SCIENCE GRANTING COUNCILS INITIATIVE SGCI IOSRS INITIATIVE DES ORGANISMES SUBVENTIONNAIRES DE LA RECHERCHE SCIENTIFIQUE

UNCST

Strengthening Public - Private Partnerships in Research and Innovation in the Manufacturing Sector in Uganda Project

FINAL TECHNICAL REPORT

IDRC Project Number: 109369-001/002

Uganda National Council for Science and Technology

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KAMPALA

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Foreign, Commonwealth & Development Office | IDRC · CRDI Canada | NRF National Research Foundation | Sida | DFG Deutsche Forschungsgemeinschaft German Research Foundation | Norad

List of Abbreviations and Acronyms

ACTS	Africa Centre for Technology Studies
AAS	African Academy of Sciences
AAU	Association of African Universities
CTAs.	Competent Technical Agencies
CeSTII	Centre for Science, Technology and Innovation Indicators
GERD	Gross Expenditure on Research and Development
GDP	Gross Domestic Product
GFGP	Good Financial Grant Practice
GMS	Grants Management System
GEI	Gender, Equity and Inclusivity
HSRC	Human Sciences Research Council
IDRC	International Development Research Centre
ICARDA	International Centre for Agricultural Research in Dry Land Areas
PPP	Public – Private Partnerships
MEL	Monitoring, Evaluation, and Learning
SGCI	Science Granting Councils Initiative
SGCs.	Science Granting
SARIMA	Southern African Research and Innovation Management Association
STI	Science, Technology and Innovation
TTA	Targeted Technical Assistance
R&D	Research and Development
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MEL	Monitoring Evaluation and Learning
NAPRECA	Natural Products Research for East and Central Africa
NAPIANA	Natural Products Industry Advancement Network Africa
NDP	National Development Plan
NCHE	National Council for Higher Education

NARO	National Agricultural Research Organization
SOPS	Standard Operating Procedures
TUNADO	The Uganda National Beekeeping Development Organization
UCU	Uganda Christian University
UNBS	Uganda National Bureau of Standards
UNCST	Uganda National Council for Science and Technology
URSB	Uganda Registration Service Bureau

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1. Executive Summary:

Building on the foundation laid by SGCI-I, the Uganda National Council for Science and Technology (UNCST) has undertaken a project under SGCI-II (2018–2023) titled "Public – Private Partnerships in Research and Innovation in the Manufacturing Sector." The project aimed at enhancing research and innovation initiatives addressing the challenges within Uganda's manufacturing value chains through collaborative research efforts between universities and industries. This final technical project report offers an overview and summary of the tasks, products, and results attained throughout the project's execution. The project primary objectives were: (i) strengthening the research management capacity of the Uganda National Council for Science and Technology (UNCST), (ii) fostering collaboration between universities and industries, and (iii) contributing to the increased productivity and competitiveness of the manufacturing sector by addressing technology bottlenecks.

The project yielded significant outputs. One of the major results of the project was the creation of TECHNOMART, an online gateway for technology matchmaking. This platform acts as a hub for researchers, investors, entrepreneurs, venture capitalists, and other stakeholders interested in commercializing Uganda's R&D products. It also helps to establish connections between the private and academic sectors, encouraging technopreneurship, partnerships, and collaborations within Uganda's Science, Technology and Innovation Ecosystem. Furthermore, the platform makes it easier for academic institutions to share specialized research facilities and equipment. The ICT physical infrastructure (server) of UNCST ICT was also upgraded. Additionally, the UNCST ICT physical infrastructure (server) was upgraded, and a Monitoring, Evaluation, and Learning (MEL) framework with a corresponding dashboard developed.

To furthermore strengthen the academia-industry collaborations in research, six manufacturing research projects were funded under the PPP that aimed at contributing to the improvement in productivity and competitiveness within the manufacturing sector in Uganda through generating research based solutions. These six research projects yielded impressive outputs. Four successful Shea butter based products—body cream, lotion, and

bath soap—were created by the Shea Butter Fractionation Project and are presently being tested on the market under the brand Nilo Beauty Products. Additionally, the Shea butter research team locally designed, optimized and fabricated a fractionation unit for commercial separation of olein and stearin fractions of shea butter further improving the product quality and competitiveness. Propolis-infused tea bags and body cream, which are currently sold under the names Adlea Cosmetics and Ejim Tea, respectively, were successfully developed by the Bee Propolis Commercialization Project. The Bakery and Confectionery Standards Gaps Research Project not only created simplified bread and cake standards but also translated them into pictorial formats and three languages (English, Luganda, and Swahili). This format of baking standards has been adopted by the Uganda National Bureau of Standards (UNBS), and twenty-two (22) bakers were trained in their implementation, thereby enhancing both standards and productivity. Additionally, the project on local wheat production has successfully identified two wheat varieties after screening seven and submitted them to the Ministry of Agriculture for potential release. If cleared for release, this intervention will go a long way to boosting the productivity and competitiveness of local wheat farmers and thus the bakery and confectionery sub-sector. The other two projects, focused on essential oil crops and low-cost cricket feed, have both generated prototypes with commercial potential, albeit requiring further refinement. In summary, all the six PPP manufacturing research projects have demonstrated positive outputs, with some outputs already undergoing market testing, suggesting potential benefits for the productivity and competitiveness of the manufacturing sector in Uganda. Ultimately, the project 'Public – Private Partnerships in Research and Innovation in the Manufacturing Sector' has not only strengthened the UNCST research management capabilities but has also laid the groundwork for sustained academia-private sector collaboration in research and innovation and introduced new commercial products to the market. Additionally, the various tools and platforms developed by the project also provide the much-needed spaces for UNCST's lasting impact on research management, technology commercialization, and gender integration in Uganda's science, technology and innovation ecosystem.

Additional impressive results were achieved through collaboratively working the CTAs. Notable is the development and implementation of an Online Grants Management System (GMS), which served as a blueprint for widespread adoption by other Sub-Saharan African countries participating in the Science Granting Councils Initiative (SGCI) Phase II. Six (6) Science Granting Councils, including UNCST, adopted and customized this system to digitize their grants management processes. Relatedly, a UNCST institutional Monitoring, Evaluation, and Learning (MEL) framework and dashboard were created. Furthermore, the project led to the establishment of UNCST's first Gender Committee which subsequently developed the UNCST Institutional Gender Policy pending approval by the UNCST Governing Board. This Policy has become a mainstay towards mainstreaming gender into UNCST's regular activities.

2. Project Background and Justification:

Uganda is actively pursuing economic growth and improved social well-being, as outlined in its national development policies and strategies. These plans, including Vision 2040, National Development Plan III (2021-2025), the National Industry Policy (2008), and the National Industry Sector Strategy, aim to elevate the country to a lower middle-income status. A key focus of these policies is the prioritization of value addition to local raw materials and agro-processing. The National Development Plan III (NDP III) emphasizes the manufacture of consumer, investment, and high-tech goods and value addition to agricultural products as key avenues to move the country towards upper middle-income status by 2040 and eventually to a first world economy.

To achieve these goals, performance targets have been set, including increasing the industrial sector's contribution to GDP from 25 percent (2010) to about 31 percent, with manufactured exports rising from 24.1 percent to 50 percent. Additional targets involve enhancing labor productivity, expanding the labor force in the industrial sector, increasing technology uptake, raising Gross Expenditure on Research and Development (GERD), and fostering innovation.

Currently, the contribution of manufacturing to Uganda's GDP is modest, estimated at 8.2%, with a significant portion reliant on agricultural and mineral resources. Challenges

such as limited access to finances, transportation infrastructure, energy, and research and development (R&D) facilities have hindered the full harnessing of Uganda's manufacturing potential. The Uganda's Research and Innovation Outlook of 2023 highlights low business sector expenditure on R&D and limited technology adoption from local R&D efforts. However, addressing these challenges is expected to lead to increased investments, productivity, and economic growth in both the agricultural and industrial sectors.

Acknowledging the vital role of agriculture in Uganda's economy, policies and strategies emphasize agricultural-led industrialization. The government's industrialization strategy aims to transform economic activity away from low value-added agricultural production, non-tradeable services, and manufacturing activities towards high value globally competitive industry. For example, agro-processing is viewed as a viable strategy, and is considered crucial in supporting agricultural-based industrialization.

The project**, "Strengthening Public-Private Partnerships in Research and Innovation in the Manufacturing Sector in Uganda,"** specifically targeted challenges in the manufacturing value chain, with a focus on agro-processing. This Initiative sought to foster partnerships and collaborations between academia (research and development institutions) and the industry (private sector), recognizing the pivotal role of manufacturing in socio-economic transformation. Traditionally, a growing share of manufacturing in GDP is associated with the transition from an agrarian to an industrial economy. The global importance of manufacturing is underscored by its significant contribution to global trade and business R&D. In advanced economies, manufacturing plays a crucial role in anchoring local innovation activity, a key driver of future economic performance.

Despite the current small contribution (8.2%) of manufacturing to Uganda's GDP, this project aimed at addressing challenges in the manufacturing sector, fostering innovation, and contributing to Uganda's economic prosperity, employment, and household incomes.

2. Goal and Key Objectives:

The main goal of the project was to support research and innovation projects addressing challenges in the manufacturing value chains of various industrial products in Uganda through Universities – industry collaborations.

The key objectives of the funding opportunity were to:

(a) Strengthen research management capacity of UNCST

This is critical for effective policy implementation and specifically allows UNCST to better implement and enforce science and technology policies. As the oversight agency for research in Uganda, improved research management can contribute to the overall quality of research conducted in the country through the promotion of rigorous methodologies, ethical considerations, and adherence to international standards. Such a well-managed system can increase research productivity, facilitate efficient allocation of resources, streamlined processes, and provide for effective coordination of research efforts. During the implementation of the project, this aspiration was generally achieved.

b) Strengthening collaboration between universities and industry in Uganda

UNCST plays a crucial role in strengthening collaboration between universities and industry in Uganda by facilitating partnerships that lead to the development and commercialization of research findings, contributing to economic growth. Several studies produced by UNCST have highlighted the critical gaps between universities and industry. By promoting knowledge transfer mechanisms (e.g. Intellectual Property Clinics), developing targeted collaborations with other regulators in this space (e.g. the Uganda National Council for Higher Education); and promoting and supporting universities to establish IP mechanisms (e.g. Technology Transfer Office), the UNCST has been at the forefront of promoting and supporting industry collaboration through policy brokerage. This project has enhanced UNCST's role in strengthening these partnerships as bulwarks for driving innovation, economic development, and addressing the evolving needs of society.

c) Increase the productivity and competiveness of the manufacturing sector by contributing towards the reduction of technology bottlenecks affecting it.

The Uganda National Council for Science and Technology (UNCST) can contribute to increasing the productivity and competitiveness of the manufacturing sector by addressing and reducing technology bottlenecks. By allocating resources and supporting R&D initiatives, UNCST has also activity supported collaborations between research institutions and manufacturers. Moreover, the use and potential of new technologies, digital tools, and advanced manufacturing techniques has been at the core of this project.

