and physical performance.

A combination of random and purposive sampling was used in selecting interventions and outputs from the PIAPs, Ministerial Policy Statements (MPSs) and progress reports of the respective Ministries, Departments, Agencies and Local Governments (MDALGs) for monitoring.

[1] Develop strategies to domesticate and implement international conventions and treaties that facilitate STI; Increase investment in R&D in key priority sectors like; agriculture, Oil & Gas, Energy, Health, Transport; Support the establishment and operations of Technology & Business incubators and Technology Transfer centres; Create capacity on application of drones, satellite imagery through GIS, real-time disaster modeling, and widespread connectedness improve emergency response and production; and Support the establishment and operations of Science and Technology Parks to facilitate commercialization.

To aid mapping of PIAP interventions against annual planned targets stated in the programme MPS and quarterly work plans, a multi-stage sampling was undertaken at three levels: i) Sub-programmes ii) Sub-sub-programmes and iii) Project beneficiaries. Regional representation was considered in the selection of beneficiaries and outputs.

2.3 Data Collection and Analysis

Data collection

The monitoring team employed both primary and secondary data collection methods. Secondary data collection methods include;

i) Literature review from key policy documents including, Ministerial Policy Statements (MPS) FY 2022/23; National and Programme Budget Framework Papers; A handbook for implementation of NDPIII Gender and Equity commitments, PIAPs, (NDP III), quarterly progress reports and work plans for the respective implementing agencies, Quarterly Performance Reports, Budget Speech, Public Investment Plans, Approved Estimates of Revenue and Expenditure.

ii) Review and analysis of data from the Integrated Financial Management System (IFMS) and Programme Budgeting System (PBS) Quarterly Performance Reports.

Primary data collection methods on the other hand include;

iii) Consultations and key informant interviews with Institutional heads and project/intervention managers.

iv) Field visits to various institutions, for primary data collection, observation and photography.

v) Call-backs in some cases were made to triangulate information.

Data Analysis

The data was analyzed using both qualitative and quantitative approaches. Qualitative data was examined and classified in terms of constructs, themes or patterns to explain events among the beneficiaries (interpretation analysis) and reflective analysis where the monitoring teams provided an objective interpretation of the field events. Quantitative data on the other hand was analyzed using advanced excel tools that aided interpretation.

Comparative analyses were done using percentages, averages, and cross-tabulations of the outputs/interventions; intermediate outcome indicators and the overall scores. The performance of outputs/interventions and intermediate outcome indicators was rated in percentages according to the level of achievement against the annual targets. The assessment of grants under the PRESIDE and NRIP funding windows was based on the achievement of annual output targets (numbers) and the level of annual budget disbursements. The sub-programme score was determined as the weighted aggregate of the average percentage ratings for the output/intermediate outcomes in the ratio of 65%:35% respectively.

The overall programme performance is an average of individual sub-programme scores assessed. The performance of the programme and sub-programme was rated based on the criterion in Table 2.1. Based on the rating assigned, a BMAU colour-coded system was used to alert the policy makers and implementers on whether the interventions were achieved or had very good performance (green), good performance (yellow), fair performance (light gold) or poor performance (red) to aid decision making.

Table 2.1: Assessment Guide to Measure Performance in FY 2022/23

Score	Performance Rating	Comment
90% and above		Very Good (Achieved at least 90% of outputs and outcomes)
70%-89%		Good (Achieved at least 70% of outputs and outcomes)
50%- 69%		Fair (Achieved at least 50% of outputs and outcomes)
49% and below		Poor (Achieved below 50% of outputs and outcomes)

Source: Author's Compilation

Ethical considerations

Introduction letters from the Permanent Secretary/Secretary to Treasury were issued to the respective MDAs, and beneficiaries were monitored. Entry meetings were held with the Accounting Officers or delegated officers upon commencement of the monitoring exercise. Consent was sought from respondents including programme or project beneficiaries. All information obtained during the budget monitoring exercise was treated with a high degree of confidentiality.

2.4 Limitations

i. Lack of reliable and real-time financial data on subventions which was not accessible on the IFMS.

ii. Limited access to some of the project implementation sites.

2.5 Structure of the Report

The report is structured into four chapters. These are the Introduction; Methodology; Programme Performance; Conclusion, and Recommendations respectively.

CHAPTER 3: PROGRAMME PERFORMANCE

3.1 Introduction

The Innovation, Technology Development and Transfer (ITDT) Programme contributes to objective four of the NDPIII to enhance the productivity and social wellbeing of the population. During the FY2021/22, the STI secretariat selected and supported 53 research projects through two funding streams: 1) National Research and Innovations Programme (NRIP) with 26 projects, and the Presidential Scientific Initiative on Epidemics (PRESIDE) with 27 projects. The grantees were classified into the following categories: health, agriculture, ICT, energy and mineral development, and environment and waste management. The funds for the projects were released in June 2022 and permission was provided by MFPED to implement the projects during FY 2022/23.

The semi-annual monitoring FY 2022/23 focused on the subventions of KMC, UNCST, and BIRDC as well as the funded research projects (Grants) under NRIP and PRESIDE coordinated by the Science, Technology and Innovation Secretariat.

3.2 Overall Performance

3.2.1 Financial performance

The approved budget for the ITDT Programme for FY2022/23 is Ug shs 247.676bn, of which Ug shs 98.051bn was released and Ug shs 83.716bn spent. The programme had unspent funds worth Ug shs 231.377bn as at 30th June 2022 largely released as a supplementary, and these funds were re-voted for financial year FY2022/23. Therefore, the total resource available to the programme during the period under review was Ug shs 329.429bn. The overall absorption was fair at 64% (Table 3.1). The low absorption was partly due to the late release of funds and initiation of procurements.

Table 3.1: Financial performance of the ITDT Programme as at 31st December 2022

Institution	Budget (Ug shs bn)	Release (Ug shs bn)	Spent (Ug shs bn)	% Release	% Spent
UIRI	25.502	10.362	9.741	41	94
BIRDC	29	14.555	4.411	50	30
NSTEIC	63.65	30.44	28.88	48	95
KMC	32.5	7.22	6.6	22	91
STI-State House	97.025	35.475	34.084	37	96
Sub-total	**247.677**	**98.052**	**83.716**	**40**	**85**
Balance brought forward from FY2021/22					
KMC	152.98	152.98	47.33	100	31
PRESIDE	51.153	51.153	51.153	100	100
NRIP	9.189	9.189	9.189	100	100
Crop value chain	2.048	2.048	2.048	100	100
BIRDC	16.007	16.007	16.007	100	100
Sub-total	**231.377**	**231.377**	**125.727**	**100**	**54**
Total	**479.054**	**329.429**	**209.443**	**69**	**64**

Source: IFMS and Field Findings

Physical performance

The overall programme performance was good at 73.2% (Table 3.2). The Industrial Value Chain Development Sub-programme performed better than that of STI Ecosystem Development at 83.5% and 62.9% respectively. One therapeutic for the treatment of respiratory diseases was approved for use in humans by the National Drug Authority (NDA). Three vaccine candidates were ready for pre-clinical trials. The Pearl of Africa Sat-1 satellite was launched into low earth orbit in November 2022. Implementation of the National Science, Technology Engineering, Innovation and Skills Enhancement Project (NSTEI-SEP) registered good progress while the commercialization of the pilot plant operations at the Banana Industrial Research and Development Centre (BIRDC) was ongoing at a rather slow pace largely due to limited funding in the first quarter of the FY2022/23 and the spike in raw material (matooke) prices in the second quarter.

