BUSITEMA UNIVERSITY
Pursuing excellence

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CONCEPT NOTE ON THE INSTITUTIONALIZATION OF THE NATURAL PRODUCTS RESEARCH AND INNOVATION CENTRE (NaPRiC) AS A CENTRE OF EXCELLENCE AT BUSITEMA UNIVERSITY FACULTY OF HEALTH SCIENCES

BY

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PRESENTATION TO THE FACULTY BOARD AND SENATE

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1.0 Introduction

1.1 Background

The Natural Products Research and Innovation Centre (NaPRiC) started in 2020 as a multidisciplinary research group (originally known as Busitema University Natural Products and Drug Research Group – BUNaPReG) at the peak of COVID-19 pandemic with an aim to develop a natural therapeutic for COVID-19. Under the oversight of Prof. Paul Waako, the Vice Chancellor of Busitema University at that time, Dr. Samuel Baker Obakiro from the Department of Pharmacology and Therapeutics founded the research group. The other pioneer members were Prof. Gavamukulya Yahaya from the Department of Biochemistry and Molecular Biology, Dr. Andima Moses and Dr. Richard Oriko Owor, both from the Department of Chemistry, Dr. Mukhama Peter Kiondo and Mr. Kiyimba Kenedy from the Department of Pharmacology and Therapeutics.

In 2020, Dr. Obakiro Samuel Baker as Principal Investigator, won the pioneer project of the research group entitled “Evaluation of the Anti-SARS-COV-2 activity of selected medicinal plants and formulation of herbal products for management of COVID-19”. This project was funded by the Presidential Scientific Initiative on Epidemics (PRESIDE – Chaired by Dr. Monica Musenero Masanza) which later on become the Secretariat of Science Technology and Innovation –Office of the President after abolishing of the Ministry of Science, Technology and Innovation in 2021. This project led to the development of herbal remedy, known as TAZCOV® for management of acute respiratory infections, which secured additional funding during FY2021/2022. This support enabled us to advance product development and establish a permanent research facility for our group. . With this funding, dedication and commitment from members, the group undertook rigorous preclinical research on TAZCOV® with support from other partners like Uganda Virus Research Institute (UVRI), Directorate of Government Analytical Laboratory (DGAL), COVAB and Natural Chemotherapeutics Research Institute (NCRI). The TAZCOV® product was notified by National Drug Authority (TH1087) and submitted for clinical trials to the Clinical Trial of Natural Therapeutics (CONAT) platform at Makerere Lung Institute (MLI) established by the Secretariat of Science Technology and Innovation – Office of the President (STI-OP). This was the second clinical trial of a natural therapeutic in Uganda after UBV01N.

The group expanded with other members of different faculties (Health Sciences, Science and Eduction, Engineering and Technology) joining as well as expansion of infrastructure

and funding. These included establishment of the Botanical garden at Nagongera campus and acquisition of state of art equipment like Preparative HPLC, Bulk extractor, lyophilizer, rotary evaporator, formulation tank, among others. In FY 2022/2023, the group received funding from the Busitema University Research and Innovation Fund (BURIF). The Principal Investigators were Dr. Samuel Baker Obakiro (Diabetes Mellitus Project), Dr. Richard Oriko (Herbal Soap), Dr. Hokello Joseph (HIV /AIDS – project) and Prof Dan Kibuule (Aflatoxin project). With this increased funding and infrastructure development, the research group evolved into a research centre with a permanent home at the Faculty of Health Sciences. In the FY 2022/20234, the centre attracted more funding from both STI-OP and BURIF. The principal investigators are Dr. Obakiro Samuel Baker (Glucotak Project), Prof. Gavamukulya Yahaya (Dental Solutions Project), Dr. Richard Oriko Owor (Beta propiolactone), Dr. Andima Moses (Trichos Project), Dr. Hokello Joseph (HIV/AIDS –Project) and Dr. Richard Oriko Owor (Hericorp Herbal Soap).

With the leadership of Prof. Paul Waako, NaPRiC signed momeranda of Understanding with the University of Free State, South Africa and Chongquig Medical and Pharmaceutical College, China. Delegates from NaPRiC have had benchmarking trips to South Africa and China which has promoted knowledge exchange and technology transfer to NaPRiC. Nationally, NaPRiC is collaborating with Uganda Virus Research Institute, Makerere University, Directorate of Governmental Analytical Laboratories, Mbarara University of Science and Technology and Natural Chemotherapeutic Research Institute. Collaborative agreements have been signed with various community organizations such as Operation Wealth Creation, CDH Herbal Solution Ltd., among others. The Centre is also increasing its foot print in the community by profiling and establishing a Busitema University Herbalists Association (BUHA). A number of students are undergoing internship at the Centre and various graduate programmes are under development.