4. Project Methodology/ Approach:

Collaboration with CTAs. This methodology proposed was focused on receiving technical support from CTAs to strengthen the capacities of UNCST through training, mentorship, consultancies, peer to peer learning and workshops. However, during the implementation of the generic grants management system for SGCs, in addition to receiving technical support from AAU, UNCST teamed with AAU support the digitalization the grants management systems at other SGCs.

Explain how the project has collaborated with other CTAs to implement the project (in the context of a "joined up" approach).

(i) UNCST-AAU Collaboration

a. **Generic grants management system for SGCs:** UNCST collaborated with the Association of African Universities (AAU) to develop a generic end-to-end Online Grants Management System based on UNCST's grants management system and the SARIMA generic grants management manual that was made available to Science Granting Councils (SGCs) participating the SGCI II framework. This was done through consultations, learning visits and onsite and offsite technical support to SGCs that registered their interest in adopting the system for their grants management processes.

b. **Hosted two (2) Peer-to Peer Learning Meetings organized by AAU:** UNCST hosted two (2) learning visits (26-27 October, 2022 and 7-8th August, 2023) organized by AAU for the SGCs participating the initiative to bench mark on UNCST's grant and ethics management processes and systems.

c. **Competence Assessment for the UNCST Grants Management Processes:** With technical support from the AAU and African Academy of Sciences (AAS), UNCST applied to the Global Grants Community to have its grants management system to be certified on the Good Financial Grant Practice (GFGP) Standard at the Platinum grade tier. The UNCST completed the pre-certification assessment scoring 98%. This process involved the identification of gaps within UNCST's system and this

provided an opportunity and a basis for strengthening grant process quality assurance and internal checks for stronger internal controls.

However, the process stalled with UNCST still waiting for guidance from AAU, the lead CTA for the next steps. Annex 1: for the pre—assessment certification screen shoot.

(ii) UNCST-Scinnovent Centre Collaboration

UNCST participated in both physical and virtual workshop, seminars and trainings that were organized by the Scinnovent Centre under the SGCI-2 theme on "Strategic Communications and Knowledge uptake". In total two (2) UNCST staff from the Community Engagement and Outreach, and Science and Technology Policy Analysis Unit were trained in strategic science communication and policy brief writing. See Annex 2: for pictures of UNCST officers receiving certificates of participation in the training workshop

(iii) UNCST-ACTS Collaboration

a. Monitoring and Evaluation Framework

With support from Africa Centre for Technology Studies (ACTS), UNCST developed a robust organizational-level MEL frameworks and plans (with particular alignment to the National Development Plan (III), SDG Framework and the UNCST Strategic Plan). This process also allowed for a re-think on integrating MEL across all functions of UNCST; Set up an organization-wide MEL reporting system; Provide technical backstopping in the collection, analysis and write-up of MEL data; and, assist UNCST in writing their first full MEL report.

b. Data Management

UNCST worked with the ACTS and the Centre for Science, Technology and Innovation Indicators (CeSTII) on a set of toolkits for STI policy review, for developing digital data management systems and for analyzing R&D and innovation survey data to inform policy. UNCST has received the tool kits and these shoulder be very effective in supporting UNCST's co-leadership in developing Uganda's new STI Policy. This effort was also critical for peer to peer learning between the councils and in building a community of practice on STI Policy for Africa.

c. Capacity Building

ACTS supported capacity building in Project management of two (2) UNCST staff through Prince Two training. In addition, fifteen staff members of the Uganda National Council for Science and Technology (UNCST) underwent a specialized training on translating Science, Technology, and Innovation (STI) policies into regulations supported by a local STI Policy Consultant. The training, consisting of five coaching sessions, aimed to enhance UNCST's capacity in STI policies into regulations effectively. The sessions, conducted in a participatory manner, included a 2-day workshop on policy implementation and the translation of STI policies into regulations. The training, held from February 14th to 15th, 2023, focused on building staff skills in contextualizing the new function of *Translating STI policies into regulations.* This training is anticipated to support UNCST's ongoing STI policy review process, conducted in collaboration with the Science, Technology, and Innovation Secretariat-Office of the President.

(iv) UNCST-HSRC Collaboration

a. Gender Equity and Inclusion

Establishment a 3-member UNCST Institutional Gender committee: This was an outcome of the one-day workshop on Gender and Inclusivity that was held on the 15th march 2021 by Human Science Research Council (HSRC). As a recommendation of the workshop, the Executive Secretary appointed three UNCST staff to form the UNCST Gender Committee. The Executive secretary presented the proposal to the UNCST top management that formalized it into the institutional structures and among other function to be responsible for advising UNCST management on issues related to gender, develop a UNCST institutional Gender Policy, build a system's capacity in gender analysis; gender mainstreaming and integration framework for all UNCST programs and projects.

To further strengthen the Council's capacity in main streaming gender and inclusivity into its programs and projects, two members of the UNCST Gender committee attended a 3 day Targeted Technical Assistance (TTA) Workshop from the 23rd – 25th of August 2022, in Cape Town, South Africa organized by the Human Sciences Research Council (HSRC) of South Africa. This TTA Workshop was organized to develop a common vocabulary of GEI-related terms and concepts across the participating Science, Granting Councils (SGCs); Critically explore gender mainstreaming in the SGC landscape; Analyze how Gender, Equity and Inclusivity (GEI) contributes to research excellence, innovation and social

responsiveness; Critically examine own grant-making cycles for weaknesses and opportunities for strengthening GEI; Identify points in grant-making cycle to introduce practical and doable GEI strengthening activities in the immediate and longer-term.

5. Project Findings and Outputs:

i) Findings: List at least 5 most important findings (results) from the project and how they have been useful or innovative

(a) Online Grants Management System (available at https://grants.uncst.go.ug/). During the SGCI Phase II UNCST was able to complete the upgrading of the UNCST's Online Grants Management System(GMS) through end-to-end digitalization of the grants management process flow and then using it as a blue print (generic GMS through provision of a source code) for the benefit of other SGCs in Sub-Saharan Africa participating in SGCI II in collaboration with AAU to adopt and customize towards digitizing of their individual grants management systems. By the end of the project, six (6) SGCs including UNCST – Uganda, FONRID – Burkina FASO, MESTI – Ghana, NCST – Malawi, RCZ-Zimbabwe, and NACOSTI- Namibia).

(b) Online Gateway for Technology Match Making (TECHNOMART): TECHNOMART, an Online Supermarket for Technology Solutions, represents a pivotal component of the Public-Private Partnerships in Research and Innovation in Uganda's Manufacturing Sector project. The UNCST built this Online Gateway to seamlessly connect private sector entities with academia, fostering a robust environment for technopreneurship and catalyzing partnerships and collaborations between public and private sector stakeholders within Uganda's dynamic private sector. The primary aim of TECHNOMART is to serve as a nexus, bringing together a diverse range of stakeholders, including inventors, researchers, investors, venture capitalists, and other key players keen on commercializing Uganda's research and development products. This platform is anticipated to cultivate an atmosphere conducive to fruitful partnerships between academia (research and development institutions) and the private sector. The ongoing development of TECHNOMART includes the incorporation of several essential modules, such as technology and innovation matchmaking, patent information dissemination, sharing of Science and Technology (S&T) research facilities, connecting with S&T human resources (experts), and

facilitating collaborative problem-solving by sharing industrial challenges to build potential partnerships around shared issues. From this project, the TECHNOMART emerges as a transformative tool, poised to make a significant contribution to bridging the gap between academia and industry, propelling Uganda's manufacturing sector in particular and private sector in general into a new era of innovation, collaboration, and sustainable technological advancement. Accessible at https://technomart.uncst.go.ug/, TECHNOMART stands as a testament to UNCST's commitment to creating a vibrant ecosystem for research commercialization for economic growth.

(c) UNCST Institutional Gender Policy: Through the support (training workshops, mentorship and peer to peer learning) by the Human Science Research Council (HRSC) on integration of gender imperatives within UNCST's broader mandate, a UNCST set up a three-member institution Gender Committee that developed the draft UNCST Institutional Gender Policy that is due for presentation to the UNCST to the UNCST Governing Board for approval.

(d) ICT Infrastructure (server) upgraded: In terms of physical infrastructure, the acquired a new server. The is new server strengthened UNCST's capacity to better serve the research community with more reliable, effective and efficient digital services. This infrastructure has provided an ideal platform for optimal utilization and continuous improvement of the upgraded grants management system among others.

(e) MEL Data Management framework and dashboard: Through support from the SGCI, ACTS procured a consultant that supported UNCST to design a dedicated MEL dashboard and finalize/review MEL Framework and plan. This strengthened UNCST's role of Monitoring and Evaluation for Uganda's entire STI system. The working with the consultant, UNCST developed an MEL Plan and a draft dashboard which can be found at: https://lookerstudio.google.com/reporting/c2412742-145c-4d75-9892-fdf110cf2bb8/page/p_pcsgkj04yc. The MEL plan was based largely on the government OPM framework with influences from the STI sector wide framework developed from the participatory sector MEL working group meetings held by UNCST.

(f) 6 (six) Public Private Partnership (PPP) projects (sub-grants): The six manufacturing research projects funded under the PPP that aimed to improve the productivity and competitiveness within the manufacturing sector through research based solutions have

yielded impressive outcomes. For example, the Shea Butter Fractionation Project, three products with commercial potential—bathing soap, body cream, and lotion—are currently undergoing market testing as Nilo Beauty Products. Additionally, in a bid to standardize the Shea butter products, the research team designed, optimized and fabricated a fractionation Machine for commercial separation of olein and stearin fractions of shea butter. The Bee Propolis Commercialization Project has successfully introduced propolis-infused tea bags and body creams under the Ejim Tea and Adlea Cosmetics brands. The Bakery and Confectionery Standards Project not only created simplified bread and cake standards but also translated them into pictorial formats and three languages (English, Luganda, and Swahili). This format of baking standards has been adopted by the Uganda National Bureau of Standards (UNBS), and twenty-two (13 males and 9 female) bakers were trained in their implementation, thereby enhancing both standards and productivity. Additionally, the project on local wheat production has identified two wheat varieties after screening seven and submitted them to the Ministry of Agriculture for potential release, aiming to boost the productivity and competitiveness of local wheat farmers and the bakery and confectionery sub-sector. The research project on essential oil crops developed five *prototypes (2 pure essential oil products; 1 Cough Mix; 1 body herbal jelly and liquid soap)*. The low-cost cricket feed project developed four prototypes of potential commercial crickets' feeds from household and restaurant waste that were evaluated for efficacy, safety and economic feasibility. However, although the prototypes generated by the essential oil crops and low-cost cricket feed research projects have commercial potential, they require further refinement. Therefore, all the six PPP manufacturing research projects have demonstrated positive outputs, with some outputs already undergoing market testing, suggesting potential benefits for the productivity and competitiveness of the manufacturing sector in Uganda. Below is a table summarizing the outputs per research project.