Construction of the Kiira Motors Corporation (KMC) manufacturing and assembly infrastructure (phase 1) in Jinja stood at 99.8% against a time progress of 100% and a contract for the supply of a production and assembly line was signed with M/s CHTC from the People's Republic of China.

Table 3.2: ITDT Programme Performance by 31st December 2022

Sub-programme	Performance (%)	Remark
STI Ecosystem Development	83.5	Good performance
Industrial Value Chain Development	62.9	Fair performance
Average	**73.2**	**Good performance**

Source: Field Findings

Detailed performance of the monitored interventions is given hereafter:

3.3 STI Ecosystem Development Sub-programme

The sub-programme contributes to the five ITDT Programme objectives. The sub-programme has nine (9) interventions, of which four were monitored. The sub-programme performance was fair at 62.9% (Annex 3: Performance of the STI Ecosystem Development Sub-programme as at 31st December 2022). Interventions contributing to STI Infrastructure Development performed more than the other interventions related to Research and Development. The summary performance of the monitored interventions is given in table 3.3.

Table 3.3: Performance of interventions under the Industrial and Technological Development Sub-programme by 31st December 2022

Intervention	Colour code	Remark
Develop strategies to domesticate and implement international conventions and treaties that facilitate STI	71.1%	Fair performance
Increase investment in R&D in key priority sectors like; agriculture, Oil & Gas, Energy, Health, Transport	55.9%	Fair performance
Support the establishment and operations of technology & business incubators and technology transfer centres	93.7	Very good performance

Source: Authors' Compilation

3.3.1 Develop strategies to domesticate and implement international conventions and treaties that facilitate STI

The intervention aims at increasing the development, transfer and adoption of appropriate technologies and innovations. The planned outputs under this intervention for FY2022/23 were: Localized Kayoola EVS Frame; Preliminary Design of the Bus Seat (Coach); 3-in-1 Trike Design and Engineering Specification developed; 25 buses built; Six 3-in-1 Trike[2] Prototypes developed (Engineering, Manufacturing, Production Intent); and a market validation report of 3-in-1 Trike produced.

The design, engineering and manufacturing process specifications for the Kayoola Bus Seat and Kayoola EVS Web Frame and Chassis Localization with Victoria Engineering and Pumps were at 100%. The five (5) buses whose assembly and production started in FY21/22 were delivered to M/s Tondeka Metro Company and rolled out on the city roads.

The draft three-in-one Trike Design, *Engineering, Manufacturing and Test* case specifications were completed. The design prototype development commenced. The design intent of the Trike is for the capacity to deliver 6,000 litres per hour of water for irrigation, generate 6kw of electricity for basic household and production, and transport goods up to 1,000 kg. The recruitment of the corporation staff was ongoing. There were no buses built during the period under review due to a lack of budget releases made for the output. The intervention performance during the period under review was good.

3.3.2 Increase investment in R&D in key priority sectors like; agriculture, Oil & Gas, Energy, Health, Transport

The planned outputs under this intervention for FY2022/23 include: the banana pilot at BIRDC operationalized and International Standards Organization (ISO) certification secured; the COVID-19 research (PRESIDE) implemented, the National Research and Innovation Program framework (NRIP) and crop value chain projects supported (Annex 1: List of Projects funded under the PRESIDE, Annex 2: List of Projects funded under the NRIP). The grantees were classified into the following categories: agriculture, health, ICT, energy and mineral development, and environment and waste management. The performance of outputs under the intervention for the period under review is given hereafter:

Research and development in agriculture

Research and development in agriculture is funded under the BIRDC and NRIP. The monitoring covered outputs under the BIRDC and selected NRIP-funded grantees.

1. Banana Industrial Research Development Centre

The planned outputs for FY2022/23, include operationalizing the BIRDC model, the banana pilot plant and research laboratories commercialized, continuous product development, bio-waste utilized through R&D, product development and branding; and Global supply chain development and operationalization.

[2] A trike is a three wheeled vehicle with capacity for mobility, irrigation and power generation.

The approved budget to BIRDC was Ug shs 38.03bn inclusive of non-tax revenue from the sales of *Tooke* products (Ug shs 9.03bn). By 31st December 2022 Ug shs 14.955bn was released (39.3%) and Ug shs 4.411bn spent (29.5%). The poor absorption was attributed to the late release of quarter-one funds which led to the late initiation of planned activities. The operationalization of the pilot plant at the BIRDC-Bushenyi was ongoing at a rather slow pace. A total of 274.2MT of raw bananas were processed against an annual target of 1,820MT.

The BIRDC sold Tooke products worth Ug shs 0.456bn during the period under review against the Ug shs 9.03bn annual target. The poor performance was attributed to the rise in the price of raw bananas from October to December 2022 (Q2).

The renewal of products and process certification was attained for both the pilot plant and Tooke products (UNBS Q-mark, and Halal). The scope for UNBS certification was increased from two to twelve products[3]. The BIRDC developed twelve new products ready for market testing[4]. ISO certification was still pending by half year.

The BIRDC participated in two international and five local trade exhibitions during the period under review. Product awareness and advertisement was done through TV broadcast, radio mentions and print media (magazines). The procurement of 17 tricycles, a pilot plant and laboratory equipment[5] was ongoing. It was observed that the procurements for pilot plant equipment[6] initiated in FY2021/22 had not been completed as at 31st December 2022. The BIRDC performance was fair, however, the outputs related to the commercialization of the pilot plant performed poorly. The BIRDC was at risk of not running commercially as planned in FY2022/23 due to a lack of a clear strategic direction for commercialization, shifting priorities, delayed procurements, and intermittent funding.

2. Harnessing gravitational energy for domestic and precision agricultural application

The goal is to support smart agriculture in Uganda by automating the irrigation process and monitoring soil nutrient levels to achieve optimal productivity. The intention is to develop Gravitational Energy (GE) and precision agriculture (PA) irrigation systems. The project budget is Ug shs 0.26bn which was all advanced to the implementer and Ug shs 0.063bn spent by 31st December 2022. The GE unit consists of three sets of planetary gearboxes (a sun gear, a planet carrier, and three planet gears) and can produce 6W, modification of the GE unit was ongoing to increase the power output to 30W. The remaining activities include the development of an application that can allow remote control, a database for different crop water requirements and field testing of the prototype.

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3 Raw Tooke Baking Flour, Instant Tooke Flour, Tooke Biscuits, Tooke Scones, Tooke Mandazi, Tooke Bread, Tooke Dough nuts, Tooke Crisps, Tooke Buns, Tooke Queen Cakes, Tooke Instant porridge and Tooke Cookies

4 Gluten free bakery flour; Tooke High fibre biscuits Vanilla flavoured; Tooke High fibre biscuits Coffee flavoured; Tooke High fibre biscuits Chocolate flavoured; Tooke Rusks; Tooke herbal tea/beverage; Tooke Composite porridge; Tooke gluten free biscuits Vanilla flavoured; Tooke gluten free biscuits Coffee flavoured; Tooke gluten free biscuits Chocolate flavoured; Tooke Chocolate Biscuit; Tooke Coffee Biscuit

5 Crisps line; Doughnut Machine; Continuous bag stitching machine; Biscuit packaging machine; Differential proportional scale and mixer for flour composite line; Flour packaging machine; Metal detector machine; Banana washing machine; Banana peeling machine; Multiple depositor Machine.

6 Drum dryer, dicer, fluidized bed dryer, and distribution truck.

3. Bioelectricity production for wastewater treatment and soil fertility enhancement

The study budget is Ug shs 0.200bn, of which Ug shs 0.130bn was disbursed to the implementers. The project aims to uplift the wellbeing of urban dwellers through improved sanitation and the provision of sustainable energy.