1.2 Justification for establishment of NaPRiC

Drug discovery and development form the cornerstone of pharmaceutical industrialization. However, Uganda's pharmaceutical sector remains underdeveloped, heavily reliant on imports to meet its medication needs. Uganda and Africa at large shares a high burden of infectious diseases including HIV/AIDS, tuberculosis, malaria and non-communicable diseases like cancers, diabetes mellitus, cardiovascular diseases, mental illness among other, Neglected tropical diseases like visceral leishmaniasis, human African trypanosomiasis etc. The World Health Organization (WHO) projects an increase in epidemics and reemergence of controlled diseases in this century. The resurgence of pathogens particularly in sub-Saharan Africa will demand for increased utilization of pharmaceuticals including vaccines, therapeutics and diagnostics. COVID-19 pandemic exposed the weak pharmaceutical supply chains and dependence on exports. All these ailments need to be treated with pharmaceutical products with majority being derived from natural products such as medicinal plants, microorganisms, animal products and minerals.

A drug development value chain is a central component of equitable access of medicines which forms part of the core public health strategy. This value chain creates employment opportunities to improve livelihood of its people. In 2021, the global pharmaceutical market size was valued at 1.42 trillion dollars. With an estimated growth in global population at 3.1%, the use of pharmaceuticals is expected to increase proportionally in the future.

There is a current drive in Africa to expedite the discovery and development of medicines. The African Union recognizes the urgent need to develop local capacity to strengthen their own pharmaceutical value chains and invest in infrastructure development, as well develop appropriate human capital for this industry. Uganda’s NDP-3 earmarks the development of the pharmaceutical industry. The Pathogen Economy as a pillar of the Ministry of Science, Technology and Innovation advocates for the development of the Pharmaceutical value chain as a priority.

Uganda is endowed with rich biodiversity particularly natural resources with potential pharmacological applications. Over 60% of Uganda’s population depends on natural products for primary health care. However, there is limited capacity to sustainably exploit these natural resources scientifically. Despite the abundant natural resources, Uganda

depends largely on import of medicines with limited drug discovery or value addition. In 2020, Uganda imported pharmaceutical products worth $500M (NPA, 2020). To attain the goal for pharmaceutical industrialization goal, Uganda's local drug discovery and development industry requires highly trained personnel with a unique skillset in sciences, pharmaceutical and natural products.

1.3 Relevance of NaPRiC

NaPRiC is aligned to Uganda's NDPIII and vision 2040. These stipulate that Uganda should develop her capacity to (1) add value to her natural resources, (2) manufacture products locally (3) promote import substitution (4) accelerate productivity with an ultimate goal of fighting poverty and underdevelopment. NaPRiC aims to develop experts required for the pharmaceutical industrial value chain. The ultimate goal is NaPRiC to create employment opportunities and wealth for Ugandans, alongside improving health outcomes.

In line with the Africa Union agenda 2063, NaPRiC will contribute to the "acceleration of Africa's transition to an innovation-led, Knowledge-based Economy" by building a critical mass of experts with professional and technical competence in drug development. The graduates will develop innovations to address health needs of the country to ensure good health and well-being.

The Science, Technology and Innovation establishment under the office of the President (STI-OP) earmarks the development of the drugs under Pathogen Economy among the eight industrial value chains that will propel the industrialization of the country through science – led innovations and strategies. In this bureau, development of pharmaceuticals products is at the core. Hence strengthening the Research and Development capacities including human resource are critical. NaPRiC will ready Uganda for future epidemics and pandemics with regards to the development of therapeutics for old and new diseases.

Through development of Masters and Doctoral training programmes, NaPRiC will contribute to postgraduate training of biomedical and clinical scientists in natural product related fields such as Pharmacology, Chemistry, Biology, Pharmaceutical Sciences, biotechnology and Environmental Sciences. This will contribute to the development of the human resource capacity of the country and Africa.

2.0 NaPRiC Governance and Administration

2.1 Vision

A Centre of Excellence in Natural Products Training, Research and Innovation in Africa

2.2 Mission

To contribute to socioeconomic transformation of Uganda through innovations and technology development that lead to value addition and sustainable use of natural products in health and agriculture.

2.3 Strategic goal

To develop human and infrastructure capacity in the region to harness its rich medicinal natural resources

2.4 Objectives

1. To generate and disseminate new knowledge regarding natural products and their metabolites in biological systems so as to improve health care, agriculture and conserve the environment.
2. To train students in natural product related fields such as chemistry, pharmacology, pharmaceutical sciences, biotechnology and nanotechnology that is relevant to their professional and career practice.
3. To create opportunities for the development of the pharmaceutical industry in Uganda through highly impacting and productive research outputs.
4. To innovate pharmaceutical products and technologies from natural products that solve health, agricultural and environmental problems of the society.
5. To create businesses from the natural products for employment opportunity and wealth creation.