#	Principle Investigator/Host Institution/Industry Partner	Project Title	Total Project Funding (UGX)	Out puts
1	**PI:** Dr. Bosco Chemayek **Host Institution:** Buginyanya Zonal Agricultural Research and Development Institute **Industry Partner:** Uganda Manufacturers Association	Increasing wheat production and productivity through science based knowledge and innovations for a competitive wheat manufacturing value chain in Uganda.	109,000,000	1. *Acquired germplasm (7 lines) developed for low altitude areas from International Centre for Agricultural Research in Dry Land Areas (ICARDA) to augment and fast track variety development for wide adaptability.* 2. *Acquired seed varieties from ICARDA multiplied and examined for key characteristics such as disease and drought resistance, lodging, yield and heading dates* 3. *Four promising rust resistant wheat lines with yields between 2-3 t/ha selected after completion of Advanced yield trials (AYT2)* 4. *The four candidate types were evaluated at national performance trials (NPT) 6 sites representing low mid and high altitude* 5. *0.6 tons of elite seed of pipeline line materials bulked* 6. *2 candidate wheat varieties with wide adaptability and high yields above 5*

				t/ha in the mid and high-altitude areas and above 1.5 t/ha in the low altitude areas were developed and submitted to the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) for consideration for release. ***7.*** *1.5 tons of elite foundation seed of Narowheat 1, 2 and 3 were bulked and availed to uptake pathways and 0.5 tons of breeder seed pipeline materials multiplied.* ***8.*** *1 (one) draft manuscript titled "Performance of improved wheat varieties in the low, mid and high-altitude areas of Uganda" has been produced and still undergoing internal reviews* ***9.*** *Poster Presentations. Chemayek, B., Baguma, C., Wasukira, A., Walimbwa, K., Woniala, B., Kakhasa, E., Gidoi, R., Wagoire, W., & Owere, L. (2023). Increasing wheat production and productivity through science-based knowledge and innovations for a competitive wheat manufacturing value chain in Uganda. 2023 SGCI Regional Meeting in Kamapala* ***10.*** *2 conference Presentations* *a. Performance of improved wheat varieties in the low, mid and high-*

				altitude areas of Uganda. Presented during the NARO-MAK conference March 2023, Munyonyo Commonwealth Resort, Kamapala b. *Development of Climate Resilient Wheat for the non-traditional Mid and Low Altitude Environments of Uganda – Wheat and Maize conference, September 2023, Asmara Eritrea*  *Figure 1: UNCST Grants management and MEL Team visiting the Wheat Project trial gardens*
2	**PI:** Dr. Geoffrey Ssepuuya **Host Institution:** Uganda Christian University (UCU) **Industry Partner (s):**	Piloting the production and distribution of low cost protein and micro-nutrient rich cricket feed from	108,990,000	1. *4 prototypes of potential commercial crickets' feeds developed from household and restaurant waste and being evaluated for efficacy, safety and economic feasibility.*

	PKM Reliable Enterprises Limited	food waste in Kampala		 *Figure 2: Developed Crickets feeds Prototypes with commercial potential* 2. *1 Scientific Journal paper published: Ssepuuya, G., Nsiyona, E., Kakungulu, M. et al. Food waste supply and behaviour towards its alternative uses in Kampala city, Uganda. Sustain Environ Res 33, 34 (2023). https://doi.org/10.1186/s42834-023-00195-6* 3. *1 Msc student graduated and more 2 Msc Students of UCU current doing their Msc These (in progress): (1) Household Willingness to pay for food waste disposal in Kampala by Tukamushaba Judith; (2) Economic Analysis of the Processed Food waste as Cricket Feed in the Kampala Metropolitan Area of Uganda by Alex Gumisiriza; (3) Demand, Supply and Pricing of Food Waste Resource in Kampala Area-Angella Ayo.* ***NB. All the Msc students are pursuing a***

				master's degree in Agribusiness Business Management and Entrepreneurship at UCU 4. *2 BSc students of UCU graduated who did their final year Special Research Projects titled: (1) Evaluating the Quality of Cricket Feed Processed from food Waste by Katono Grace: (2) Local Food Wastes as Alternative Ingredients for A Nutrient-Rich Cricket Feed by Petrina Mary Kizza* ***NB: All the BSc students were pursuing a Bachelor's degree in Food Science and Technology at UCU*** 5. ***Poster Presentation:*** *Ssepuuya, G., Mulondo, P. K., Nsiyona, E., Nampala, P., & Alowo, J. F. (2023). Piloting the Production and Distribution of a Low-Cost 'Protein and Micro-Nutrient Rich Cricket Feed from Food Waste in Kampala (Food Waste-2-Cricket Feed) Project at the 2023 SGCI Regional Meeting, Kampala* 6. ***1 (One) New Articles:*** *University proves insect value in nutrition and alleviating food waste. Available at: https://www.ugandapartners.org/2023/05/university-proves-insect-value-in-nutrition-and-alleviating-food-waste/*

3	**PI:** Prof. Charles Muyanja **Host Institution:** Makerere University **Industry Partner (s):** Hot Loaf Bakery, Jovay School of Cookery, Nakku Food Safety Consults Limited	Identification of standards and gaps in the bakery and Confectionery Industries	109,000,000	1. *1 Survey report of the standards gap in the bakery sub sector in Uganda* **2.** *1 (One) BSc student supported: Nutritional composition and sensoric acceptability of wheat bread supplemented with soybean flour, maize bran and maize germ. Available at: http://dissertations.mak.ac.ug/handle/20.500.12281/6714* 3. *2 Baking Standard (Bread Standard-US EAS 43:2012 and Cake Standard, US 1923: 2020) simplified and translated into pictorial and 3 languages (English, Luganda and Swahili)* 4. *22 Bakers (13 males and 9 females) were trained on Baking Standards* 5. *1 (one) draft manuscript titled "Identification of standards gaps in the bakery and confectionery industries" still undergoing internal reviews before submission.* 6. *Poster Presentation: Charles Muyanja (2023). Identification of standards gaps in the bakery and confectionery industries (IDE-STABACO) at 2023 SGCI Regional Meeting, Kampala*
4	**PI:** Dr. Francis Omujal **Host**	Fractionation of Ugandan	109,000,000	1. *Locally designed and Fabricated a Fractionation Machine for commercial*

	Institution: National Chemotherapeutic Laboratories **Industry Partner (s):,** Nilo Beauty Products Limited	Shea butter into Commercial Shea stearin and Shea Olein for industrial food and cosmetic application		*separation of olein and stearin fractions from shea butter.*  **Figure 3**: *the locally designed and fabricated fractionation Machine for commercial separation of olein and stearin fractions from shea butter.* 2. Drafting of an application for an Industrial Design for the fabricated pilot fractionating machine for shea butter being finalized for submission to the National Patent Office (Uganda Registration Service Bureau) 3. *Optimized the fractionation process for shea butter extracted by cold pressing method (Managed to obtain fraction ratio stearin: olein (59%:41%)* 4. Completed the physico-chemical analysis of the shea fractions 5. *Three (3) shea butter based products developed: Nilo Soap, Nilo Cream, and Nilo Body Lotion.*

***Figure 4**: Nilo Soap, Nilo Cream, and Nilo Body Lotion*

Figure 5: Shea Streain (left) and Olein (right) fractions from the optimized process

6. *Quality assessment of the formulated shea butter products completed*
7. Support development of a website (*https://nilosheabutter.com/*) for the partner company, Nilo Beauty Products for E-market testing the developed shea butter products. The company reported receiving on average two order per week through the website by the time of reporting.
8. Poster presentation: Omujal, F., Lamoris, O. J. B., Solomon, A. M., Irene,

				K., & Sheilla, N. (2023). Fractionation of Ugandan Shea Butter into Commercial Shea Stearin and Shea Olein at the 2023 SGCI Regional Meeting, Kampala 9. *1 (one) undergraduate student research project (Mr. Ambrose TURYAMWESIGA) at the department of Chemistry, Makerere University.* ***Research Project title:*** *Solvent Fractionation of Cold Pressed and Locally Processed Shea Butter into Olein and Stearin for Food and Cosmetic for industrial Application* 10. *Attended 4 (four) Product exhibitions. The developed products were exhibited at national Expos and conferences: (i) Annual National Agricultural Show at Jinja organized by Uganda Farmers' Federation, (ii) Natural Products Research for East and Central Africa (NAPRECA) conference at Makerere University, (iii) the Natural Products Industry Advancement Network Africa (NAPIANA) conference held at Royal Imperial Hotel from July 5-7, 2022., and (iv) the National Council for Higher Education (NCHE) annual exhibition organized at Lugogo Show Ground.*

5	**PI:** Prof. Maud Kamatenesi Mugiha, **Host Institution:** Bishop Stuart University (BSU), **Industry Partner:** Afri-Banana Products Limited	Essential Oil crops commercialization for sustainable public health products development and rational promotion	109,000,000	1. *1 Publication (Book chapter):* Tugume, P., Kamatenesi-Mugisha, M., Bazirake, G. B., Noah, W., & Asiimwe , S. (2022). The Potency and Efficacy of Essential Oils from Selected Aromatic Crop Species Commercially Grown in Uganda: A Review of their Use in Animal and Human Therapeutics. *Challenges and Advances in Pharmaceutical Research Vol. 4*, 180–204. https://doi.org/10.9734/bpi/capr/v4/2445A 2. *30 farmers (17 males and 13 females) trained.* 3. *Poster Presentation:* 4. *5 prototypes developed: 2 Essential Oil Products; 1 Cough Mix; 1 body herbal jelly and liquid soap*  *Figure 6 (L to R): Herbal Jelly, Cough Mix and the 2 essential oil from Rosemary and Eucalyptus*

				5. *Attended 4 (four) Product exhibitions. The developed products were exhibited at national Expos and conferences: (i) Annual National Agricultural Show at Jinja organized by Uganda Farmers' Federation, (ii) Natural Products Research for East and Central Africa (NAPRECA) conference at Makerere University, (iii) the 2022 National Science Week Expo, and (iv) the National Council for Higher Education (NCHE) annual exhibition organized at Lugogo Show Ground.* **6.** *Established 3 mother gardens for aromatic plants at Bishop Stuart University (1 acre) Mbarara Zonal Agriculture Research Station (10 acres) and Afri-Banana Ltd-Private sector partner (0.25 acres). The mother gardens are serving as demonstration gardens for training farmers and students, in addition to being the prime sources of quality planting materials for the out growers and cooperative schemes*

6	**PI:** Dr Deborah Ruth Amulen **Host Institution:** Makerere University **Industry Partner:** Uganda National Beekeeping Development Organization (TUNADO)	Commercialization of Propolis Powder and Infused Tea bags for Improved Health and Income in Uganda	129,962,832	1. *Two (2) products developed: Propolis infused body cream and Propolis infused tea*  *Figure 7: packaged Propolis infused tea under the brand name Ejim*  *Figure 8: Body cream infused with propolis powder under the brand name of Adlea* *The two Brand Names of **Ejim** and **Adlea** have been registered with the Uganda Services Registration Bureau.*

				2. *1 MSc Students (Nakabugo Immaculate) did her Msc theses (Antioxidant and antimicrobial properties of propolis extracts from four ecological zones of Uganda: potential application in livestock health) and graduated with MSc in Livestock Development, Planning and Management* ***Msc dissertation available at:*** *http://makir.mak.ac.ug/handle/10570/10007* **3. 2 draft manuscript:** *(1) Amulen, Vudriko, and Akullo. Consumer perception, Attitude, and acceptability of propolis powder and propolis infused tea in Uganda.* *(2) Nakabugo, Vudriko, Okoth, Smagghe and Amulen. Antioxidant and antimicrobial properties of propolis extracts from four ecological zones of Uganda: potential application in livestock health* **New articles** 1. Bee Propolis, venom give Ugandan Beekeeper new source of Income. Available at: https://www.newvision.co.ug/category/agriculture/bee-propolis-venom-give-ugandan-beekeepers-ne-NV_130622

				2. Propolis will give you money. Available at: https://www.monitor.co.ug/uganda/magazines/farming/propolis-will-give-you-money-1822914

ii) Knowledge/ learning outputs: Provide a list of knowledge/ learning outputs from the project. Is this list similar or different from the list of expected outputs in the approved proposal (please refer to the original approved proposal)? Outputs may include journal articles; research papers; books; policy briefs, SOPS, manuals, templates etc. Indicate the outputs that were published on an open access basis. Please note that we need the actual materials (as attachments) or links that lead directly to them.