The characterization of waste water samples from municipal, dairy and sugar industries was done. Of the three wastewater, preliminary results show a higher energy potential for municipal waste water. The lab-scale prototypes for waste treatment and electricity generation were constructed and the first experiment was run. The prototypes were reported to generate 2 watts.
Two graduate students were enrolled and critical project staff was recruited. The optimization of the microbial fuel cell was ongoing to increase the voltage output from the cell. The project had challenges of low stakeholder buy-in, especially industrialists.

4. Sweet potato value chain development through technology transfer and promotion

The study goal is to commercialize the sweet potato (SP) value chain by producing innovative value-added products that can contribute to import substitution and export promotion in Uganda and help address poverty in the Bukedi, Teso and Busoga sub-regions. The project deliverables are SP varieties profiled for value addition; priority recipes for the production of candidate SP-based products catalogue; technically viable SP-based product prototype developed; and industrial process prototyped.

The year one project budget was Ug shs 1.260bn which was all released and Ug shs 1.161bn spent by 31st December 2022. The profiling of SP varieties for the production of value-added products (ethanol, cakes, bread, doughnuts, mandazi and chapatti) was done. Technically viable product recipes were developed and procurement of pilot plant equipment and construction of pilot plant was ongoing at Kampala Industrial and Business Park-Namanve. The project performance was good with some of the planned outputs achieved; however, the type of outputs achieved was not commensurate with the funding provided, thus little value for money.

5. Optimizing of suitable substrates for mass production of black soldier fly larvae

The study goal is to optimize substrates for mass culture of black soldier fly larvae (BSFL) for fish/animal feed development. The project deliverables include; the abiotic culture conditions of BSLF on selected substrates determined; the final performance response of the candidate substrate conducted; the nutrient composition of BSFL reared on experimental substrates determined; and the performance evaluation of two feed formulations from BSFL.

The study budget is Ug shs 0.152bn and all was released. A total of Ug shs 0.144bn was spent by 31st December 2022. The project carried out preliminary activities like inception and planning meetings; procurement of equipment (feed mill, feed mixer and rearing trays and racks) and renovation of the rearing facility. Five candidate substrates (wheat bran, coffee husks, potatoes, chicken manure and maize bran) were mobilized for composition analysis. The intended project outputs were yet to be achieved amidst 95% expenditure of the resources released.

L-R: Some of the prototype value added products from sweet potato; and trays and racks for rearing of the black soldier fly larvae at Buginyanya ZARDI-Mbale site

6. Development of a rapid low-cost point-of-care nucleic acid diagnostic tools for Banana Xanthomona wilt (BXW), Cassava Mosaic (CMD)and Sweet Potato Viruses (SPVD)

The goal is to develop, test and market simple low-cost paper-based assays suited for resource-limited rural settings for effective banana, cassava and sweet potato disease management and control. The project planned outputs are a paper-based lateral flow assay for detection of BXW, CMD and SPVD developed and optimized; an optimized prototype of multiple lateral flow paper-based assays developed; and a business plan for commercialization and dissemination of the developed assays developed.

The project budget is Ug shs 0.50bn which was all advanced to the implementers and Ug shs 0.106bn spent by 31st December 2022. The following progress was achieved; training of project staff and graduate students on field sweet potato virus, banana and cassava disease symptoms identification, scoring and sampling procedures; completed designing of 20 pairs of primers and probes for BXW, CMD and SPVD; 445 samples of infected banana, cassava and sweet potato were collected and analysis was ongoing; and fabrication of the paper channels and cassettes was ongoing. The project was delayed to start due to delayed authorization from STI-Secretariat; and lengthy procurement processes.

7. Round-the-clock solar crop drying system

The goal is to develop a scalable novel solar crop dryer to enable different farmers and other interested stake holders in Uganda, to minimize postharvest losses on account of high storage moisture contents. The planned project outputs are the Kanyarusoke-Musinguzi day and night solar dryer upgraded and capacity built. The project budget is Ug shs 0.502bnwhich was all disbursed and Ug shs 0.163bn was spent by 31st December 2022.

An upgrade of the Kanyarusoke-Musinguzi day-night solar dryer 1 was completed with automated controls to eliminate turning of the product during the night. The solar collecting area was increased in the new version of the dryer from 2 to 6m^2, chamber volume from 1 to 3m^3, and loading capacity from 25 to 160kg. Maize at 24% moisture content was used as a reference product and the drying time was 24 hours. The upgraded prototype of the solar dryer was available and construction of a silo to store the dried products was ongoing. The project sited challenges of intermittent power supply in the area that causes delays in fabricating the dryers.

8. Improving the livelihood of poultry farmers through egg processing and value addition

The project goal is to establish an egg-processing pilot plant and incubation centre. The planned project deliverables are: value-added shelf stable egg products (pasteurised liquid whole egg, egg white and egg yolk; and powdered whole egg, egg white, yolk and shell); an atomized spray drier for egg powder production; and secondary value-added products.

The project budget is Ug shs 0.53bn which was all disbursed to the host institution (Kyambogo University) and Ug shs 0.141bn was spent by 31st December 2022. The project had conducted preliminary experiments for the production of powdered egg products, however, these were not produced using recommended equipment and product quality was not good. The procurement of egg processing and value addition equipment and the designing of an atomized spray drier were ongoing though with administrative delays. The project is behind schedule due to procurement delays including pre-shipment verifications.

Research and development in ICT

9. Kawu Financial platform

The project goal is to increase access to convenient and affordable digital financial services for students that are not allowed to own phones at school yet need upkeep in the form of money. The planned project deliverables are: Kawu smart card developed and piloted in schools; three applications developed and hosted; and Kawu smart card certified for e-transactions.

The project budget is Ug shs 0.075bn which was all released and spent by 31st December 2023. The project had registered the following progress: a prototype of the Kawu smart card was developed and a total of 5,000 cards were printed. The application was piloted in 10 schools[7] with over 2,000 users, 1,000 parents and 20 agents. The project developed three applications: Kawu parents; agents and web-based applications. The project performance was good.

Research and development in the health sector

The research is funded through two windows: PRESIDE and NRIP. The PRESIDE is a platform set up to fast-track local research and development to generate products to enable the country to cope with the COVID-19 pandemic and future health security needs (pathogen economy).

By 31st December 2022, there were no funds disbursed to the PRESIDE projects. Therefore, the monitoring focused on funds (Ug shs 52.064bn) disbursed to some of the 27 PRESIDE projects in June 2022. The NRIP supported two research projects in the health sub-programme

[7] Midland High School; Namilyango High School; Lubiri Secondary School; Mityana Modern Senior Secondary School; Namilyango Modern Senior Secondary School; St John's SS Nkoowe; St Katherine SSS Lira; Lango College, Lira; Dr. Obote College, Lira; Mentor College, Lira; St Noa Mawagali, Jinja; St Elizabeth Nkoowe; Seat of Wisdom SS, Kasawo; and Kakungulu memorial SS.

Annex 2: List of Projects funded under the NRIP). The progress of monitored projects in given hereafter:

10. COVID-19 sub-unit vaccine

The project aims at developing a subunit/ acellular vaccine to be used in the management of the COVID-19 spread. The project is implemented by the College of Veterinary Medicine, Animal Resources and Biosecurity (COVAB), Makerere University, and its main deliverable is a COVID-19 vaccine.