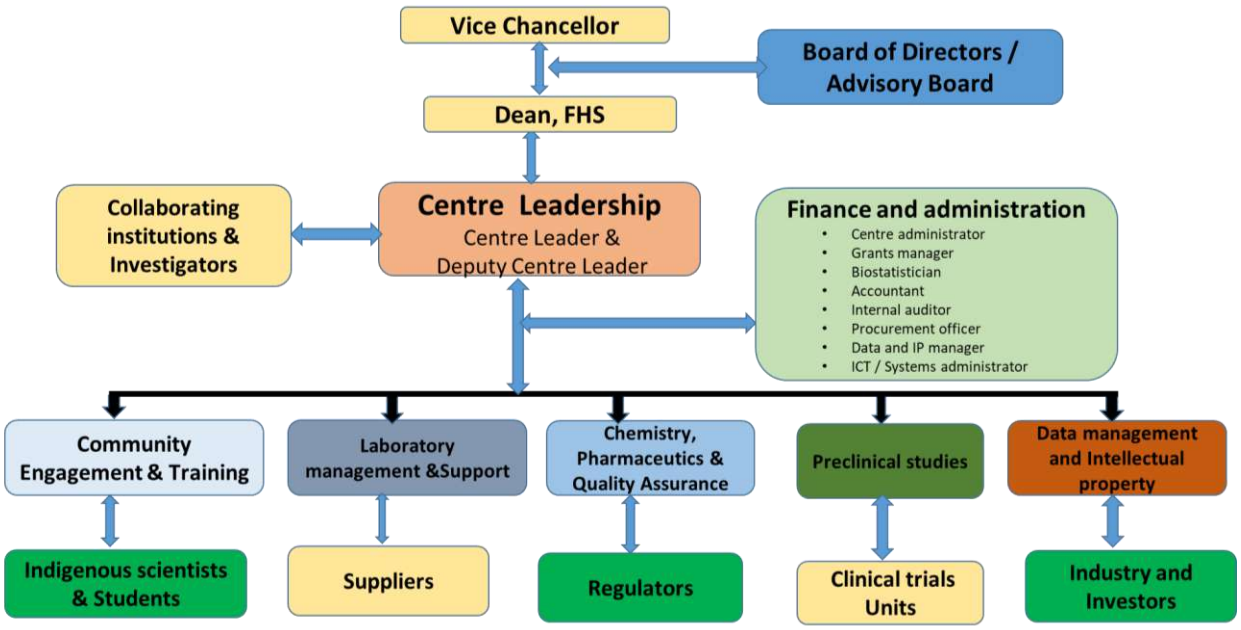
Motto: *Traditional medicine – A choice for All.*

2.5 Core Values

- ❖ Creativity
- ❖ Excellence

- ❖ Teamwork
- ❖ Integrity
- ❖ Respect
- ❖ Quality
- ❖ Accountability
- ❖ Mentorship

2.6 NaPRiC structure and administration



NaPRiC will have three levels of corporate governance / administration

2.6.1 Board of Governors / Governing Council

This will be the highest level of management and will be responsible for strategic decision making as well as providing oversight / supervision of the top management level / executive level. This level will consist of the Board of Directors / Advisory board whose composition will be determined by Vice Chancellor in consultation with the NaPRiC executive. It will have representative from;

i. Vice Chancellor – to represent the interest of the University
ii. Traditional medicine practitioners – to protect the interests of the indigenous scientists
iii. UNCST / NCRI – to represent the interests of government
iv. National Drug Authority – to represent the interests of regulators

v. Pharmaceutical Industry – Represent the interests of industry
vi. The Dean of Faculty of Health Science – to represent the interests of the Faculty
vii. The Centre Leader – to represent the interest of the centre staff and shall be secretary to the Board

The Vice – Chancellor will be the Chairperson and the Centre Leader the Secretary of the Governing Council

2.6.2 Executive / top management level

This level will be responsible for providing strategic leadership and management of the centre particularly charged with administration of the centre. This will be headed by the Centre Leader who will be appointed by the Vice Chancellor on recommendation of the advisory board. The other members at this level will constitute Deputy Centre Leader, and Principal Investigators of the various projects at the Centre and the Centre Administrator.

2.6.3 Operation / functional level

This will be responsible for managing specific operations of the centre to ensure that it achieves its intended goals and objectives. The centre will have the following Committees which will be headed by a Chief Scientist;

i. Laboratory management and support
ii. Community engagement and training
iii. Chemistry and Pharmaceutics
iv. Quality Assurance
v. Preclinical Studies
vi. Data management and Intellectual Property
vii. Commercialization
viii. Advancement, Linkages and partnership

The centre will have a Centre administrator / Operation managers who be the in charge of the daily operations of the Centre and other support staff.

2.7 Roles of the different positions at the Centre

2.7.1 The Board

The major function of the board will be to provide an oversight role on the management of NaPRiC. Specifically the board will;

i. Set broad goals and targets to be achieved by the Centre
ii. Develop strategies to achieve set goals
iii. Approve policies for corporate governance of the Centre
iv. Supervise the management of the NaPRiC
v. Provide reports and accountability to the University Council
vi. Support the Centre Leader / Director in administration of the Centre
vii. Ensure the availability of adequate financial resources for the operation of the Centre
viii. Ensure legal and ethical compliance as well as corporate Social responsibility
ix. Safeguard/hold in trust the mission and vision of NaPRiC
x. Buffer the NaPRiC from its external environment
xi. Arbiter of internal disputes among stakeholders
xii. Monitor and review the roles and functions of top management / executive

2.7.2 The Centre Leader / Director

The Centre Leader will be the executive head of NaPRiC and will be responsible for the following;

i. Provide strategic management and leadership to the centre to achieve its goals and objectives
ii. Plan for and mobilize resources (human and infrastructure) required for the smooth running of the centre with support from the University management and advisory Board.
iii. Coordinate and supervise all staff working at NaPRiC to ensure high productivity and efficiency.
iv. Provide accountability for all the inputs and outputs of NaPRiC as required by existing policies and regulations to the Advisory Board.
v. Represent the University management on all issues related to the operations of NaPRiC both nationally and internationally.
vi. Initiate and foster strategic partnerships for the development of NaPRiC.