#	Principle Investigator/Host Institution/Industry Partner	Project Title	Knowledge Out puts
1	**PI:** Dr. Bosco Chemayek **Host Institution:** Buginyanya Zonal Agricultural Research and Development Institute **Industry Partner:** Uganda Manufacturers Association	Increasing wheat production and productivity through science based knowledge and innovations for a competitive wheat manufacturing value chain in Uganda	1. *1 (one) draft manuscript titled "Performance of improved wheat varieties in the low, mid and high-altitude areas of Uganda" has been produced and still undergoing internal reviews*
2	**PI:** Dr. Geoffrey Ssepuuya **Host Institution:** Uganda Christian	Piloting the production and distribution of low cost protein and micro-nutrient rich cricket	1. *1 Scientific Journal paper published: Ssepuuya, G., Nsiyona, E., Kakungulu, M. et al. Food waste supply and behaviour towards its alternative uses in Kampala city, Uganda. Sustain Environ Res 33, 34 (2023). https://doi.org/10.1186/s42834-023-00195-6* 2. *1 Msc student graduated and more 2 Msc Students of UCU current doing their Msc These (in*

	University (UCU) **Industry Partner (s):** PKM Reliable Enterprises Limited	feed from food waste in Kampala	*progress): (1) Household Willingness to pay for food waste disposal in Kampala by Tukamushaba Judith; (2) Economic Analysis of the Processed Food waste as Cricket Feed in the Kampala Metropolitan Area of Uganda by Alex Gumisiriza; (3) Demand, Supply and Pricing of Food Waste Resource in Kampala Area-Angella Ayo.* 3. *2 undergraduate research project reports at Uganda Christian University (UCU) titled: (1) Evaluating the Quality of Cricket Feed Processed from food Waste by Katono Grace: (2) Local Food Wastes as Alternative Ingredients for A Nutrient-Rich Cricket Feed by Petrina Mary Kizza* ***NB: All the BSc students were pursuing a Bachelor's degree in Food Science and Technology at UCU***
3	**PI:** Prof. Charles Muyanja **Host Institution:** Makerere University **Industry Partner (s):** Hot Loaf Bakery, Jovay School of Cookery,	Identification of standards and gaps in the bakery and Confectionery Industries	**7.** *1 (One) BSc student supported: Nutritional composition and sensoric acceptability of wheat bread supplemented with soybean flour, maize bran and maize germ. Available at: http://dissertations.mak.ac.ug/handle/20.500.12281/6714* 8. *2 Baking Standard (Bread Standard-US EAS 43:2012 and Cake Standard, US 1923: 2020) simplified and translated into pictorial and 3 languages (English, Luganda and Swahili)* 9. *1 (one) draft manuscript titled "Identification of standards gaps in the bakery and confectionery industries" still undergoing internal reviews before submission.*

	Nakku Food Safety Consults Limited		
4	**PI:** Dr. Francis Omujal **Host Institution:** National Chemotherapeutic Laboratories **Industry Partner (s):,** Nilo Beauty Products Limited	Fractionation of Ugandan Shea butter into Commercial Shea stearin and Shea Olein for industrial food and cosmetic application	*1 (one) undergraduate* ***Research Project title:*** *Solvent Fractionation of Cold Pressed and Locally Processed Shea Butter into Olein and Stearin for Food and Cosmetic for industrial Application*
5	**PI:** Prof. Maud Kamatenesi Mugiha, **Host Institution:** Bishop Stuart University (BSU), **Industry Partner**: Afri-Banana Products Limited	Essential Oil crops commercialization for sustainable public health products development and rational promotion	*7. 1 Publication (Book chapter):* Tugume, P., Kamatenesi-Mugisha, M., Bazirake, G. B., Noah, W., & Asiimwe , S. (2022). The Potency and Efficacy of Essential Oils from Selected Aromatic Crop Species Commercially Grown in Uganda: A Review of their Use in Animal and Human Therapeutics. *Challenges and Advances in Pharmaceutical Research Vol. 4*, 180–204. https://doi.org/10.9734/bpi/capr/v4/2445A

6	**PI:** Dr Deborah Ruth Amulen **Host Institution:** Makerere University **Industry Partner:** Uganda National Beekeeping Development Organization (TUNADO)	Commercialization of Propolis Powder and Infused Tea bags for Improved Health and Income in Uganda	1. *1 MSc thesis (Antioxidant and antimicrobial properties of propolis extracts from four ecological zones of Uganda: potential application in livestock health) and graduated with MSc in Livestock Development, Planning and Management* ***Msc dissertation available at:*** *http://makir.mak.ac.ug/handle/10570/10007* 2. **1 draft manuscript:** *Amulen Deborah Ruth & Vudriko Patrick. Safety and Quality of Ugandan propolis in terms of heavy metal and agrochemicals.* ***Status:*** *The samples are still being analyzed at UNBS laboratories. The results are expected end of December and draft manuscript will be submitted to a journal in January 2024.* 4. **1 Submitted manuscript:** Amulen, D. R., Vudriko, P., & Akullo, J. (2023). Knowledge, attitudes, and practices of Ugandan beekeepers towards propolis production and processing**. Status:** Paper was submitted to Journal of Apicultural Research in September 2023, still undergoing review (https://www.tandfonline.com/journals/tjar20)

iii) Dissemination of Knowledge Outputs

Explain how the outputs have been disseminated or communicated and how have they been used. What (if any) is unique about the outputs? Dissemination can be through participation in workshops and conferences, formal and informal meetings with policy and decision makers, or the project website. Illustrate with specific examples.

#	Principle Investigator/Host Institution/Industry Partner	Project Title	Dissemination of Out puts
1	**PI:** Dr. Bosco Chemayek **Host Institution:** Buginyanya Zonal Agricultural Research and Development Institute **Industry Partner:** Uganda Manufacturers Association	Increasing wheat production and productivity through science based knowledge and innovations for a competitive wheat manufacturing value chain in Uganda	1. ***Poster Presentations.*** *Chemayek, B., Baguma, C., Wasukira, A., Walimbwa, K., Woniala, B., Kakhasa, E., Gidoi, R., Wagoire, W., & Owere, L. (2023). Increasing wheat production and productivity through science-based knowledge and innovations for a competitive wheat manufacturing value chain in Uganda. 2023 SGCI Regional Meeting in Kampala* 2. *2 conference Presentations* c. *Performance of improved wheat varieties in the low, mid and high-altitude areas of Uganda. Presented during the NARO-MAK conference March 2023, Munyonyo Commonwealth Resort, Kamapala*

			d. *Development of Climate Resilient Wheat for the non-traditional Mid and Low Altitude Environments of Uganda – Wheat and Maize conference, September 2023, Asmara Eritrea*
2	**PI:** Dr. Geoffrey Ssepuuya **Host Institution:** Uganda Christian University (UCU) **Industry Partner (s):** PKM Reliable Enterprises Limited	Piloting the production and distribution of low cost protein and micro-nutrient rich cricket feed from food waste in Kampala	11. ***Poster Presentation:*** *Ssepuuya, G., Mulondo, P. K., Nsiyona, E., Nampala, P., & Alowo, J. F. (2023). Piloting the Production and Distribution of a Low-Cost 'Protein and Micro-Nutrient Rich Cricket Feed from Food Waste in Kampala (Food Waste-2-Cricket Feed) Project at the 2023 SGCI Regional Meeting, Kampala* 12. ***1(One) New Articles:*** *University proves insect value in nutrition and alleviating food waste. Available at: https://www.ugandapartners.org/2023/05/university-proves-insect-value-in-nutrition-and-alleviating-food-waste/ and https://ucu.ac.ug/university-proves-insect-value-in-nutrition-and-alleviating-food-waste/*
3	**PI:** Prof. Charles Muyanja **Host Institution:** Makerere University	Identification of standards and gaps in the bakery and Confectionery Industries	7. *22 Bakers (13 males and 9 females) were trained on Baking Standards* 8. *Poster Presentation: Charles Muyanja (2023). Identification of standards gaps in the bakery and confectionery*

	Industry Partner (s): Hot Loaf Bakery, Jovay School of Cookery, Nakku Food Safety Consults Limited		*industries (IDE-STABACO) at 2023 SGCI Regional Meeting, Kampala*
4	**PI:** Dr. Francis Omujal **Host Institution:** National Chemotherapeutic Laboratories **Industry Partner (s):**, Nilo Beauty Products Limited	Fractionation of Ugandan Shea butter into Commercial Shea stearin and Shea Olein for industrial food and cosmetic application	1. Support development of a website (*https://nilosheabutter.com/*) for the partner company, Nilo Beauty Products for E-market testing the developed shea butter products. The company reported receiving on average two order per week through the website by the time of reporting. 2. **Poster presentation:** Omujal, F., Lamoris, O. J. B., Solomon, A. M., Irene, K., & Sheilla, N. (2023). Fractionation of Ugandan Shea Butter into Commercial Shea Stearin and Shea Olein at the 2023 SGCI Regional Meeting, Kampala 3. *Attended 4 (four) Product exhibitions. The developed products were exhibited at national Expos and conferences: (i) Annual National Agricultural Show at Jinja organized by Uganda Farmers' Federation, (ii) Natural Products Research for East and Central Africa (NAPRECA) conference at Makerere University, (iii) the Natural*