The isolation, gene coding of the spike protein and viral Deoxyribonucleic Acid (DNA) amplification and expression was achieved in E.coli[8] was done. The surface spike protein from the different SARS COV2 variants was freeze-dried and dosed in laboratory mice for safety, immunogenicity and toxicity preclinical studies. The results from the preclinical studies showed that the candidate vaccine was immunogenic and safe. The pending activities include; preclinical studies in humanized mice for toxicity, safety, immunogenicity and efficacy studies and clinical trials. However, the pending activities are awaiting completion of the central laboratory animal research facility, good manufacturing practice facility to conduct efficacy studies, and vaccine adjuvant and delivery system.

Two breeding pairs of humanized mice and a license were procured and breeding to obtain sufficient numbers (colony) to enable vaccine evaluation is yet to begin due to the lack of a bio-secure breeding house.

The development of antibody enzyme-linked immunosorbent assay (ELISA) for COVID-19 surveillance was ongoing. The antigen for COVID-19 was obtained and expression in E. coli was ongoing.

11. Biomarker Research Facility

The project is implemented by COVAB-Makerere University. The project goal is to strengthen the country's capacity to develop disease diagnostic/prognostic assays and drug development. The project's general objective is to develop a diagnostic biomarker test kit for diagnosing and management of COVID-19. The deliverables include: a biomarker research facility established at Makerere University; SARS-CoV-2 biomarkers in saliva, urine and blood with diagnostic/ prognostic or therapeutic potential identified; and biomarker panels (lateral flow assays) developed.

The project budget for FY2022/23 for operations was Ug shs 2.950bn which was all received. Equipping of the biomarker research facility was at 80% progress. A total of 12 biomarkers were detectable in urine, saliva, blood, plasma and serum. A lateral flow kit for detecting severe SARS COV2 was developed using serum and plasma samples (analytes). The project recruited two master's students for capacity building. The following activities were pending; sensitivity, specificity, performance and stability and clinical evaluation of the developed diagnostics.

[8] Escherichia coli (E. coli), is a type of bacteria that normally lives in animal intestines.

12. Central laboratory animal research facility (CLARF)

The project is implemented by COVAB-Makerere University whose goal is to establish a central shared laboratory animal research facility (pre-clinical trials) at COVAB. The key project deliverables include a renovated and equipped CLARF; biological molecules used in the treatment and prevention and diagnostics for infectious disease produced; small laboratory animals bred; and consultancies in drug efficacy studies provided. The scope of work for renovation include: renovation and equipping the CLARF for small animal experimentation (laboratory to level 2 biosecurity and animal house to level three biosecurity), and construction of a perimeter wall around the facility.

The project budget was Ug shs 1.440bn which was all released and spent. Civil works were at 90%, and a standby generator to provide redundancy in case of power outages was procured and installed. A request to have the animal facility approved was submitted to the National biosafety committee. The remaining activities for the renovation works were final finishes and gate house. The delayed completion of CLARF poses a risk to the viability of the mice breeding programme.

13. Inactivated COVID-19 vaccine development

The project goal is to reduce Uganda's chronic dependence on external donors and turn the threats of viral epidemics into an emerging economy by building local capacity for developing vaccines needed to respond to emerging and re-emerging viral diseases. The project key deliverables are tested and approved inactivated COVID-19 vaccine and local capacity for epidemic response preparedness built. The project had registered progress in growing the virus on viral cells, isolation and inactivation. The inactivated vaccine was isolated from delta and omicron variants. The capacity of three staff was built in vaccine preparation. The remaining project activities include; pre-clinical, clinical and efficacy studies. The anticipated spinoffs from the project include SARS-CoV-2 monoclonal antibodies and antigen proteins and pseudo viruses.

14. Production and clinical evaluation of bee products

The overall project goal is to develop safe and effective natural products as preventative and therapeutic drugs against COVID-19 and other related diseases. The project planned outputs include; ethnomedicine properties of Wabugia Ugandanensis and bee products documented; preclinical studies of the formulated therapeutics; standardised dosage clinical trials of the formulated therapeutics.

The project budget for the year was Ug shs 2.0bn which was all disbursed to the host institution-National Chemotherapeutic Research Institute (NCRI) and Ug shs1.981bn was spent by 31st December 2022. A therapeutic product from Wabugia Ugandanensis and bee products were developed (UBV-01N). Clinical trials for the UBV-01N were completed and the product got approval from the NDA and UNBS for use by humans for the treatment of respiratory diseases. However, studies on standardized dosage and viral efficacy (UVRI) were still ongoing. A good manufacturing practice facility was set up and partially equipped at NCRI. The project progress was good however completion of the pending studies is key before the massive production of the product.

L-R: Some of the procured equipment under the PRESIDE grant at COVAB; and renovated building to act as GMP facility for production of therapeutic bee products at NCRI

15. NANO-Adjuvant Therapeutics, vaccine adjuvant and materials testing

The project is implemented by the College of Engineering Design Art and Technology (CEDAT), Makerere University, MAPRONANO ACE. The project goal is to formulate and evaluate the adjuvanticity of nano-adjuvant delivery systems for the SARS-CoV-2 subunit vaccine. The project budget was Ug shs 1.485bn which was all released and Ug shs 1.382bn spent by 31st December 2022.

The following activities were completed: Formulation of chitosan and lipid nano delivery systems, and its biocompatibility with the vaccine determined. The developed adjuvant was reported to be compatible with the SARS-CoV-2 subunit vaccine developed by COVAB. A total of 300 laboratory mice were vaccinated with the vaccine-loaded nano-adjuvants to evaluate their safety, toxicity and immunogenicity profiles. The vaccine-loaded adjuvant was found to be safe and would induce the intended antibodies. However, the pre-clinical trial/evaluation of the vaccine adjuvant in humanised mice was yet to be done.

16. Novel Adeno-vector COVID-19 vaccine

The project aims at developing a SARS-CoV-2 vaccine using an Adenovirus vector and viral spike (S-glycoprotein) from Ugandan viral strains. The project planned outputs include Ugandan non-human primate (NHP) adenovirus vector developed; adeno-vector COVID-19 vaccine developed; and technical capacity for vaccine production built.

The project budget was Ug shs 1.252bn which was all disbursed to the implementer and Ug shs 1.351bn was spent by 31st December 2022. The following progress has been registered; genotypic characterization of 73 faecal samples collected from chimpanzees was completed; adeno-vector backbone were generated; three vaccine candidates (A23.1, Delta and Omicron) were generated from E1 deleted adeno-vectors; bulk laboratory stock of both the vaccine and vector were generated; and capacity building of project staff in areas of bioinformatics, next generation sequencing and cytometry flow panels was done.

The following activities were yet to begin: pre -existing immunity data for the Ugandan population and preclinical trials. Delays in procurement of critical consumables like vivapure purification kits and cells for bulk production affected the timely attainment of project-planned output.

Equipped Laboratory for vaccine development research at UVRI

17. Development and production of medical and biomedical plastic supplies in Uganda

The project goal is to develop local capacity in the manufacture of medical and biomedical plastic products to reduce the importation of medical and biomedical supplies in Uganda and provide their sustainable supply to end users. The project has two deliverables: specifications and requirements for medical plastics developed; and processes for the manufacture of medical and biomedical plastics and equipment developed and optimized.

By 31st December 2022, Ug shs 1.599bn had been disbursed to the project and Ug shs 0.452bn (28%) spent and the following had been achieved: feasibility study on the manufacture of medical and biomedical plastics and stakeholder interactions and; prototypes of medical plastics by 3D additive manufacturing. The following activities were pending: moulds/dies/equipment specifications, and selection of appropriate equipment and suitable suppliers.