2.7.3 Deputy Centre Leader

The Deputy Centre Leader will support the Centre Leader in the strategic management and leadership of the centre to achieve its goals and objectives.

Specifically, the Deputy Centre Leader will;

i. Participate in the development of strategic plans for the centre
ii. Participate in daily administration of the centre.
iii. Supervise the Centre Administrator and Chief Scientists to ensure efficient administration of the Centre
iv. Be in charge of student and researcher placement / internship at the Centre with guidance from the Centre Leader.
v. Report to the Centre Leader of NaPRiC as the immediate supervisor.

2.7.4 Chief Scientists

The Chief Scientists will be Chairpersons of the different operational committees at NaPRiC. Specifically, a Chief Scientist will

i. Provide technical support to all NaPRiC operations that require application of his knowledge and expertize
ii. Manage the designated laboratory facilities including issues related to procurement, maintenance and inventory
iii. Coordinate and supervise all staff working at the designated Laboratory to ensure high productivity and efficiency.
iv. Support student and staff training and mentorship so as to attract and retain talented staff.
v. Advise the Centre Leader on matters related to human and infrastructure developments of the designated field.
vi. Prepare periodic reports and provide accountability as determined by the Centre Leader.
vii. Report to the Centre Leader or Deputy Centre Leader as the immediate supervisor.

2.7.5 Centre Administrator

The major duty of the Centre Administrator will be to provide administrative support to the Centre. Specifically the Centre Administrator will;

i. Undertake planning, organizing, coordinating, controlling, supervising, directing, reporting and budgeting for the various operations.

ii. Provide technical support as may be required depending on his or her skills and expertise.

iii. Prepare and keep proper records and documents related to project activities including but not limited to minutes for meetings, reports from various project activities, and communications from various stake holders among others.

iv. Report to the Deputy Centre Leader Or Centre Leader

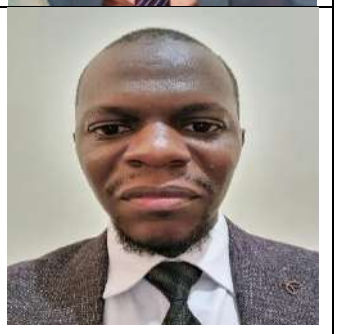
2.7.6 Other Employees at NaPRiC

i. Research Scientists – Conduct research, collect data and supervise technicians
ii. Technicians – Support research scientists and laboratory maintenance
iii. Data Manager / Biostatistician - Data management and analysis
iv. Accountant – Financial Management
v. Procurement officer – Handling of procurement issues
vi. M&E officer – Monitoring and Evaluation of NaPRiC operations
vii. ICT / Communications officer/ Systems administrator – Digitalization and communication of NaPRiC operation
viii. Quality, Safety & Risk Officer: Development and implementation of Quality, Risk and Safety structures and processes within the centre.
ix. Maintenance /Estate officer – General maintenance and repairs of the facility
x. Support staff (Causal Laborer) – General cleaning of the facility
xi. Driver – Transportation of staff and property

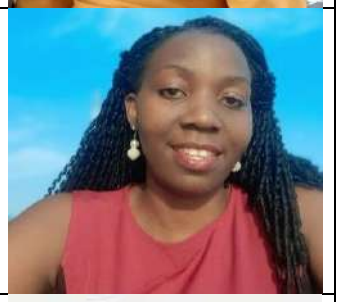
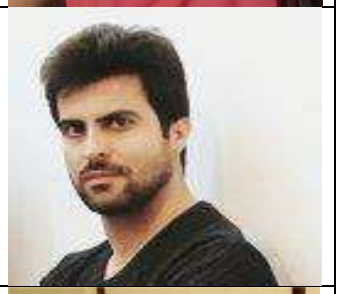
3.0 Human resource capacity requirement at NaPRiC

SN	Position	FTE	Establishment	Current	Gap
1.0	Centre Director	50%	1	1	0
2.0	Deputy Centre Director	40%	1	1	0
3.0	Chief Scientists	40%	5	4	1
4.0	Data Manager	40%	1	0	1
5.0	Centre Administrator	100%	1	1	0
6.0	Research Scientists	50%	10	10	0
7.0	Research Assistants / Graduate fellows	50%	5	4	1
8.0	Technicians	100%	5	3	2
9.0	Accountant	100%	1	0	1
10.0	Procurement officer	40%	1	0	1
11.0	Internal Auditor	40%	1	0	1
12.0	M&E Officer	100%	1	0	1
13.0	Quality, Safety & Risk Officer	40%	1	0	1
14.0	ICT / systems manager	100%	1	1	0
15.0	Secretary	100%	2	0	2
16.0	Estate Officer	40%	1	0	1
17.0	Transport officer	100%	2	1	1
18.0	Support staff	100%	5	3	2
19.0	Total		45	29	16