			Products Industry Advancement Network Africa (NAPIANA) conference held at Royal Imperial Hotel from July 5-7, 2022., and (iv) the National Council for Higher Education (NCHE) annual exhibition organized at Lugogo Show Ground.
5	**PI:** Prof. Maud Kamatenesi Mugiha, **Host Institution:** Bishop Stuart University (BSU), **Industry Partner:** Afri-Banana Products Limited	Essential Oil crops commercialization for sustainable public health products development and rational promotion Piloting the production and distribution of low cost protein and micro-nutrient rich cricket feed from food waste in Kampala	11. ***Poster Presentation:*** Tugume, P., Kamatenesi-Mugisha, M., Bazirake, G. B., Noah, W., & Asiimwe , S. *(2023)* Essential Oil crops commercialization for sustainable public health products development and rational promotion at the 2023 SGCI Regional Meeting, Kampala 12. *Attended 4 (four) Product exhibitions. The developed products were exhibited at national Expos and conferences: (i) Annual National Agricultural Show at Jinja organized by Uganda Farmers' Federation, (ii) Natural Products Research for East and Central Africa (NAPRECA) conference at Makerere University, (iii) the 2022 National Science Week Expo, and (iv) the National Council for Higher Education (NCHE) annual exhibition at Lugogo Show Ground.*
6	**PI:** Dr Deborah Ruth Amulen	Commercialization of Propolis Powder	**New articles**

	Host Institution: Makerere University **Industry Partner:** Uganda National Beekeeping Development Organization (TUNADO)	and Infused Tea bags for Improved Health and Income in Uganda	3. Bee Propolis, venom give Ugandan Beekeeper new source of Income. Available at: https://www.newvision.co.ug/category/agriculture/bee-propolis-venom-give-ugandan-beekeepers-ne-NV_130622 4. Propolis will give you money. Available at: https://www.monitor.co.ug/uganda/magazines/farming/propolis-will-give-you-money-1822914
	AAU/UNCST	Digitalization of the grants management System	**Press Release:** A Free Open-Source Digital Grants Management System Developed for Science Granting Councils in Sub-Saharan Africa https://blog.aau.org/press-release-a-free-open-source-digital-grants-management-system-developed-for-science-granting-councils-in-sub-saharan-africa/

6. Meeting of Project Objectives

Assess the extent to which the project has met its objectives (as stated in the original approved proposal) using a scale of 1 (not met) to 4 (fully met). Explain each rating with clear examples

Objective i) Strengthen research management capacity of UNCST

The **score is 4 out of 4.**

Comment: The objective on strengthen research management capacity of UNCST scored 4 out of 4 because all the set out goals were achieved through (i) the procurement of ICT

equipment (sever) that provided additional space for UNCST to effectively and efficiently provide reliable digital services such as the upgraded online grant management system, the national research information system and the Technomart platform, etc. (ii) the end-to-end digitalization of the entire work flows of the UNCST grants management processes starting from the call for applications, through selection and award to research projects implementation, MEL and reporting and closure. (iii) 5 (five) UNCST staff from the grants management department had their capacity built through trainings in grants (2 staff) and project management (3 staff), and practically managed a full cycle of the grants management from standard call development to research projects closure and reporting. This is in addition to technical support received from CTAs such as the AAU in research excellence, ACTS in monitoring, evaluation and learning; and Scinnovent in strategic communication. Furthermore, a total of 6 students have been supported to do their theses on SGCI funded research projects. The table below shows the Contribution of SGCI -funded projects to research capacity strengthening

#	SGCs Country	total funded projects	Post-doc researchers		Doctoral students		MSc students		BSc students		Total
			Female	Male	Female	Male	Female	Male	Female	Male	
	Uganda	6	0	0	0	0	3	1	2	0	6

(iv) The UNCST grants management system went through a competence assessment on the Good Financial Grant Practice (GFGP) Standard to get certification at the Platinum tire grade. Although the certification process stalled (still waiting for a feedback from AAS), UNCST used this pre-certification assessment process to identify of gaps in its system and used it has an opportunity to put in place a quality assurance system/or internal checks for stronger internal controls. This contributed to strengthening of the UNCST grants management system.

Objective ii) Strengthening collaboration between universities and industry in Uganda

The score is 3 out 4.

Comment: The objective on strengthening collaboration between universities and industry in Uganda was 3 out of 4. This is because the project was designed to achieve this objective through two delivery mechanisms. (i) sub-granting research projects that have principle investigators (PIs) from the academia/research institute who are knowledge generators and co-PIs from the private sector who presented an industrial bottleneck the research team worked on. The private sector was also encouraged to co-fund the research projects either in cash or in-kind. During the implementation, each research project worked with at least one private sector partner (in total 8 private sector players got involved with 5 projects each having one and one project on baking standards having 3), and the private sector mainly supported the projects through in kind contributions such as access to the private sector research facilities and staff time. One research project on ***'commercialization of propolis powder and infused tea bags for improved health and income in Uganda'*** was able to attract more funding *(100,000,000 Uganda Shillings) from Makerere University's Innovation Fund that supported Capacity building of TUNADO (which is the private sector apex body for bee keepers) to mobilize its members to produce mass volumes of propolis; comprehensive assessment of quality and medicinal aspects of the two types of propolis powder (red and black) found in Uganda; and initiated the establish the propolis value chain platform at TUNADO for continued product development and commercialization. This has strengthened the Makerere University-TUNADO Partnership to support the apiculture subsector advancement through scientific research, technology transfer and training. The research team also benefited from TUNADO's vast experience in commercialization and marketing of bee products*; (ii) The development of an On-line gateway for technology match making (TECHNOMART- an Online Supermarket for Technology Solutions). Under this delivery mechanism, the UNCST is working on an online platform to provide functional linkages between the private sector actors and academia through bringing together inventors, researchers, investors, and venture capitalists. The modules (capabilities) currently being tested and refined include (i) technology/innovations match making (Market), (ii) Patent Information, (iii) S&T Research Facilities Sharing, (iv) S&T Human Resource (experts), (v) Sharing industrial problems to

build potential collaborations around the shared problems. This Technomart Platform is about 75% complete (platform building) as there are still data requirements (25% incomplete) to make the platform functional. When complete, this platform will be a one stop technology supermarket and it is hope that it will significantly contribute to Academia-private sector engagements as information on what the academia (innovations, patents, experts, lab equipment) will be easily accessible by the private sector by just a click away. This work has continued into the new phase of the SGCI and therefore not complete.

Objective iii): Increase the productivity and competiveness of the manufacturing sector by contributing towards the reduction of technology bottlenecks affecting it.

The score is 3 of 4

Comment: The Objective on increasing the productivity and competiveness of the manufacturing sector by contributing towards the reduction of technology bottlenecks affecting it has a score of 3 out 4 because it was designed to be achieved through sub-granting of research projects working to address the bottle necks facing manufacturing sector. While all the 6 (six) funded projects under this call reported positive results, three projects have reported products/or services resulting directly from the research being market tested or and implemented by the private sector partners. i.e, (a) the research project on '*Fractionation of Ugandan Shea butter into Commercial Shea stearin and Shea Olein for industrial food and cosmetic application*' reported that their private sector partner is market testing the three research products of bathing soap, body cream and lotion under the brand name of Nilo Beauty Products; (b) the research project on '*commercialization of propolis powder and infused tea bags for improved health and income in Uganda*' reported market testing of a developed propolis infused tea bags and *Propolis infused body cream under the registered brands of Ejim tea and Adlea Cosmetics respectively; (c) the research project on 'Identification of standards and gaps in the bakery and Confectionery Industries'* reported that after carrying out a survey on the standards gaps in the bakery and confectionary sub-sector, the research team worked with Uganda National Bureau of Standards (UNBS) – the agency responsible for formulating and enforcing food standards in Uganda and designed 2 (two) simplified baking standards (*Bread Standard*-US EAS 43:2012 *and Cake Standard, US 1923: 2020) and translated into*

pictorial and 3 languages (English, Luganda and Swahili) that are now easily understood by all bakers. The simplified versions of the baking standards have been adopted by UNBS for official use. In addition, the project trained 22 (twenty-two) bakers from small scale bakeries (13 males and 9 females) on how to implement the simplified baking standards, thus improving their productivity and competitiveness of the sub-sector; (d) the research project on '*Increasing wheat production and productivity through science based knowledge and innovations for a competitive wheat manufacturing value chain in Uganda'* reported to that after screening 7 (seven) wheat verities, 2 (two) candidate wheat varieties with wide adaptability and high yields above 5 t/ha in the mid and high-altitude areas and above 1.5 t/ha in the low altitude areas were developed and submitted to the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) for consideration for release. The tangible outputs, including the submission of varieties for potential release and the provision of elite foundation and breeder seeds, signify a noteworthy contribution to local wheat production landscape's growth and resilience. It is hoped that if MAAIF considers these two wheat verities for release, they will improve the productivity and competitiveness of local wheat farmers and thus the bakery and confectionary sub-sector that uses wheat has its main raw material. (e) In addition, the two other research projects *('Essential Oil crops commercialization for sustainable public health products development and rational promotion' and 'Piloting the production and distribution of low cost protein and micro-nutrient rich cricket feed from food waste in Kampala')* have also reported positive results with prototypes with commercial potential but which need further refinement and standardization before they can be market tested.

7. Project Outcomes:

i) Explain how the project has contributed to positive change/ field of study/ research area

a) Research Management Capacity of UNCST Strengthened:

The project has strengthened the capacity of UNCST grants management in a number of ways both directly and indirectly through:

(i) the procurement of ICT equipment (sever) that provided additional space for UNCST to effectively and efficiently provide reliable digital services such as the upgraded online grant management system, the national research information system and the Technomart platform, etc.

(ii) the end-to-end digitalization of the entire work flows of the UNCST grants management processes starting from the call for applications, through selection and award to research projects implementation, MEL and reporting and closure. This has made the process more effective, efficient and earned trust from the research community. This has been achieved with support from AAU.

(iii) UNCST staff on the grants management department have had their capacity built through trainings in grants (2 staff) and project management (3 staff), and practically managing a full cycle of the grants management from standard call development to research projects closure and reporting. This is in addition to technical support received from CTAs such as the AAU in research excellence, ACTS in monitoring, evaluation and learning; and Scinnovent in strategic communication.

(iv) The UNCST grants management system went through a competence assessment on the Good Financial Grant Practice (GFGP) Standard to get certification at the Platinum tire grade. Although the certification process stalled (still waiting for a feedback from AAS), UNCST used this pre-certification assessment process to identify of gaps in its system and used it has an opportunity to put in place a quality assurance system/or internal checks for stronger internal controls. This contributed to strengthening of the UNCST grants management system.

b) Universities-Industry Collaborations in Uganda Strengthened:

This has been achieved through: (i) designing the funding opportunity to break the barriers to the uptake and application of research for economic and social development by bringing together the knowledge and technology generators (universities and research institute) and relevant private sector prayers to work on an industrial challenge/or bottle neck that was faced by the private sector pattern who took up the generated knowledge and technology (processes, products and services). To ensure University-Industry partnerships were formed, the call was designed with a mandatory requirement that the co-PI of the research project is from the industry whose challenge is being researched. In

addition, all applicants were required to submit support letters from the head of applying university/ or research institution and the head of the private sector prayer co-applying.

