



Annual Research Report

**2023/
2024**



Creating a Future
for the Knowledge
Generation



Creating a Future for the Knowledge Generation



Table of Contents

List of Abbreviations	4
Vice Chancellor's Foreword	6
The Deputy Vice-Chancellor, Research and Enterprise's Message	8
Introduction	10
Performance and Rankings – Research Outputs and Impact	11
Research Outputs and Impact	14
Internationalisation	17
Office of Research and Development	19
School of Graduate Studies	28
Faculty of Science	31
Faculty of Engineering and Technology	41
Faculty of Social Sciences	55
Faculty of Health Sciences	58
Faculty of Medicine	64
Faculty of Education	75
Faculty of Humanities	77
Faculty of Business	80
Research Institutes and Centres of Excellence	83
Okavango Research Institute	83
San Research Centre	86
Centre for Scientific Research, Indigenous Knowledge and Innovation	89
Clean Energy Research Centre	89
Department of Library Services	91



List of Abbreviations

- | | |
|--|-------------|
| 1. African Energy Efficiency-Institute for Sustainable Technologies | - AEE INTEC |
| 2. African Vaccine Manufacturers Initiative | - AVMI |
| 3. Amalgamated Banks of Southern Africa | - ABSA |
| 4. Austrian Development Agency | - ADA |
| 5. Biocultural Community Protocol | - BCP |
| 6. Botswana Bureau of Standards | - BOBS |
| 7. Botswana College of Engineering Technology | - BCET |
| 8. Botswana Defence Force | - BDF |
| 9. Botswana Digital Innovation Hub | - BDIH |
| 10. Botswana Energy Regulatory Authority | - BERA |
| 11. Botswana Housing Corporation | - BHC |
| 12. Botswana Innovation and Technology Research Institute | - BITRI |
| 13. Botswana International University of Science and Technology | - BIUST |
| 14. Botswana Police Service | - BPS |
| 15. Botswana Tourism Organisation | - BTO |
| 16. Botswana Smoking Abstinence Reinforcement Trial | - BSMART |
| 17. Botswana Solar Thermal Roadmaps and Implementation | - BSTTR |
| 18. Botswana University of Agriculture and Natural Resource | - BUAN |
| 19. Botswana-UPenn Partnership | - BUP |
| 20. Clean Energy Research Centre | - CERC |
| 21. Centre for Scientific Research, Indigenous Knowledge and Innovation | - CesrIKi |
| 22. Centre for Disease Control and Prevention | - CDC |
| 23. Centre for International Child Health | - CICH |
| 24. Center for the Study of Renewable and Sustainable Energy | - CSRSE |
| 25. Centre for the Study of HIV and AIDS | - CSHA |
| 26. Coordinating Lead Author | - CLA |
| 27. De Beers Botswana Mining Company | - Debswana |
| 28. Department of Agricultural Research | - DAR |
| 29. Department of Energy | - DoE |
| 30. Edison Biotechnology Institute | - EBI |
| 31. Educational Partnership for Innovation with Communities | - EPIC |
| 32. Energy Efficiency | - EE |
| 33. Engineering Technology Innovation Centre | - ETIC |
| 34. Faculty of Engineering and Technology | - FET |
| 35. Faculty of Medicine | - FoM |
| 36. Southern African Development Committee Centre for Renewable Energy and Energy Efficiency | - SACREEE |
| 37. Food and Agriculture Organisation | - FAO |
| 38. Hospitality and Tourism Association of Botswana | - HATAB |
| 39. Human Immuno Virus | - HIV |
| 40. Acquired Immuno Deficiency Syndrome | - AIDS |
| 41. Gaborone City Council | - GCC |
| 42. Gaborone Private Hospital | - GPH |
| 43. George Washington University | - GWU |