3.1 Technical experts and support staff available at NaPRiC

SN	Name	Qualification	Position	Photo
1.	Prof. Paul Waako	MBChB ; MSc. Pharmacology; PhD	Vice – Chancellor and Chairperson Board	
2.	Prof. Dan Kibuule	BPharm; MSc and PhD. Pharmacology	Dean of Faculty of Health Science and Member of Board	
3.	Dr Obakiro Samuel Baker	BSc; MSc. Pharmacology; PhD	Centre Director and member of Board	
4.	Prof. Gavamukulya Yahaya	BSc; MSc. Molecular Biology and Biotechnology; PhD	Deputy Centre Director	
5.	Dr Richard Oriko Owor	BSc.; MSc. Chemistry; PhD	Chief Scientist - Laboratory Management and Chemistry	
6.	Dr. Moses Andima	BSc; MSc, PhD, Postdoc Nanotechnology and drug delivery systems	Chief Scientist – Pharmaceutics and Quality Assurance	

7.	Mr. Kiyimba Kenedy	BBLT; MSc. Pharmacology; PhDc	Chief Scientist – Preclinical Trials	
8.	Ms. Carol Kawuma	BSc.; MSc. Botany ; PhDc	Chief Scientist – Ethnobotany and community engagement	
9.	Dr. Dennis Bwayo	MBCHB, MMED, MPH	Clinical Trialist	
10.	Dr. Joseph Hokello	BSc.; MSc.; PhD.	Senior Scientist and Molecular Virologist	
11.	Dr. Maseruka Richard	BSc, BPharm, MSc Chemistry	Centre Administrator	
12.	Ms. Catherine Nabitandikwa	BSc., MSc. Pharmaceutical Sciences	Research Scientist	

13.	Dr. Banson Barugahare	BSc; MSc; MPhil Immunology and Genetics	Senior Research Scientist	
14.	Dr. Peter Mukhama Kiondo	BPharm ; MSc. Pharmacology	Senior Research Scientist	
15.	Dr Godliver Owomugisha	BSc.; MSc. Computer Science PhD	Artificial Intelligence in Drug Discovery Advisor	
16.	Ms. Proscovia Nabachenje	BSc.; MPH Nutrition	Research Scientist	
17.	Dr. Mohammad Yasin Zamanian	BSc.; MSc.; PhD Physiology and Pharmacology	Associate Member	
18.	Mr. Lukwago Tonny	BSc., MSc, PhDc Ethnopharmacology	Research Scientist	

19.	Ms. Angellah Namuyomba	BSc., MSc. Computer Science	ICT and Systems Officer	
20.	Dr. Lulenzi Jalia	MBChB; M. Med Candidate (Paediatrics and Child Health)	Research Assistant	
21.	Dr. Wamani Samson	DCM, MBChB, MPH	Research Scientist	
22.	Mr. Bewala Fred	DMLT, BBLT	Laboratory Technician	
23.	Ms. Chebijira Mercy	BSc., Chemistry	Research Assistant	

24.	Ms. Opio Moses	BSc., Cytotechnology	Research Assistant	
25.	Mr. Kibuuka Ronald	BSc. Laboratory Technology, MBChB Candidate	Research Assistant	
26.	Ms. Edeya Sharon Tracy	Diploma Chemistry	Technician	
27.	Mr. Kasajja Anthony	UCE, Certificate in Library and Information Science	Administrative Assistant/ Intern	
28.	Mr. Manana Geofrey	UCE	Transport Officer	
29.	Ms. Grace Alukudo	PLE	Support staff	

4.0 Developed programmes that can be supported at NaPRiC

4.1 Doctor of Philosophy in Chemistry

Higher degree training, research, and innovations are fundamental requirements for any higher education institution to establish a reputation in the global knowledge economy. Higher degree training that emphasizes research in Science, Technology, and Innovations (STI) continues to play a leading role in national developments by producing critically and appropriately skilled human resources, especially to support growth in developing economies. Therefore, the initiation of the Ph.D. program provides an avenue for generating new knowledge and innovations. The doctorate (the 'third cycle' of degrees) is distinctive because it creates new knowledge or applies existing knowledge in a new way. This characteristic differentiates the Ph.D. program from bachelor's and master's degrees (first and second cycles, respectively). The development of a Ph.D. program at Busitema University will contribute to national development and enhance integration, growth, and competitiveness of the economy of Uganda, in particular, and also support the growth of the East African or wider global community in general because of focusing on the generation of new knowledge in science, technology, and innovations. The generation of new knowledge is a vital contribution to supporting the economy's growth and ultimately contributing to the achievement of sustainable development goal targets.

Doctoral degree programs are the highest level of academic attainment with specialist qualifications aimed at professional development in specific areas or disciplines. Tinker and Jackson (2004) suggest that in terms of the academy, the Ph.D. (or doctorate) is the highest formal qualification awarded, and recognized internationally to signify high-level intellectual endeavors in a specialized field of study. As such, the doctoral degree has a common currency globally as the highest academic qualification a University can award. Attaining a doctoral qualification is considered a route to continuing professional development above that which can be achieved in the workplace, rather than as a means to becoming a practitioner of a profession. Doctoral degrees are the most individually distinct of the academic qualifications available because of their roots in research and the pursuit of knowledge. They require the candidate to produce work requiring original thought based on independent study.