In total, there were eight (8) private sector participants involved in the six (6) supported/sub-granted research projects, with at least one private sector entity participating in each research project. Among these, five (5) projects had one private sector partner each, while the research project conducted by Makerere University on the Identification of standards and gaps in the Bakery and Confectionery Industries featured the participation of three private sector entities (Hot Loaf Bakery, Jovay School of Cookery, Nakku Food Safety Consults Limited). To ensure uptake of the generated knowledge, processes and products/or (services) by the industry for example: (i) the research project on baking standards, the researchers teamed up with Uganda National Bureau of Standards (UNBS) to trained *22 Bakers (13 males and 9 females)* from the different small scale bakeries on how to implement the simplified baking standards. In addition, the UNBS adopted the simplified versions of the baking standards for official use; (ii) Under the project, researchers from Makerere University partnered with Uganda National Beekeeping Development Organization (TUNADO). During the Implementation of the project, the team reported that it attracted Uganda Shillings 100 Million from Makerere University Fund to further fund the project outreach activity targeting bee farms to improve reach and scale

The six (6) research projects supported under the Public – Private Partnerships in Research and Innovation in the Manufacturing Sector

#	Principle Investigator	Project Title	Host Institution	Industry Partner
1	Dr. Bosco Chemayek	Increasing wheat production and productivity through science based knowledge and innovations for a competitive wheat manufacturing value chain in Uganda	Buginyanya Zonal Agricultural Research and Development Institute	Uganda Manufacturers Association

2	Dr. Geoffrey Ssepuuya	Piloting the production and distribution of low cost protein and micro-nutrient rich cricket feed from food waste in Kampala	Uganda Christian University (UCU)	PKM Reliable Enterprises Limited
3	Prof. Charles Muyanja	Identification of standards and gaps in the bakery and Confectionery Industries	Makerere University	Hot Loaf Bakery, Jovay School of Cookery, Nakku Food Safety Consults Limited
4	Dr. Francis Omujal	Fractionation of Ugandan Shea butter into Commercial Shea stearin and Shea Olein for industrial food and cosmetic application	National Chemotherapeutic Laboratories	Nilo Beauty Products Limited
5	Prof. Maud Kamatenesi Mugiha	Essential Oil crops commercialization for sustainable public health products development and rational promotion	Bishop Stuart University (BSU)	Afri-Banana Products Limited
6	Dr. Deborah Ruth Amulen	commercialization of propolis powder and infused tea bags for improved health and income in Uganda	Makerere University	The Uganda National Apiculture Development Organization (TUNADO),

It is expected that these collaborations will be sustained beyond the life the of the project to further innovation, product development and commercialization.

Technomart Platform: This online platform facilitates linkages between private sector entities and academia, fostering technopreneurship, partnerships, and collaborations within Uganda's and manufacturing sectors, serving as a nexus for inventors, investors, researchers, venture capitalists, and other stakeholders interested in commercializing Uganda's research and development products. Additionally, the platform facilitates sharing of specialized research equipment and

facilities among the academia, an important ingredient for enhancing the contribution of R&D in the socio-economic development of countries. Equipment and infrastructure sharing is based on the concept of mutual needs and complimentary expertise. It requires that due to the high cost of specialized equipment, not every institution needs to own one but a framework for utilization is required. The equipment needs to be accessible and well managed. This is what the technomart seeks to achieve in facilitating research equipment sharing.

Collaboration and Partnerships: Strengthening partnerships between academia and industry remains a challenge for other STI regulators as well. UNCST has signed strategic partnerships with critical partners to harmonize, enhance and strengthen the bridge between academia and industry. UNCST signed an MOU with the National Council for Higher Education (NCHE); the Research and Education Network (RENU), among others to strengthening and establish functional and scalable solutions to academia-industry contradictions.

C) Productivity and competiveness of the manufacturing sector increased:

To contribute to the productivity and competiveness of the manufacturing sector through the reduction of technology bottlenecks affecting it, UNCST supported a total of six (6) Public-Private Partnership in research projects that were competitively selected. All the six project had at least one private sector partner and focused on working on industrial challenges to provide a research based solution. Below is a table showing the project Principal Investigators, host institution, private sector partner(s), project title and project outputs.

#	Principle Investigator/Host Institution/Industry Partner	Project Title	Out puts
1	**PI:** Dr. Bosco Chemayek **Host Institution:** Buginyanya Zonal	Increasing wheat production and productivity through science	**13.** *Acquired germplasm (7 lines) developed for low altitude areas from International Centre for Agricultural Research in Dry Land Areas (ICARDA)*

	Agricultural Research and Development Institute **Industry Partner:** Uganda Manufacturers Association	based knowledge and innovations for a competitive wheat manufacturing value chain in Uganda.	*to augment and fast track variety development for wide adaptability.* **14.** *Acquired seed varieties from ICARDA multiplied and examined for key characteristics such as disease and drought resistance, lodging, yield and heading dates* **15.** *Four promising rust resistant wheat lines with yields between 2-3 t/ha selected after completion of Advanced yield trials (AYT2)* **16.** *The four candidate types were evaluated at national performance trials (NPT) 6 sites representing low mid and high altitude* **17.** *0.6 tons of elite seed of pipeline line materials bulked* **18.** *2 candidate wheat varieties with wide adaptability and high yields above 5 t/ha in the mid and high-altitude areas and above 1.5 t/ha in the low altitude areas were developed and submitted to the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) for consideration for release.* **19.** *1.5 tons of elite foundation seed of Narowheat 1, 2 and 3 were bulked and availed to uptake pathways and 0.5 tons of breeder seed pipeline materials multiplied.*

			20. *1 (one) draft manuscript titled "Performance of improved wheat varieties in the low, mid and high-altitude areas of Uganda" has been produced and still undergoing internal reviews* **21.** *Poster Presentations. Chemayek, B., Baguma, C., Wasukira, A., Walimbwa, K., Woniala, B., Kakhasa, E., Gidoi, R., Wagoire, W., & Owere, L. (2023). Increasing wheat production and productivity through science-based knowledge and innovations for a competitive wheat manufacturing value chain in Uganda. 2023 SGCI Regional Meeting in Kamapala* **22.** *2 conference Presentations* *e. Performance of improved wheat varieties in the low, mid and high-altitude areas of Uganda. Presented during the NARO-MAK conference March 2023, Munyonyo Commonwealth Resort, Kamapala* *f. Development of Climate Resilient Wheat for the non-traditional Mid and Low Altitude Environments of Uganda – Wheat and Maize conference, September 2023, Asmara Eritrea*

			 *Figure 9: UNCST Grants management and MEL Team visiting the Wheat Project trial gardens*
2	**PI:** Dr. Geoffrey Ssepuuya **Host Institution:** Uganda Christian University (UCU) **Industry Partner (s):** PKM Reliable Enterprises Limited	Piloting the production and distribution of low cost protein and micro-nutrient rich cricket feed from food waste in Kampala	9. *4 prototypes of potential commercial crickets' feeds developed from household and restaurant waste and being evaluated for efficacy, safety and economic feasibility.*  *Figure 10: Developed Crickets feeds Prototypes with commercial potential* 10. *1 Scientific Journal paper published: Ssepuuya, G., Nsiyona, E., Kakungulu, M. et al. Food waste supply and behaviour towards its alternative uses*

			in Kampala city, Uganda. Sustain Environ Res 33, 34 (2023). https://doi.org/10.1186/s42834-023-00195-6 11. *1 Msc student graduated and more 2 Msc Students of UCU current doing their Msc These (in progress): (1) Household Willingness to pay for food waste disposal in Kampala by Tukamushaba Judith; (2) Economic Analysis of the Processed Food waste as Cricket Feed in the Kampala Metropolitan Area of Uganda by Alex Gumisiriza; (3) Demand, Supply and Pricing of Food Waste Resource in Kampala Area-Angella Ayo.* ***NB. All the Msc students are pursuing a master's degree in Agribusiness Business Management and Entrepreneurship at UCU*** 12. *2 BSc students of UCU graduated who did their final year Special Research Projects titled: (1) Evaluating the Quality of Cricket Feed Processed from food Waste by Katono Grace: (2) Local Food Wastes as Alternative Ingredients for A Nutrient-Rich Cricket Feed by Petrina Mary Kizza*

			NB: All the BSc students were pursuing a Bachelor's degree in Food Science and Technology at UCU 13. ***Poster Presentation:*** *Ssepuuya, G., Mulondo, P. K., Nsiyona, E., Nampala, P., & Alowo, J. F. (2023). Piloting the Production and Distribution of a Low-Cost 'Protein and Micro-Nutrient Rich Cricket Feed from Food Waste in Kampala (Food Waste-2-Cricket Feed) Project at the 2023 SGCI Regional Meeting, Kampala* 14. ***1 (One) New Articles:*** *University proves insect value in nutrition and alleviating food waste. Available at: https://www.ugandapartners.org/2023/05/university-proves-insect-value-in-nutrition-and-alleviating-food-waste/*
3	**PI:** Prof. Charles Muyanja **Host Institution:** Makerere University **Industry Partner (s):** Hot Loaf Bakery, Jovay School of Cookery, Nakku Food Safety Consults Limited	Identification of standards and gaps in the bakery and Confectionery Industries	10. *1 Survey report of the standards gap in the bakery sub sector in Uganda* **11.** *1 (One) BSc student supported: Nutritional composition and sensoric acceptability of wheat bread supplemented with soybean flour, maize bran and maize germ. Available at: http://dissertations.mak.ac.ug/handle/20.500.12281/6714* 12. *2 Baking Standard (Bread Standard-US EAS 43:2012 and Cake Standard, US*

			1923: 2020) simplified and translated into pictorial and 3 languages (English, Luganda and Swahili) 13. *22 Bakers (13 males and 9 females) were trained on Baking Standards* 14. *1 (one) draft manuscript titled "Identification of standards gaps in the bakery and confectionery industries" still undergoing internal reviews before submission.* 15. *Poster Presentation: Charles Muyanja (2023). Identification of standards gaps in the bakery and confectionery industries (IDE-STABACO) at 2023 SGCI Regional Meeting, Kampala*
4	**PI:** Dr. Francis Omujal **Host Institution:** National Chemotherapeutic Laboratories **Industry Partner (s):**, Nilo Beauty Products Limited	Fractionation of Ugandan Shea butter into Commercial Shea stearin and Shea Olein for industrial food and cosmetic application	13. *Locally designed and Fabricated a Fractionation Machine for commercial separation of olein and stearin fractions from shea butter.*  **Figure 11:** *the locally designed and fabricated fractionation Machine for commercial*

			separation of olein and stearin fractions from shea butter. 14. Drafting of an application for an Industrial Design for the fabricated pilot fractionating machine for shea butter being finalized for submission to the National Patent Office (Uganda Registration Service Bureau) 15. *Optimized the fractionation process for shea butter extracted by cold pressing method (Managed to obtain fraction ratio stearin: olein (59%:41%)* 16. Completed the physico-chemical analysis of the shea fractions 17. *Three (3) shea butter based products developed: Nilo Soap, Nilo Cream, and Nilo Body Lotion.*  ***Figure 12:*** *Nilo Soap, Nilo Cream, and Nilo Body Lotion*

Figure 13: Shea Streain (left) and Olein (right) fractions from the optimized process