L-R: Electron scanning microscope acquired PRESIDE grant and some of the prototypes for biomedical plastics made by 3D additive manufacturing at CEDAT

18. ICT Platform for the Pathogen Economy

The project goal is to develop a robust software platform to support critical internal business processes of the STI secretariat; and deployment of a commercial and integrated artificial intelligence (AI)-driven platform for disease screening. The project has six deliverables: grants application and management platform; Atlas system; training module for innovators; coordination, implementation and evaluation platform for STI secretariat; an integrated disease screening platform and; an artificial intelligence database for healthcare solutions.

By 31st December 2022 Ug shs 0.999bn had been disbursed to the project and Ug shs 0.424bn spent. The project developed all system requirements, design and modules for all the platforms; a Ugandan-based cervical cancer image dataset; a system prototype for the disease screening, mobile application and screening dashboard; and patient information exchange through the Open Health Exchange platform (OpenHIE); others include; a Ugandan-based breast cancer image dataset; web-based data tools for the data collection, integration and preparation and Machine Learning (ML) pipelines for training image classification and object detection for medical images.

Development and integration of the application programming interface (APIs), system deployment, testing and piloting were ongoing for all platforms and systems, and are anticipated to be completed in Q4 FY2022/23. Data preparation and annotation by experts, ingestion pipeline designed and evaluation of AI model on a specific machine for the AI disease screening platform were also ongoing.

19. Pathogenic epidemiological studies

The project's main objective is to conduct anti-microbial resistance (AMR) surveillance model and predict resistance and pharmaceutical needs and products that will support the fight against AMR. The project deliverables are three herbal and biotechnological products, a predictive model for AMR in Uganda in 2030; Polymerase Chain Reaction (PCR) diagnostic kits, data-driven treatment guidelines developed and capacity building.

The project received a grant worth Ug shs 2.621bn and Ug shs 1.60bn was spent by 31st December 2022. The project procured key equipment to be used in conducting the research; 11 plant extracts were evaluated and three extracts were reported to have anti-microbial properties; a draft ARM predictive model was designed and recruited seven masters' students for capacity building. The project performance was good.

3.3.3 Support the establishment and operations of technology & business incubators and technology transfer centres

The intervention contributes to the ITDT Programme's objective: to develop the requisite STI infrastructure. The planned and monitored budgeted outputs for FY2022/23 under the interventions are: civil works for UNCST-TIBIC and NSTEIC executed; technical service company established and operationalized; and framework for operationalization of the TIBIC & NSTEIC developed.

Civil works for UNCST-TIBIC and NSTEIC executed

The National Science Technology Engineering Innovation-Skills Enhancement Project (NSTEISEP) is a multiyear project implemented by the Uganda National Council for Science and Technology that started on 1st July 2019 with an end date of 30th June 2024. The project is funded through a loan from the Government of the People's Republic of China.

The FY2022/23 approved budget for the NSTEI-SEP under the Uganda National Council for Science and Technology (UNCST) is Ug shs 63.65bn, of which Ug shs 30.44bn (47% of the budget) was released and Ug shs 28.88bn spent by 31st December June 2022.

The civil works for the NSTEI-SEP were ongoing at both sites of Namanve-Mukono and Rwebiteete in Kiruhura districts. The civil works at the Technology Innovation and Business Incubation Centre (TIBIC)–Namanve were at 94% against a time progress of 100%. The facility was expected to be handed over to the client by 30th September 2022, however, an extension of eight months was granted up to May 2023. The equipment for the maintenance workshop was installed, pending testing and commissioning by MoWT. The procurement of equipment for the laboratories was ongoing and incubates had expressed interest to use the shared facilities at TIBIC. The pending activities were the completion of the smart conference hall and approval of the site for the waste treatment plant by NEMA and its construction. The negotiations with the contractor for the modification of the smart conference hall were ongoing.

The civil works at the National Science, Technology, Engineering and Innovation Centre (NSTEIC)-Rwebiteete were at 76% against a time progress of 82% and completion was expected on 17th May 2023. The metallurgical and industrial, construction machinery and civil construction hub, students' dormitory (Block 27), staff quarters, central administration block, guest house, dining hall, and lecture rooms were undergoing final finishes. The electrical and plumbing works were completed.

The IT infrastructure designs for the NSTEIC were under review by the client and contractor. The construction of the agricultural, electro-pneumatic, and automotive hubs was ongoing and the superstructures were completed. The external works within the complex including roads, and parking aprons were at 70% physical progress. The construction of the recreation facilities was pending a review of the designs. The installation of equipment for laboratories and workshops was anticipated to be completed in November 2023.

Top to bottom: Completed and equipped heavy duty machinery workshop at TIBIC in Namanve and ongoing construction of training workshops at NSTEIC in Rwebiteete in Kiruhura District

Technical Service Company established and operationalized

The project developed the following framework partnership agreement between UNCST and National Enterprise Corporation (NEC): The Memorandum of Understanding (MoU) covered; Service Level Agreement for the MoU implementation framework; contract for machinery and equipment rental.

A total of 48 units and 30 units of road construction equipment were leased to M/s Rohi Investments and M/s National Enterprise Corporation respectively. A total of 141 units of delivered equipment remained parked for over a year, unused. Moreover, the client was meeting the costs for routine maintenance and servicing on top of parking charges. The investment faced the risk of the equipment warrant expiring before they are used.

Framework for operationalization of the TIBIC and NSTEIC developed

The NSTEISEP signed MoUs between UNCST and Private Sector Foundation Uganda (PSFU); the Electricity Regulatory Authority (ERA), the Directorate of Industrial Training (DIT), and the Uganda Business and Technical Examinations Board (UBTEB). The project developed an operational plan and guidelines for the NSTEIC. The development of a training curricula; operational plan and guidelines for NSTEIC and TIBIC were ongoing.
The following technology majors will be considered: construction machinery technology, civil engineering technology, automotive technology, agricultural mechanization, industrial /mechanical technology, metallurgical technology, and electronic & electrical engineering.

3.3.4 Create capacity on application of drones, satellite imagery through GIS, real-time disaster modelling, and widespread connectedness improve emergency response and production

The intervention contributes to the programme's objective of strengthening R&D capacities and applications. The intervention NDPIII output is National Space Science and Aeronautics Program Feasibility Study and Strategy developed. The planned outputs for the FY2022/23 include: Mpooma ground station renovated and equipped; Pearl Africa Sat-1 launch into the low earth orbit done; stakeholder mapping for aeronautics and space science done; national strategy for aeronautics and space science bureau developed; capacity skills audit done; and feasibility study report for the aeronautics and space science programme developed.

Mpooma ground station renovated and equipped

Renovated infrastructure at Mpooma Satellite Station

The STI secretariat renovated and remodelled the ground earth station at Mpooma in Mukono district for command, control and management of the Pearl Africa sat-1 satellite. By 31st December, the contractor had substantially completed the works (construction of internal fence, replacement of the roof, doors, and windows, floor finishes, plumbing works, electrical works, installation of CCTV cameras, motion sensors, computers, furniture, and external works) and was addressing the snags pending handover. The equipping of the geo-spatial data centre and space laboratory was also completed. However, the furnishing of office space for the ground station was yet to be done.