Generally, doctorate programs result in the completion of an original piece of research

presented as a thesis and examined by an expert in the chosen field. The philosophy of introducing the Ph.D. program in the Faculty of Science and Education stands on the premise that depth within a specialty and interdisciplinary breadth are critical to shaping the minds of future generations of scientific leaders and innovators. The emphasis of the program is to train independent thinkers by fostering creativity, and innovation, and channeling curiosity through the acquisition of multi-disciplinary transferable skills and knowledge and undertaking in-depth specialized scientific training and literature analysis.

Particularly, the Doctor of Philosophy in Chemistry program is developed to produce competent graduates with practical knowledge and skills in the specialized branches of pure and applied chemistry to drive the chemical and associated industry. This is based on the fact the products of chemistry research are all around us, from the water we drink and the food we eat to the clothes we wear, the cars we drive, and the energy used to heat and light our homes. Chemistry research has changed our way of living and increased our quality of life. Chemistry has contributed substantially to the development of many countries in the developed world and it is expected to contribute immensely to our present and future developments, particularly in technology, green environment, sustainable energy solutions, reducing global warming, sustainable food production, and good health. At the heart of many industrial processes is chemistry and thus, chemistry is a crucial element for the industrialization of a given economy. Endowed with a wealth of mineral resources, including petroleum, Uganda's industrial growth is hinged on its advancement and development of the chemical industry for value addition in the course of exploitation of the rich mineral resources as evangelized in NRM Manifesto 2021-2026 and Third National Development Plan (NDP) 2020/21 – 2024/25. In this context, it is necessary to concentrate effort on training and research in the related fields of science with chemistry leading; being a central field of science. Training and research should focus on value addition to address environmental quality issues, sustainable food production, sustainable energy solutions, public health, home and industrial products, and construction and technology inputs.

4.2 Masters of Science in Chemistry

Society needs professionals who can generate scientific solutions and technical innovations for its continued prosperity. The Ugandan population still has widespread poverty and a narrow manufacturing and export base, becoming a huge economic burden for the country. Uganda, in particular, is endowed with vast mineral resources, including petroleum, iron ore, gold, copper, cobalt, nickel, phosphorus, gypsum and limestone. Also, the most valuable resources Uganda has is its abundantly rich flora, fauna and other natural resources, within which lies a huge potential for commercial exploitation by agricultural, pharmaceutical, cosmetic and other industrial sectors. Most of Uganda's resources, some of which are still not exploited, present enormous potential to spur the development of the chemical, processing and manufacturing industry, thus the country's industrialization and economic growth. However, the productive use of these resources requires sufficient availability of skilled personnel to supply the necessary skills, competencies and leadership needs that are vital for the growth of the chemical and manufacturing industry. This calls for urgent training of graduates with practical, research and industrial skills for developing the chemical and manufacturing industry in Uganda. There are very high prospects for employment of the Master of Science in Chemistry graduates in the manufacturing sectors, academia, and research institutions.

Based on this background, the Master of Science in Chemistry of Busitema University is designed to produce graduates with theoretical and highly practical skills and technological know-how applicable to research, academia, and the manufacturing sector. The program is designed to produce graduates to become innovative thinkers with an entrepreneurial spirit, the very attributes which are essential in Uganda's economic development. The program will prepare graduates for careers that require logical thinking, analytical skills, and a talent-oriented and curious mind with practical applications.

4.3 Masters of Pharmacology (Drug Discovery and Development)

The current need for indigenous pharmaceutical solutions to meet the healthcare needs of the country cannot be over emphasized. In Uganda there is a dearth of Pharmacologists with requisite knowledge and skills to guide drug discovery and development process. This has largely contributed to the current over dependence of the country on importation of majority of its pharmaceuticals. The proposed program of Master of Pharmacology seeks to address this need by producing professional pharmacologists with advanced knowledge and skills in drug discovery and development. With the growing reliance of communities on

local products to meet their health needs especially as the case was during the COVID-19 pandemic, there is little guidance or involvement of academia, researchers, or government to help nature and improve these local discoveries. To reduce this gap, the department of Pharmacology in partnership with local communities under the stewardship of the secretariat of Science Technology and Innovation – Office of the President is actively undertaking research and development of natural therapeutics from Ugandan medicinal plants. The Master of Pharmacology program envisions contributing to optimization of natural therapeutics and their commercialization in and outside the country through training professionals with requisite knowledge and skills in drug discovery and development.

The Master of Pharmacology will be a two year program run in the department of Pharmacology and Therapeutics, Busitema University with support from relevant departments (Chemistry, Biochemistry, Physiology, Public Health and Internal medicine). The program is envisioned to enroll its first set of learners in academic year 2023/24. Throughout the entire program, courses have been designed in such a way that much emphasis is put on developing hands on skills among the graduates through the various practical sessions, laboratory and field exposures as well as industrial attachment. It is envisaged that this program will skill graduates and make them competent in the field of drug discovery and development particularly from the rich natural resources in the country. These professionals are also predicted to contribute towards the workforce in the growing pharmaceutical industry sector in the East African region and beyond, as well as contribute personnel to academia, both in the biomedical and clinical fields. The program specifically seeks to produce a five-star pharmacologist with key attributes in research, innovation, entrepreneurship, education, and leadership in drug discovery and development.