18. *Quality assessment of the formulated shea butter products completed*
19. Support development of a website (*https://nilosheabutter.com/*) for the partner company, Nilo Beauty Products for E-market testing the developed shea butter products. The company reported receiving on average two order per week through the website by the time of reporting.
20. Poster presentation: Omujal, F., Lamoris, O. J. B., Solomon, A. M., Irene, K., & Sheilla, N. (2023). Fractionation of Ugandan Shea Butter into Commercial Shea Stearin and Shea Olein at the 2023 SGCI Regional Meeting, Kampala
21. *1 (one) undergraduate student research project (Mr. Ambrose TURYAMWESIGA) at the department of Chemistry, Makerere University.* ***Research Project title:*** *Solvent*

			Fractionation of Cold Pressed and Locally Processed Shea Butter into Olein and Stearin for Food and Cosmetic for industrial Application 22. *Attended 4 (four) Product exhibitions. The developed products were exhibited at national Expos and conferences: (i) Annual National Agricultural Show at Jinja organized by Uganda Farmers' Federation, (ii) Natural Products Research for East and Central Africa (NAPRECA) conference at Makerere University, (iii) the Natural Products Industry Advancement Network Africa (NAPIANA) conference held at Royal Imperial Hotel from July 5-7, 2022., and (iv) the National Council for Higher Education (NCHE) annual exhibition organized at Lugogo Show Ground.*
5	**PI:** Prof. Maud Kamatenesi Mugiha, **Host Institution:** Bishop Stuart University (BSU), **Industry Partner**: Afri-Banana Products Limited	Essential Oil crops commercialization for sustainable public health products development and rational promotion Piloting the production and	*8. 1 Publication (Book chapter):* Tugume, P., Kamatenesi-Mugisha, M., Bazirake, G. B., Noah, W., & Asiimwe , S. (2022). The Potency and Efficacy of Essential Oils from Selected Aromatic Crop Species Commercially Grown in Uganda: A Review of their Use in Animal and Human Therapeutics. *Challenges and Advances in Pharmaceutical Research*

		distribution of low cost protein and micro-nutrient rich cricket feed from food waste in Kampala	*Vol. 4, 180–204.* https://doi.org/10.9734/bpi/capr/v4/2445A 9. *30 farmers (17 males and 13 females) trained.* 10. *Poster Presentation:* 11. *5 prototypes developed: 2 Essential Oil Products; 1 Cough Mix; 1 body herbal jelly and liquid soap*  *Figure 14 (L to R): Herbal Jelly, Cough Mix and the 2 essential oil from Rosemary and Eucalyptus* 12. *Attended 4 (four) Product exhibitions. The developed products were exhibited at national Expos and conferences: (i) Annual National Agricultural Show at Jinja organized by Uganda Farmers' Federation, (ii) Natural Products Research for East and Central Africa (NAPRECA) conference at Makerere*

			University, (iii) the 2022 National Science Week Expo, and (iv) the National Council for Higher Education (NCHE) annual exhibition organized at Lugogo Show Ground. **13.** *Established 3 mother gardens for aromatic plants at Bishop Stuart University (1 acre) Mbarara Zonal Agriculture Research Station (10 acres) and Afri-Banana Ltd-Private sector partner (0.25 acres). The mother gardens are serving as demonstration gardens for training farmers and students, in addition to being the prime sources of quality planting materials for the out growers and cooperative schemes*
6	**PI:** Dr Deborah Ruth Amulen **Host Institution:** Makerere University **Industry Partner:** Uganda National Beekeeping Development Organization (TUNADO)	Commercialization of Propolis Powder and Infused Tea bags for Improved Health and Income in Uganda	5. *Two (2) products developed: Propolis infused body cream and Propolis infused tea*  *Figure 15: packaged Propolis infused tea under the brand name Ejim*

			 *Figure 16: Body cream infused with propolis powder under the brand name of Adlea* *The two Brand Names of* ***Ejim*** *and* ***Adlea*** *have been registered with the Uganda Services Registration Bureau.* 6. *1 MSc Students (Nakabugo Immaculate) did her Msc theses (Antioxidant and antimicrobial properties of propolis extracts from four ecological zones of Uganda: potential application in livestock health) and graduated with MSc in Livestock Development, Planning and Management* ***Msc dissertation available at:*** *http://makir.mak.ac.ug/handle/10570/10007*

			7. **2 draft manuscript:** *(1) Amulen, Vudriko, and Akullo. Consumer perception, Attitude, and acceptability of propolis powder and propolis infused tea in Uganda.* *(2) Nakabugo, Vudriko, Okoth, Smagghe and Amulen. Antioxidant and antimicrobial properties of propolis extracts from four ecological zones of Uganda: potential application in livestock health* **New articles** 5. Bee Propolis, venom give Ugandan Beekeeper new source of Income. Available at: https://www.newvision.co.ug/category/agriculture/bee-propolis-venom-give-ugandan-beekeepers-ne-NV_130622 6. Propolis will give you money. Available at: https://www.monitor.co.ug/uganda/magazines/farming/propolis-will-give-you-money-1822914

From the above research projects out comes, it is clear that several research based solutions have been developed for the industry. For Example:

(*a*) Under the research project ***'Commercialization of Propolis Powder and Infused Tea bags for Improved Health and Income in Uganda'*** *the* research team from Makerere University worked with Uganda Bee Farmers Association to add value to bee propolis which resulted into development of two commercial products namely

Propolis infused body cream and Propolis infused tea (registered under the brand names of Ejim and Adlea respectively), thus creating a new income stream for bee farmers (Sale of bee propolis) in addition to the bee honey and wax. In addition, farmers were also trained on how to properly harvest and handle bee propolis.

(b) the research project on ***'Identification of standards and gaps in the bakery and Confectionery Industries'***, the researchers teamed up with Uganda National Bureau of Standards (UNBS) and several bakeries to study the standards gaps and designed 2 simplified baking standards (*Bread Standard*-US EAS 43:2012 *and Cake Standard, US 1923: 2020) and translated into pictorial and 3 languages (English, Luganda and Swahili)* that can easily be understood by all bakers. These simplified versions of the baking standards have been adopted by UNBS for official use. In addition, the project trained *22 Bakers (13 males and 9 females)* from the different small scale bakeries on how to implement the simplified baking standards, thus improving their productivity and competitiveness.

(c) The project ***'Essential Oil crops commercialization for sustainable public health products development and rational promotion'*** developed 5 prototypes developed: 2 pure essential oil products; 1 Cough Mix (more studies on efficacy and safety are needed); 1 body herbal jelly and liquid soap. In addition, to strengthen the aromatic plants seed and training system, the project team established 3 (three) mother gardens for aromatic plants at Bishop Stuart University (1 acre), NARO's Mbarara Zonal Agriculture Research Station (10 acres) and Afri-Banana Ltd-Private sector partner (0.25 acres). The mother gardens are serving as demonstration gardens for training farmers and students, in addition to being the prime sources for quality planting materials (seed) for the out growers and cooperative schemes.

(d) The project ***'Fractionation of Ugandan Shea butter into Commercial Shea stearin and Shea Olein for industrial food and cosmetic application'*** locally designed and fabricated a fractionation machine for optimized commercial separation of olein and stearin fractions (managed to obtain fraction ratio stearin: olein 59%:41%) from shea butter. Based on the achieved fractions, three (3) shea butter based products (Soap, body cream and body lotion) were developed and being market tested under the Nilo cosmetics brand. In addition, the projected supported the

development an e-commerce website (https://nilosheabutter.com/) for the partner company, Nilo Beauty Products for E-market testing the developed shea butter products. The project team reported that the company is receiving on average two order per week through the website by the time of reporting.

(e) The Project ***'Piloting the production and distribution of low cost protein and micro-nutrient rich cricket feed from food waste in Kampala'*** *has developed 4 prototypes of crickets feeds developed with commercial potential (all the 4 prototypes were evaluated for efficacy, safety and economic feasibility) from household and restaurant waste. The University is in the process of protecting the generated IP before entering talks with the private sector partner who has shown interest in commercializing one of the products.*

(f) *The project on* ***'Increasing wheat production and productivity through science based knowledge and innovations for a competitive wheat manufacturing value chain in Uganda'*** *strategically acquired 7 (seven) germplasm designed for low-altitude environments from the International Centre for Agricultural Research in Dry Land Areas (ICARDA). This acquisition aimed to expedite variety development for broad adaptability, particularly in low altitude areas of Uganda. Throughout the project duration, meticulous screening processes were conducted. As a result, two promising wheat varieties emerged, demonstrating wide adaptability and delivering high yields surpassing 5 t/ha in mid and high-altitude zones, and exceeding 1.5 t/ha in low-altitude areas. These accomplished varieties were subsequently submitted to the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) for thorough consideration and potential release. In addition, 1.5 tons of elite foundation seed of Narowheat 1, 2 and 3 were bulked and availed to uptake pathways and 0.5 tons of breeder seed pipeline materials multiplied.*

ii) How would you compare the expected in the proposal and actual outcomes realised by the project? Why did it happen that way?

As shown, the project was generally able to meet its overall outcomes. However, in some areas, there were gaps that have duly acknowledged. However, challenges like the COVID-19 pandemic created new avenues for knowledge transfer and capacity building.

ii) Were there any unintended outcomes of the project and why did they occur? What was the impact? **YES, there were unintended outcomes**.

a. **Increased collaboration:** For example, through the SGCI, UNCST has entered into collaborative agreements with National Research Fund of Kenya and FONSTI of Ivory Coast. In addition, researchers that have participated in the SGCI funded research projects have forged collaborations both locally and regionally. For example, through the Locust4Industry Research project, researchers from Uganda's Makerere University (Co-PI) and Uganda Christian University (team member) are working together with researchers from Kenya's Egerton University to develop the safe mass rearing tools and value addition for the desert locust value chain in East Africa.

b. **Increased the profile of UNCST** both locally within Uganda and regionally among other Science Granting Councils. For example, Regionally, UNCST's profile raised when it entered into a collaboration with the Association of African Universities (AAU) to provide technical support to other SGCs in digitalization of their grants management processes. Additionally, with the support of the SGCI, UNCST held the 2023 regional SGCI meeting in Munyonyo which was a success, further improving UNCST's image.

c. **The first national research Infrastructure Survey**. Because of the research equipment data requirements for the Technomart, an imitative of the SGCI, the UNCST has initiated a national wide survey to map and document the status of the national research infrastructure, in addition to taking the stock of the available research equipment. This is the first time Uganda is conducting a national research infrastructure survey.