Pearl Africa Sat-1 launch into the low earth orbit done

Uganda with support from the United States of America National Aeronautics and Space Administration (NASA) successfully launched its first-ever satellite into international space in November 2022. The cube-type satellite, Pearl Africa Sat-1, was deployed into the low earth orbit in December 2022. The satellite is designed to provide research and observation data that will provide solutions in weather forecasts, land, and water bodies, mineral mapping, disaster preparedness, border security and agriculture monitoring. The collection of data was ongoing but it has not been put to use as calibration of the system was yet to be done.

National Aerospace Strategy for Uganda developed

An Inter-Ministerial Committee was constituted to aid the conduction of the following activities: stakeholder mapping per sector; needs assessment per sector; human capacity audit; infrastructure audit; a market survey for products and pilots in each sector that can be supported; business model template starting with saving money on projects being implemented locally and working towards

putting products on the market, providing employment and expert services within the country and the region; Uganda Aerospace Policy Draft; and fulfilling international requirements for outer space exploration. The results of the above-mentioned activities will pave the way for the drafting of an aerospace strategy for Uganda.

Sub-programme challenges

i. Delayed release of funds for continuing research projects in FY2022/23.
ii. Lack of a governance board for BIRDC.
iii. Withdraw of COVID-19 research collaborators thus straining ongoing research.
iv. Restrictions by international suppliers on procurement of some COVID-19 research consumables to Sub-Saharan Africa.

3.3.4 Conclusion

The STI Ecosystem Development Sub-programme performance was fair at 62.9% (Annex 3). The performance of the intervention aimed at increasing investment in research and development was fair; with some projects registering prototypes and others at pre-clinical and clinical stages. It was observed that some of the project deliverables especially COVID-19 were overtaken by events owing to the development of test kits, procedures; and vaccines by other scientists elsewhere in the world and were already in the country. However, the successful implementation of the PRESIDE projects would build the capacity of Ugandan scientists and create preparedness to manage future epidemics.

Most of the studies experienced delays in the acquisition of critical equipment and a shortfall in funding. The CLARF for preclinical efficacy studies was yet to be approved and there was no Good Manufacturing Practices (GMP) facility for the production of human vaccines in the country. The above challenges put the research projects at risk of not attaining the intended outputs and outcomes in time; demotivation of researchers and a likelihood of resource wastage.

Therefore, the STI secretariat should ensure funding for approved research projects; expedite the process of establishment of the required infrastructure for efficacy studies and GMP facilities; expedite the process of approving the BIRDC governance board; expedited the calibration of equipment for the geospatial data centre and space laboratory to effectively use the data collected by Pearl Africa Sat-1 satellite and establish and strengthen research collaborations.

3.4 Industrial Value Chain Development Sub-programme

The sub-programme aims to increase development, transfer and adoption of appropriate technologies and innovations; and the development of requisite STI infrastructure. The sub-programme has three interventions, and one was monitored. The sub-programme performance was good at 83.5% (table 3.3). The performance of the monitored intervention is given hereafter:

3.4.1 Support the establishment and operations of science and technology parks to facilitate commercialization

The intervention contributes to the programme objective of the development of requisite STI infrastructure and has three outputs to be attained over the NDPIII period. These are: Kiira Vehicle Plant operationalised and functional; automotive industrial and technology park established; and banana industry infrastructure park established.

The planned annual outputs for FY2022/23 are: Functional Kiira Vehicle Plant Operationalised by June 2023; a master plan for the Automotive Industry and Technology Park (AITP) developed and a feasibility study for the AITP conducted.

Physical performance

The construction of the KMC manufacturing and assembly infrastructure (phase 1) contracted to the National Enterprise Corporation (NEC) at the Jinja Industrial and Business Park stood at 99.8% against a time progress of 100% as at 31st December 2022.

The completion of the warehouse and main gate were on hold due to ongoing road works. Phase II civil works that included paving of circulation and principal access roads, test track (road), quality and inspection facility, upgrade of the waste treatment, water reservoir and power substation, production facility (paint, electro-coating shop) were at 35% physical progress as at 31st December 2022. The overall infrastructure development of the Kiira Vehicle Plant stood at 67%.

Ongoing construction of electro-coating shop at Kiira Vehicle Plant, Jinja

The KMC signed a contract with M/s CHTC Motor Company Limited, the Technology Partner, for the supply, installation, testing, training and support of the Kiira Vehicle Plant production system. The contract commenced on 8th December 2022 and delivery and installation of equipment by 30th June 2023. The operationalization and commissioning of the Kiira Vehicle Assembly Plant was planned for 30th June 2023. The Last Mile fibre connection to the Kiira Vehicle Plant was completed by Research and Education Network for Uganda (RENU). The KMC cited a challenge of transaction loss due to variations in currencies for the Kiira Vehicle Production System and other imported production parts and materials.

The master plan for the Automotive Park was approved by the Kayunga District Council in October 2022. The pre-feasibility study and business plan for the AITP were concluded and submitted to the KMC board for approval.

The KMC sales revenues (sale of Kayoola Diesel Buses, contract manufacturing of buses and bus lease/hire operations with Kalita Transporters and other VIP shuttle services) was Ug shs 645 million. Table 3.4 shows the sub-programme performance.

Table 3.4: Performance of the Industrial Value Chain Development Sub-programme as at 31st December 2022

Intervention	Output	Financial Performance			Physical Performance			Remark
		Annual Budget (bn Ug shs)	% of budget received	% of budget spent	Annual Target	Cum. Achieved Quantity	Physical performance Score (%)	
Support the establishment and operations of science and technology parks to facilitate commercialization	Functional Kiira Vehicle Plant operationalized	151.736	100.0	30	100.00	67.00	67.00	Fair performance
	AITP established	1.149	100.0	100	2.00	2.00	100.00	Very good performance
Average Outputs Performance							**83.50**	**Good performance**

Source: Project Implementers and Field Findings

Challenge

Transaction loss due to variation in currencies for the Kiira Vehicle Production System and other imported production parts and materials.

3.4.2 Conclusion

The Industrial Value Chain Development Sub-programme performance was good at 83.5% (Table 3.4). Construction of the Kiira vehicle plant was ongoing at 67% physical progress and is anticipated to be commissioned by 30th June 2023. Implementation was generally affected by transaction loss due to variations in currencies for the imported production parts and materials.

Recommendation

The KMC should seek authorisation from MFPED to use USD currency for the procurement of the Kiira vehicle production systems to ensure that the set timelines are achieved and reduce transactional losses arising from the shilling appreciation/depreciation against the USD.

CHAPTER 4: CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

The programme performance was good at 73.2%. Good progress was observed for infrastructure development-related outputs like the NSTEI-SEP at both Namanve and Rwebitete, renovation of the Mpooma Satellite Station, and the KMC assembly plant in Jinja.

Several research projects had developed prototypes for use in health, agricultural and ICT applications. It was observed that some of the project deliverables especially for COVID-19-related interventions were overtaken by events. The BIRDC performance was poor owing to the late release of funds which affected the procurement of critical equipment. This was further exacerbated by the spike in prices of matooke between October and December 2022 which affected the processing. It is therefore unlikely that the centre will run commercially as anticipated in FY2022/23.

It was observed that most of the studies experienced delays in the acquisition of critical equipment and a shortfall in funding. None of the vaccine development projects moved to the clinical trial stage owing to the lack of an approved facility for preclinical efficacy studies and lack of a certified Good Manufacturing Plant (GMP) facility for the production of human vaccines in the country. The KMC cited a challenge of transaction loss due to variations in currencies for the Kiira Vehicle Production System and other imported production parts and materials.