4.4 Bachelor of Pharmacy

Pharmacists and pharmaceutical scientists are a vital part of the healthcare system in Uganda, as part of the multi-disciplinary teams in drug development, manufacture and healthcare. Pharmacists in particular ensure quality in pharmaceutical care provision. However, investment in a comprehensive and transformative Bachelor of Pharmacy (BPharm) programme in Uganda with clinical, industrial and supply chain tracks, will improve equity of healthcare and medicines access, and also provide sustainable solutions to human resource, pharmaceutical innovations, development and manufacturing.

In 2011, the Busitema University made history by admitting the first ever Bachelor of Medicine and Surgery students in Eastern Uganda with the ultimate goal of alleviating the shortage and inequitable distribution of health personnel, particularly in the rural settings of the country. The Bachelor of Pharmacy (BPharm) curriculum is envisaged in 2024, to be approved by the Busitema University, National Council of Higher Education and the professional regulator – the Pharmaceutical Society of Uganda. The BPharm programme will be hosted in the Department of Pharmacy that has been operationalized within the administrative structure of the Faculty of Health Sciences, and will work collaboratively with existing faculties, departments and programmes, particularly, the Bachelor of Medicine and surgery, Nursing and anaesthesia programmes. However, as a separate profession defined by Uganda law in an Act of Parliament, the pharmacy programme and related activities must be cultivated to continue to grow and flourish in specific and unique areas such as pharmaceutics, pharmaceutical innovation and development and the training needs of Uganda therein.

The Department of Pharmacy will benefit greatly in the existing infrastructure of the Faculty of Health Sciences at the Mbale campus with existing investment in teaching and learning resources and equipment and facilities, as well as ongoing programmes. These will provide the necessary support to ensure education and training of quality and innovative pharmacists and allied cadres, for clinical practice, research and also pharmaceutical development and production.

The contribution to the socioeconomic needs and NDP-3 of Uganda is very clear:

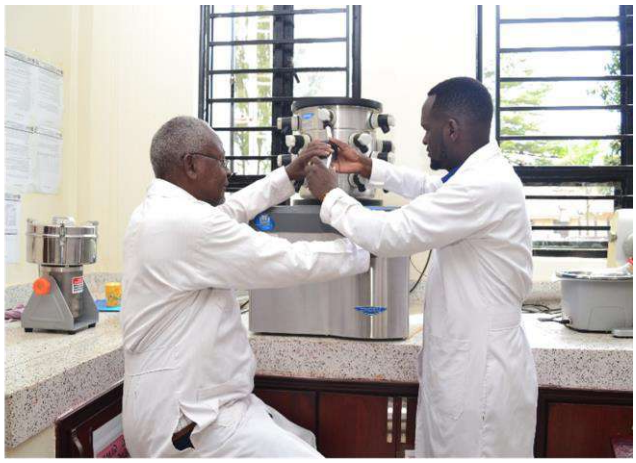
- Increased capacity of human resource translating to reduced unemployment
- Improved access to medicines and healthcare personnel translating to reduced health inequalities and reducing the burden of ill health in Uganda
- Improved quality of healthcare delivery translating to greater confidence and uptake of healthcare services particularly in the public sector
- Creating industry in Uganda to support national economic growth
- Improved career pathways translating to better job satisfaction and retention of human resource in healthcare sector

5.0 Infrastructure and Current equipment at NaPRiC

The Natural Products Research and Innovation Centre Complex

Bulk Extractor

Preparative HPLC



Freeze Dryer

Biosafety cabinet

Botanical garden at Nagongera Campus

6.0 Completed and an Ongoing projects at NaPRiC

Year	Project Title	Amount $	PI	Status	FUNDER
2023	Preclinical evaluation and standardization of antidiabetic prototypes	356,164	Dr. Obakiro Samuel Baker	Ongoing	STI-OP
2023	Synthesis of betapropiolactone from cassava for pharmaceutical application	130,000	Dr. Richard Oriko Owor	Ongoing	STI-OP
2023	Formulation and Pre-clinical Evaluation of Herbal Toothpaste/ Mouth Wash for Management of Oral Diseases	132,000	Prof. Yahaya Gavamukulya	Ongoing	STI-OP
2023	TRICHOS Microbicide and Biofertilizer from Lab Bench to Field Application: Towards Commercialization	25,000	Dr. Andima Moses	Ongoing	BURIF
2023	Bioprospecting for HIV-1 latency reversing agents (Prostratin) from indigenous medicinal plants for latency reversal in HIV-1 subtypes A and D in Uganda	15,000	Dr. Joseph Hokello	Ongoing	BURIF
2022	Formulation and Preclinical Evaluation of Herbal products for management of Diabetes Mellitus	12,500	Dr. Obakiro Samuel Baker	Completed	BURIF
2022	Fortification of Dried Cassava With Essential Oils and Trichoderma Based Microbiocide to Control Colonization by Aflatoxin Producing Fungi	10,000	Prof. Dan Kibuule	Completed	BURIF
2021	Formulation and Phase 1 clinical Evaluation of Herbal Product(s) for Management of Covid-19.	630,000	Dr. Obakiro Samuel Baker	Completed	STI-OP
2020	Evaluation of the Anti-SARS-CoV-2 Activity of Selected medicinal plants and Formulation of Herbal Product(s) for Management of Covid-19	130,000	Dr. Obakiro Samuel Baker	Completed	PRESIDE