8. **Meeting the SGCI 2020 Logical Framework Targets:**

Please refer to the relevant parts in the attached output targets set for March 2020

#	SGCI 2020 Logical Framework Target	Meeting the SGCI 2020 Logical Framework target
1	More effective research management practices among SGCs: SGCs adopt various emerging research management	This has been achieved. For example, the UNCST has implemented the end-to-end digital grants management system and has also incorporated of the applicant appeal process in

	practices, and digital grants management system	its grants management process for applicants not satisfied with the peer review process. In addition, UNCST grants management system went through a pre-certificiation competence assessment on the Good Financial Grant Practice (GFGP) Standard for the Platinum tire grade scoring 98% .
2	Increased use of data and evidence in policy and decision making by SGCs: SGCs develop robust MEL and data Management systems and use data and evidence in programme management and policy/decision	This target has been also met through a number of interventions. For example, with the technical help from ACTs, UNCST developed a robust organizational-level MEL frameworks and plans (with particular alignment to the National Development Plan (III), SDG Framework and the UNCST Strategic Plan). This process allowed for a re-think on integrating MEL across all functions of UNCST; Set up an organization-wide MEL reporting system. UNCST worked with the ACTS and the Centre for Science, Technology and Innovation Indicators (CeSTII) on a set of toolkits for STI policy review, developing digital data management systems and for analyzing R&D and innovation survey data to inform policy In addition, UNCST was able to produce the Uganda National Research Outlook Report, 2023 as a piece of evidence for policy makers in the STI ecosystem.
3	Increased capacity of SGCs to manage research calls: SGCs conduct high quality research	This target has also been achieved. For example, UNCST published a call for proposals titled *"Public – Private Partnerships in Research and*

	competitions aligned with national/regional priorities; addressing private sector needs; SGCs develop MoUs and Manage collaborative calls among themselves; mainstreaming gender and inclusivity in research)	*Innovation in the Manufacturing Sector" that sought to find research addressing industrial bottlenecks in manufacturing with a focus in Agro-processing as per NDP III. From this call 6 research projects were funded and eight (8) private sector partners were involved with each research team having at least one private sector partner. All the funded research projects worked to address challenges of the private sector.* Under SCGI II, UNCST has entered into partnerships with Research Fund of Kenya and FONSTI of Ivory Coast, further enhancing the networking between these entities. UNCST has also worked with other SGCs in the region (Kenya, Rwanda and Tanzania) to make a joint proposal for the DFG/NRF-South Africa Call for research project proposals for continuity funding. One consortium project on Locusts4Industry was selected and funded under this partnership. Furthermore, this funded project has a female Ugandan Co-PI. The granting process has also been improved to include a post-award mandatory training on gender and inclusivity for award winning research teams in addition to the tradition post-award trainings in financial management, Procurement, research ethics, and IPR & research commercialization.
4	Improved strategic communication and uptake of	**This target has been achieved through:**

	research outputs and strengthened networking among SGCs: SGCs develop and operationalize communication strategies, use Knowledge outputs and networking effectively among themselves and with other science system actors	(a) UNCST had its staff (2) capacity built in strategic communication and policy brief writing. (b) the sub-granted projects have produced a number of knowledge outputs and some directly engaged in training of industry practitioners in the new knowledge generated e.g. the research project on ***'Identification of standards and gaps in the bakery and Confectionery Industries'***, which designed 2 simplified baking standards (*Bread Standard*-US EAS 43:2012 *and Cake Standard, US 1923: 2020) and translated into pictorial and 3 languages (English, Luganda and Swahili)* that can easily be understood by all bakers. In addition, the project trained *22 Bakers (13 males and 9 females)* from the different small scale bakeries on how to implement the simplified baking standards, thus improving uptake of research results. (c) Locally, UNCST has signed strategic partnerships with critical partners to harmonize, enhance and strengthen the bridge between academia and industry. UNCST signed an MOU with the National Council for Higher Education (NCHE); the Research and Education Network (RENU), among others to strengthening and establish functional and scalable solutions to academia-industry contradictions. (d) Additionally, UNCST in collaboration with AAU supported other SGCs (FONRID – Burkina

		FASO, MESTI – Ghana, NCST – Malawi, RCZ-Zimbabwe, and NACOSTI- Namibia) in digitalization of their grants management systems. (e) UNCST hosted two (2) Peer-to Peer Learning Meetings organized by AAU for the other SGCS participating in the initiative.
5	Increased capacity of SGCs to mainstream gender equality and inclusivity: SGCs mainstream gender equality and inclusivity in research and grants management. Increased knowledge on structural gender and inclusivity issues in research, and greater participation by women scientists in research and innovation.	This target has been met. For example, through the SGCI, UNCST established an institutional gender committee within its official structures that is charged with ensuring GEI are mainstreamed in all UNCST programs and project. In addition, for the first time, an UNCST Institutional gender policy has been developed. Furthermore, two of the six winning Principle Investigators were female (Dr. Debrah Ruth Amulen and Prof Maud Kamatenesi), representing 33% of total grants awarded. Similarly, two Private Universities (Uganda Christian University and Bishop Stuart University) were among the five winning host institutions for the funded research projects. In terms of earlier career researchers, 3 out of the awarded 6 research projects had their P.Is as earlier career researchers (Dr. Debrah Ruth Amulen, Dr. Geoffrey Ssepuuya and Dr. Bosco Chemayek).

9. **Key Lessons/ Observations from the Project**:

List the key lessons that the team has learnt during the implementing of this project. What would you have done differently and why? Are there any recommendations for IDRC?

Hominization and Consolidation data collection tools by CTAs: CTAs should harmonize how they collect and possibly share data so that SGCs are not very much burdened with different CTAs separately collecting the same data.

Legal Support to Research Teams and Institutions. e.g., during the drafting of MoUs between research institution and private sector partners to ensure equitable sharing of benefits resulting from the research project and avoid conflicts that could emerge later if an interesting intellectual property (IP) emerges

Continuing Training to support Knowledge and skills in areas that may not be main domains of science but needed to translate research results such Intellectual Property training, Use already available patent information in research; Business development and technopreneurship but also in new knowledge areas such as next generation sequencing tools, data science, etc.

Regular forums and avenues for Public-Private Partnerships to interact and strengthen collaborations i.e., webinars and annual forums e.g., a PPP week to showcase and promote work being done under such arrangements. This will make players at both ends appreciate each other's' contributions. Also, other programs for Researchers/Academicians to directly interact more with industry e.g., a program that would allow researchers to spend some time in the industry working with the industry in addition to collaboration in research

Inclusion of stories of change in the reporting tools: SGCI MEL tools should include a section to document the stories of change. The current tools do not cater for this yet during SGCI Meeting, it is being emphasized to share stories of change.

10. Gender/ inclusivity and Ethical considerations:

Describe (with examples) how the project has promoted gender and inclusivity based on the *SGCI Gender Mainstreaming Framework and Action Plan*. Did any ethical issues arise during the implementation of this project? If so, how were these managed/ addressed?

Staff Training and Capacity Building: Through the work of HSRC, a total of 7 UNCST staff have had their capacity in gender and inclusivity directly built through participation in HSRC's training and mentorship workshops.

UNCST Institutional Gender Equality Committee: This three (3)-member committee has been institutionalized with clear terms of reference and is responsible for monitoring compliance with the UNCST's gender policy and reporting any violations. This committee has also trained all UNCST staff on gender awareness, inclusivity and mainstreaming, thereby increasing the understanding of gender issues among the staff and how they can mainstream gender into their daily work.

UNCST Institutional Gender Policy: **As a lesion from Peer-to-peer learning organized by the HSRC of South Africa, the CTA for the theme on Gender and Inclusivity, UNCST was able to develop an institutional gender policy that has been presented to the UNCST governing board for consideration.**

Gender and Inclusivity in the Grants Management Processes: The UNCST research proposal evaluation and scoring criteria has been updated to provide for specific scores on gender and inclusivity issues in research.

Gender and Inclusivity Training to all UNCST Grantees: In addition to the traditional trainings in financial and procurement management, grants writing, and Intellectual property (IP) management, a mandatory training in gender to all recipients of UNCST grants has been added. Thanks to the UNCST-HSRC work under the SGCI II framework.

Webinars on Gender and Inclusivity: as a dissemination and an outreach activity, UNCST hosted 2 webinars; (i) in commemoration of the international women's day, on the 24th of March 2021, on *Gender Equity in Research Advancement for a Sustainable Science and Technology Led Economy (advertised at https://www.uncst.go.ug/details.php?option=dnews&id=44&Webinar-on-Gender-Equity-in-Research-Advancement-for-a-Sustainable-S&T-Led-Economy-.html)* ; (ii) as part of the outreach program, On 28th of April 2021, UNCST together with Uganda Registration Service Bureau (URSB) and the National Agricultural Research Organization (NARO) held a webinar on the role of Intellectual Property (IP) in promoting Innovation in Uganda with a focus on Youth in the Science, Technology and Innovation (STI) Sector.

No ethical issues have arisen during implementation.

11. Overall Assessment and Recommendations:

What challenges (if any) did the research team encounter and how were these addressed? Did these challenges lead to any changes in the project's implementation? Were there any unanticipated risks that affected the project's implementation?

COVID-19 Pandemic and subsequent lockdown: There were delays that were occasioned by the COVID-19 pandemic that required the project team to work off site. This was a wakeup call for institutions like SGCs to develop and implement offsite (online) working mechanisms and platforms such online systems for the post-COVID era.

Project succession and continuity planning: There were delays occasioned by medical challenges of the first coordinator of the SGCI project at UNCST. Through this unfortunate event, UNCST had to look for a replacement that was challenging since the project had no succession and continuity plan in place. This experience calls for every project to have project succession and continuity plan to ensure projects achieve their objectives, maintaining stakeholder confidence, and ensuring that valuable project knowledge and momentum are not lost during transitions. In addition, projects should be encouraged to; (i) use project management tools and platforms to centralize project information for easy access by new team members; and (ii) identify potential successors for key project roles and responsibilities and provide necessary training and development opportunities to prepare those individuals for their future roles.

12. References**:**

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ii. Guloba, M. M., Kakuru, M., Ssewanyana, S. N., & Rauschendorfer, J. (2021). Employment creation potential, labor skills requirements and skill gaps for young people: A Uganda case study. In Addressing Africa's youth unemployment through industries without smokestacks (Research Stream). Retrieved from https://www.brookings.edu/wp-content/uploads/2021/07/21.08.02-Uganda-IWOSS.pdf

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vii. Olwor, N. (2023). Industrialization of Economies with Low Level of Manufacturing Base: Case Study of Uganda. Retrieved from http://dx.doi.org/10.2139/ssrn.4323103

viii. Uganda National Council for Science and Technology (2023). Uganda National Research Outlook Report 2032. Available at: https://www.uncst.go.ug/manage/files/downloads/Status%20Report%202022-12.pdf

13. Appendices:

You may use this section to share other detailed reports (frameworks, workshop reports, etc.)

Annex 2: Screenshot of the first page GFGP Compliance Assessment report for UNCST's application to the Platinum tier

Assessment overview

Completed to Platinum level

Submitted: 5 months, 2 weeks ago

Uganda National Council for Science and Technology: GFGP Standard (ARS 1651:2018) - Compliance report

You are **98%** compliant with the **Platinum** tier

Compliance by tier

100% 99% 98% **98%**

Compliance by section

#:	Section name:	Compliance:
5 Financial management		
5.1	Financial management	Bronze: 100% Silver: 100% Gold: 100% **Platinum: 100%**
5.2	Income management	Bronze: 100% Silver: 100% Gold: 100% **Platinum: 100%**
5.3	Expenditure management	Bronze: 100% Silver: 100% Gold: 100% **Platinum: 100%**

Annex 2: UNCST Team receive certificates of participation from facilitators of the training

Annex 3: Poster presentation by UNCST Team during the end of GEI Project review workshop in Cape Town, South Africa.