4.2 Recommendations

i. The STI secretariat should track the approval of a governance and management framework for the BIRDC.

ii. The project PIs and PRESIDE secretariat should establish sustainable collaborations with research institutions for knowledge and resource sharing.

iii. The STI secretariat should quickly invest in establishing a central GMP facility at one of the collaborating institutions such as COVAB to bridge the gap and increase efficiency in pathogen economy investments.

iv. The KMC should seek authorisation from MFPED to use USD currency for procurement of the Kiira Vehicle Production System.

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4. State House (2022); Quarterly Performance reports (Q1-Q2) FY2022/23

Annex 1: List of Projects funded under the PRESIDE

Project Name	Institution	Grant Amount	Release
PCR based Diagnostic assays	Joint Clinical Research Centre	2,967,663,556	2,967,663,556
Inactivated COVID-19 Vaccine development project	Uganda Virus Research Institute	7,003,000,000	7,003,000,000
Equipment for the biomarker research facility	Makerere University COVAB	2,950,000,000	2,950,000,000
Establishment of a high-quality biobank of samples from COVID-19 patients to facilitate research in diagnostics, treatment, and vaccines	Mak-BRC	2,354,852,786	2,354,852,786
In-vitro studies for Herbal research	Uganda Virus Research Institute	1,419,713,194	1,419,713,194
Saliva Diagnostic Kit	Makerere University College of Health Sciences (Mak-CHS)	1,030,000,000	1,030,000,000
NANO-Adjuvant Therapeutics, Vaccine adjuvants & materials testing	Mapronano ACE, College of Engineering, CEDAT	1,485,000,000	1,485,000,000
The PCR and Anti-body diagnostic kits	Ndiyo Biosciences Limited	4,576,200,000	4,576,200,000
Development of Antibody ELISA for COVID-19 surveillance	Makerere University-COVAB	845,000,000	845,000,000
Novel Adenovector COVID-19 Vaccine	MRC/UVRI & LSHTM	2,500,000,000	2,500,000,000
Sub-unit vaccine	COVAB	975,000,000	975,000,000
Convalescent plasma for production of Hyper Immune Globulin (HIG)	Joint Clinical Research Centre (JCRC)	600,000,000	600,000,000
Bee products and Warbugia Ugandensis	Natural Chemotherapeutic Research Institute	2,000,000,000	2,000,000,000
Assessment of Vitamin D Plasma Levels in high-risk groups	WINDSOR & Mak-SPH	1,600,000,000	1,600,000,000
Evaluation of the anti-SARS-COV-2 Activity of Tephrosia linearis, Zanthoxylum chalybeuum and Albizia coriaria and formulation of a herbal product for management of COVID-19	Busitema University	2,375,412,744	2,375,412,744
Matooke Starch as a pharmaceutical excipient in selected medicinal formulation for the treatment of COVID	PIBID/BIRDC	797,438,750	797,438,750
Lab Animal House	Makerere-COVAB	1,440,000,000	1,440,000,000

Project Name	Institution	Grant Amount	Release
Ivermectin & Low-dose Aspirin study (IVCOM)	Mak-CHS, Department of Pharmacology & Therapeutics	1,000,000,000	88,587,244
Clinical Trials for Natural Therapeutics (CONAT)	Makerere University Lung Institute	3,160,640,000	3,160,640,000
Pathogen Epidemiological studies (Antimicrobial Resistance Modelling and PCR development)	Mbarara University of Science and Technology (MUST)	2,620,771,250	2,620,771,250
ICT for Pathogen Economy Labs	Makerere University-CoCIS, CEDAT	1,000,000,000	1,000,000,000
Investigation of local material for the development of Medical Masks	Uganda Industrial Research Institute (UIRI)	800,000,000	800,000,000
Fermented finger millet nutraceutical	Makerere University School of Public Health	2,390,227,256	2,390,227,256
Liquid smoke (Bio-base Polyphenol)	Mbarara University of Science and Technology (MUST)	250,000,000	250,000,000
Developing a National Network of STI Excellence as a Foundry for Accelerated Transformative STI Human Capital Development	Makerere University	1,642,300,000	1,642,300,000
Assessment of feasibility, acceptability, safety, effectiveness and immunogenicity of COVID-19 vaccines among children in Uganda	Makerere University Lung Institute	681,000,000	681,000,000
Development and production of medical and biomedical plastic supplies in Uganda	MAPRONANO ACE, College of Engineering, CEDAT	1,599,853,134	1,599,853,134
Total		**52,064,072,670**	**51,152,659,914**

Annex 2: List of Projects funded under the NRIP

Project	Institution	Grant Amount	Release
Innovative Work Space Prototype	MOTIV	1,300,000,000	1,300,000,000
Development of rapid low-cost point-of-care nucleic acid diagnostic tools for Banana Xanthomona wilt, cassava mosaic disease and sweet potato viruses	Gulu University	500,000,000	500,000,000
Science-Led Productivity Accelerator Tool for Fast-Tracking Parish Development Model: Validation of Tool	AFRISA	1,098,218,000	1,098,218,000
Yo Waste: a mobile and cloud-based hauler and garbage collection service app	Yo-Waste Limited	60,471,000	60,471,000
Anti-tick vaccine	Alfasan	400,000,000	400,000,000
Establishment of a Centre for Cancer Biomarkers at the Uganda Cancer Institute	UCI	600,000,000	600,000,000
Domestic Manufacture of Triad Engine for Mobility, Irrigation and Power Generation	Kiira Motors	649,478,100	649,478,100
Azadirachta indica,(neem) powder, oil and cake, an organic pesticide and fertilizer for crop farmers in Karamoja Sub region	Karamoja Christian Ethnoveterinary Program(KACHEP)	300,000,000	300,000,000
Direct Reduction technology for metallization of Ugandan Iron Ore	MAK	440,195,000	440,195,000
KAWU Financial Platform	Lira University	75,114,000	75,114,000
Recycling of plastic waste into eco-friendly interlocking blocks to address the challenges of houses for the poor people and the construction of upe/use school classrooms.	MUST	326,393,288	326,393,288
Eco-Friendly Gold Ores Beneficiation Through Substituting the Highly Toxic and Environmentally Persistent Mercury in Artisanal Gold Mining with The Abundant and Renewable Resource; Cassava.	UMU Nkozi	246,680,001	246,680,001
Harnessing gravitational potential energy for domestic and precision agriculture applications	Gulu University	260,653,200	260,653,200
A virtual chemistry laboratory simulator. (v-chemlab)	Kabale University	119,776,118	119,776,118
Development and Commercialisation of Bee Products for Increased income and Export in Uganda	Muni University	220,265,217	220,265,217
Apokor cassava value addition project (acavap).	Apokor Farmers SACCO	119,292,600	119,292,600
Optimizing Suitable Substrates for Mass Production of Black Soldier Fly Larvae (BSFL) as Ingredient for Quality Cost Effective Fish Feeds	NARO	151,666,667	151,666,667

Project	Institution	Grant Amount	Release
Validation of Anti-plasmodium and Artemisinin pharmacokinetic enhancement potential of medicinal plants used by communities to manage symptoms of malaria	MAK CHS	228,000,000	228,000,000
Design and fabrication of a continuous flow reactor for the production of biodiesel from locally available waste	MAK	35,000,000	35,000,000
Improving livelihoods of poultry agribusiness entrepreneurs through egg processing and value addition	Kyambogo University	529,998,000	529,998,000
Production scale-up and commercialization of the Makerere Smart Solar-electric Cooker for households, catering businesses and learning institutions: MakSol Cooker	MAK	175,000,000	175,000,000
The Parish level Night - Day Solar crop dryer and 30 Tonne silo storage system	Busitema University	502,000,000	502,000,000
Develop a model for the commercialization of mushroom production Parishes in each district in Bukedi region	Great lakes Industrial Institute (GLIDE)	450,478,809	450,478,809
Development of Iron Oxide Nanoparticles from steel waste for Applications in Water Treatment	Makerere University	259,540,400	130,000,000
Bioelectricity production for wastewater treatment and soil fertility enhancement	Gulu University	200,459,600	130,000,000
Valorization of Cassava Peels Into Nano Adsorbents For Wastewater Treatment In Uganda	Makerere University	140,000,000	140,000,000
Total		**9,388,680,000**	**9,188,680,000**