7.0 NaPRiC strategic Plan 2024 – 2028

	GOAL: To make NaPRiC a destination for students, researchers and investors in Traditional and complementary Medicine in Africa								
	Objectives	**Intended Outcomes / outputs**	**Action steps**	**Set Targets**					**Evidence of Achievement**
				2024	**2025**	**2026**	**2027**	**2028**	
1	To train students and staff in different fields of natural products e.g Ethnobotany, Phytochemistry, Ethnopharmacology, computational chemistry, pharmaceutical technology, Quality control	Highly skilled and competent Scientists in Natural Product Research and Development	1. Develop curricula for masters and PhD programmes in Natural products	Two Master Programme	Two Master and one PhD programmes	Two Master and two PhD programmes	Three Master and Two PhD programmes	Three Master and Three PhD programmes	Accredited programmes
			2. Establish infrastructure for training and Research in Natural products	10 equipment	15 equipment	20 equipment	25 equipment	30 equipment	Equipment logs
			3. Recruit critical human resource in Natural products	6 PhD 4 Master	8 PhD 10 Master	8 PhD 10 Master	10 PhD 20 Master	15 PhD 30 Master	Transcripts and Certificates
			4. Provide support to students and staff to pursue further training	3 staffs	5 students	6 students	7 students	8 students	Student details

2	To mobilize resources to fund Centre's programmes	Sufficient funds to run our planned activities	1. Apply for grant and scholarship calls	2.5 B	3.5B	4B	4.5B	5B	Grant awards,
			2. Create enterprises to generate revenue	0	50M	100M	200M	400M	Cash flow
			3. Build collaborations with other partners	0	100M	500M	500M	500M	Cash flows
			4. Train in grant writing	0	2	2	2	2	Attendence lists and
3	To conduct research in epidemiology, prevention and treatment of common diseases	Publications and Policy briefs	1. Develop research projects	10	15	20	25	30	Research Proposals
			2. Generate data	10	15	20	25	30	Data sets
			3. Write manuscripts	10	15	20	25	30	Published articles
			4. Train in scholarly writing and publication	2	2	2	2	2	
4	To innovate commercial products from natural sources	Notified / registered products Patents	1. Generate prototypes	10	10	10	10	10	Prototypes
			2. Validate the prototypes	10	10	10	10	10	Data
			3. Optimize the prototypes	5	5	5	5	5	Data
			4. Brand and package the product	5	5	5	5	5	Packages
			5. Product expansion and diversification	1	2	3	4	5	Notification / marketing authorization

			Registration of Intellectual property	2	3	3	5	10	Evidence of filling for IP, Grant of IP
5	To disseminate and undertake corporate social responsibility	Increased visibility and reputation with in the community (competitive brand)	1. Educate stakeholders in different aspects pharmaceutical value chains	3 seminars	4 seminars	5 seminars	6 seminars	7 seminars	Reports and attendance lists
		Benefit the community	2. Support community activities including student engagements	4 activities	4 activities	4 activities	5 activities	5 activities	Reports
		Obtain community trust and confidence	3. Participate in National and regional exhibitions, conferences and symposium	5 exhibitions	6 exhibitions	7 exhibitions	8 exhibitions	9 exhibitions	Reports

8.0 Funding strategy at NaPRiC

The following is the proposed funding strategy for NaPRiC

1. Grants from with the government of Uganda and external funders
2. Government subvention upon institutionalization
3. Commercialization of products from NaPRiC
4. Private Public partnership

9.0 NaPRiC Partners and funders

10.0 Prototypes / products at NaPRiC


TRICHOS
Composition


HERiCOP
Skin Master
Herbal bathing soap that
Protects skin against germs
130 g
Feel the natural freshness


PROVIRID
For management of HIV/AIDS
Infection in combination with HAART
PROVIRID

11.0 Publications from NaPRiC

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3. Obakiro, S. B., Kiyimba, K., Lukwago, T. W., Lulenzi, J., Owor, R. O., Andima, M., Hokello, J. F., Kawuma, C., Nantale, G., Kibuule, D., Anywar, G., Waako, P., & Gavamukulya, Y. (2023). Ethnobotanical study of plants used in management of diabetes mellitus in Eastern Uganda. Phytomedicine Plus, 3(4), 100486. https://doi.org/10.1016/j.phyplu.2023.100486

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Appendix: NaPRiC Pictorial

NAPRIC AT THE NATIONAL SCIENCE WEEK 2022

Benchmarking at PharmBioTrac Mbarara University

Signing of MoU at UFS and Chongquig

National Capacity building: Ph.D. Students

Mr. Paul Mukasa
PhD. Student (Chemistry)
Mbarara University
Natural therapeutics for Dog bites

Mr. Tonny Lukwago
PhD. Student (Pharmacology)
Kampala International University
Natural therapeutics for Skin (NTD)

Mr. Kennedy Kiyimba
PhD. Student (Pharmacology)
University of Nairobi
Natural therapeutics for cancer

NaPRiC community engagement in Teso and Sebei

NAPRIC team members during an inspection by the Vice Chancellor

NAPRIC HOSTING THE NAPRECA –U ANNUAL SYMPSOIUM 2024