Crop value chains

Sweet Potato Value Chain Development through Technology Transfer and Promotion	CURAD	1,260,399,882	1,260,399,882
Production of Mosquito Repellent Lotions from Ethnomedicinal Plants and Shea Butter	Gudie Leisure Farm	788,316,380	788,316,380

Annex 3: Performance of the STI Ecosystem Development Sub-programme as at 31st December 2022

Intervention	Output	Financial Performance			Physical Performance			Remark
		Annual Budget (bn Ug shs)	% of budget received	% of budget spent	Annual Target	Cum. Achieved Quantity	Physical performance Score (%)	
Develop strategies to domesticate and implement international conventions and treaties that facilitate STI	Localized Kayoola EVS frame	0.096	100.00	100.00	1	1	100	Very good performance; design and manufacturing specifications for the bus web frame were completed.
	Preliminary designs off the bus seat	0.003	100.00	100.00	1	0.8	80.00	Good performance; design and manufacturing specifications for the bus seat were completed.
	3-in-1 trike	0.649	100.00	9.43	3	1	33.33	Poor performance: draft design, engineering and manufacturing specifications were developed.
Increase investment in R&D in key priority sectors like; agriculture, Oil & Gas, Energy, Health, Transport	BIRDC model operationalized	9.680	50.00	51.26	3	1	66.67	Fair performance: the subvention lacks an approved institutional/governance framework.
	Banana pilot plant commercialized	3.680	50.00	38.04	4	1.5	75.00	Good performance; 12 tooke products were certified; however 10% of the annual target sales revenue was realized and 10% of the annual target volume of raw bananas was processed and the pilot plant is very unlikely to run commercially for FY22/23.
	Research and development and product marketing	15.630	50.61	14.51	35	18.3	100.00	Very good performance; 12 new tooke products were developed yet to be tested on the market. Marketing of the already developed products performed poorly.
	Kawu financial platform	0.075	100.00	100.00	3	3	100.00	Very good performance; KAWU smart card for digital financial inclusiveness for people with no or limited access to phones was developed and piloted.

Intervention	Output	Financial Performance			Physical Performance			Remark
		Annual Budget (bn Ug shs)	% of budget received	% of budget spent	Annual Target	Cum. Achieved Quantity	Physical performance Score (%)	
Increase investment in R&D in key priority sectors like; agriculture, Oil & Gas, Energy, Health, Transport	Harnessing gravitational energy for domestic and precision agriculture	0.261	100.00	24.34	5	2	40.00	Poor performance: gravitational energy and precision agriculture systems were developed: crop data, mobile phone application and piloting of the prototype were pending.
	Bio-electricity production for wastewater treatment	0.20	64.85	43.68	3	1.5	77.10	Good performance: wastewater samples were characterized and a bio-cell was developed.
	Sweet potato value chain development	1.260	100.00	92.14	5	4	80.00	Good performance. Sweet potato varieties were profiled, and priority recipes and value-added products were developed from sweet potatoes.
	Mass production of black soldier fly larvae optimized	0.152	100.00	95.16	4	1	25.00	Poor performance. Most of the project equipment was procured but the planned outputs were yet to be achieved
	Rapid low-cost point-of-care tool for diagnosis of BBW, CMD & SPVD	0.500	100.00	32.67	4	1	25.00	Poor performance. Paper-based lateral flow assay was developed for BBW, CMD and SPVD detection.
	Round-the-clock solar crop dryer developed	0.502	100.00	32.54	1	1	100.00	Very good performance. An upgrade of the Kanyarusoke-Musinguzi was developed yet to be piloted.
	Egg processing and value addition	0.529	100.00	26.61	3	0.3	10.00	Poor performance due to procurement delays. Preliminary value-added products were developed.
	Covid-19 sub-unit vaccine	1.820	100.00	100.00	3	0.7	23.33	Poor performance. The sub-unit vaccine was developed and ready for preclinical trials.
	Biomarker research facility	2.950	100.00	100.00	3	1.8	60.00	Fair performance; equipping of the biomarker facility was at 80% progress and a prototype of the biomarker kit was developed.

Intervention	Output	Financial Performance			Physical Performance			Remark
		Annual Budget (bn Ug shs)	% of budget received	% of budget spent	Annual Target	Cum. Achieved Quantity	Physical performance Score (%)	
Increase investment in R&D in key priority sectors like; agriculture, Oil & Gas, Energy, Health, Transport	Central Laboratory animal research facility	1.440	100.00	100.00	1	0.9	90.00	Very good performance with equipping and renovation at 90% physical progress however the facility was yet to be approved.
	Inactivated COVID-19 vaccine	7.003	98.37	99.97	3	1	33.89	Poor performance. The vaccine prototype was developed and ready for preclinical trials pending completion and approval of the CLARF at COVAB.
	Bee products produced and evaluated	2.000	100.00	99.08	3	2	66.67	Fair performance, UBV-01N for the treatment of respiratory infections in humans was approved by NDA.
	Nano-adjuvant and therapeutics	1.485	100.00	93.06	2	1.5	75.00	Good performance; adjuvant was developed and some preclinical trials were done (safety and immunogenicity studies).
	Novel adeno vector COVID-19 vaccine	1.252	100.00	107.88	5	2.5	50.00	Fair performance. Non-human primate adenovirus vector and adenovector COVID-19 vaccine were developed and ready for preclinical trials.
	Medical and biomedical plastic supplies produced	1.599	100.00	2.83	2	1	50.00	Fair performance. Specifications and requirements for medical and biomedical plastic supplies were developed.
	ICT platform for the pathogen economy	0.999	100.00	42.49	6	2.5	41.67	Poor performance; system requirements, designs and module development for the grant and innovator application system; and skilling and mentorship for STI were developed. Development of an Integrated disease screening platform was ongoing.

Intervention	Output	Financial Performance			Physical Performance			Remark
		Annual Budget (bn Ug shs)	% of budget received	% of budget spent	Annual Target	Cum. Achieved Quantity	Physical performance Score (%)	
Increase investment in R&D in key priority sectors like; agriculture, Oil & Gas, Energy, Health, Transport	Pathogenic epidemiological studies	2.621	100.00	61.09	5	1.5	30.00	Poor performance, the project experienced delays to begin activities and three herbal extracts from 11 plants had exhibited wound healing properties.
Support the establishment and operations of technology & business incubators and technology transfer centres	TIBC constructed and equipped	2.395	48.60	94.04	100	94	100.00	Very good performance with civil works at 94% completion.
	NSTEIC constructed	44.250	54.85	100.00	53	29	99.76	Very good performance with physical progress at 76 against the planned target of 82%.
	Project vehicles procured	1.450	53.20	100.00	5	2	75.18	Good performance two pickups were procured
	Framework for operationalization of the TIBIC & NSTEIC developed	0.614	28.08	59.79	100	40	100.00	Very good performance
Average Outputs Performance							**64.56**	**Fair performance**

Source: Project Implementers and Field Findings

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