44.	German Cooperation for International Development	-	GIZ
45.	Low-Middle-Income Country	-	LMIC
46.	Kalahari-Rift Valley	-	KALARIVA
47.	Makerere University College of Health Sciences	-	MakCHS
48.	Mastercard Foundation	-	MCF
49.	Medical Research Council of Zimbabwe	-	MRCZ
50.	Ministry of Communications, Knowledge and Technology	-	MCKT
51.	Nagoya Protocol on Genetic Resources	-	NPGR
52.	National Agricultural Research and Development Institute	-	NARDI
53.	National Development Plan	-	NDP
54.	National Institutes of Health	-	NIH
55.	National Aeronautics and Space Administration	-	NASA
56.	Non-Communicable Diseases	-	NCDs
57.	Okavango Diamond Company	-	ODC
58.	Office of Research and Development	-	ORD
59.	Okavango Research Institute	-	ORI
60.	People Living With HIV/AIDS	-	PLWH
61.	Princess Marina Hospital	-	PMH
62.	Purchasing-Power Parity	-	PPP
63.	Strengthening Research and Innovation Management II	-	SRIM II
64.	San Research Centre	-	SRC
65.	Scientific Advisory Panel	-	SAP
66.	Screening, Brief Intervention and Referral to Treatment	-	SBRIT
67.	Serious Adverse Events	-	SAE
68.	Sir Ketumile Masire Teaching Hospital	-	SKMTH
69.	Southern African Development Committee	-	SADC
70.	Southern African Renewable Heating and Cooling Training & Demonstration Initiative	-	SOLTRAIN
71.	Southern African Research and Innovation Management Association	-	SARIMA
72.	Sub-Saharan Africa	-	SSA
73.	Surveillance of Hospital-Associated Infections and Antimicrobial Resistance	-	SHARE
74.	Times Higher Education	-	THE
75.	Transport Research Centre	-	TRC
76.	University of Botswana	-	UB
77.	United Kingdom	-	UK
78.	United Kingdom Research and Innovation	-	UKRI
79.	University Research Strategy	-	URS
80.	United States of America	-	USA
81.	University of Pennsylvania	-	UPenn
82.	United Nations Development Programme	-	UNDP
83.	United Nations Environment Programme	-	UNEP
84.	UN Global Sustainable Development Report	-	UN GSDR
85.	United Nations International Children's Emergency Fund	-	UNICEF
86.	United Nations Populations Fund	-	UNFPA
87.	United Nations World Trade Organisation	-	UNWTO
88.	University of Oxford Ethox Centre	-	Ethox
89.	World Bank	-	WB
90.	World Health Organisation	-	WHO
91.	World Meteorological Organisation	-	WMO



Vice Chancellor's Foreword



Vice Chancellor
Prof. David Norris



It is with great pleasure and pride that I present the University of Botswana's (UB) 2023/2024 Annual Research Report. This report encapsulates UB's ongoing journey towards academic excellence and innovation, guided by the University's unwavering commitment to fostering a culture of research and knowledge generation as enshrined in the University's Strategic Plan (2020-2029).

As we navigate through a rapidly evolving global landscape, the significance of research cannot be overstated. It is the cornerstone upon which progress, and development are built the world over, and at the UB, it forms the bedrock of its mission to create a future for the knowledge generation.

In this report, you will find a comprehensive overview of the University's research activities across its eight (8) faculties, research institutes, and centres. It highlights UB's achievements, celebrates the individual contributions of our researchers, and showcases our performance in key areas such as research engagement, funding, and consultancy services.

I am particularly delighted to note the significant strides we have made in improving our research performance, as evidenced by our rankings in prestigious international assessments. The University of Botswana has emerged as a beacon of excellence, not only in our region but on the global stage, thus reaffirming our position as a top-ranked institution dedicated to pushing the boundaries of knowledge through scientific research.

Looking ahead, the University is poised to build upon its successes and embrace new opportunities for growth, collaboration and societal impact. Our commitment to research excellence remains steadfast, and we are fully invested in harnessing the transformative power of knowledge to address the numerous and complex challenges facing our world today and potentially into the future.

I extend my heartfelt gratitude to our dedicated faculty, staff, students, and partners whose commitment has been instrumental in our journey thus far. Together, we will continue to chart new frontiers of discovery and innovation, propelling the University of Botswana to even greater heights of excellence. As we look forward to 2025 and beyond, our Research Strategy will continue to align with the national vision and development plans, thus enhance our contributions to the national development.

Thank you.

*...the
significance
of research
cannot be
overstated.
It is the
cornerstone
upon which
progress...*



Deputy Vice-Chancellor Research and Enterprise's Message



Deputy Vice Chancellor
Prof. Doreen Ramogola-Masire



It is my distinct pleasure to present the consolidated research narrative of the University of Botswana for the year 2023/2024. As you will appreciate from the highlights across faculties and research centres, this report makes clear the intentions of the University of Botswana to be at the forefront of knowledge creation and dissemination for societal impact. These intentions are expressed strategically in the University's inception report submitted during the reporting year. Completion of a well-thought-out research development, support and management organisational structure which will be implemented in a phased approach was another significant step towards our research agenda.

Research is the lifeblood of academia, driving innovation and fostering intellectual curiosity. At the University of Botswana, research is not merely a pursuit but a passion, ingrained in the fabric of its academic community. It is through rigorous inquiry and scholarly endeavours that the University seeks to address the pressing challenges of our time and contribute meaningfully to the advancement of society in the country, regionally and the rest of the world.

This report presents the University of Botswana's performance across key performance indicators, thematic areas and strategic initiatives. It underscores the University's commitment to excellence across diverse disciplines, from Clinical and Health Sciences to Social Sciences, Physical Sciences, Engineering and Humanities.

I am particularly encouraged by UB's sustained growth and progress in research quality and impact. The University maintained research performance growth above its regional peers, despite the decline in the number of PhD holders in the reporting year. This is particularly encouraging, and points to even better performance once

the University starts implementing its new research policy and strategy from 2025/26. The University's research fundraising efforts also increased significantly from an average of 30-40 funding applications per annum, to over 100 in 2023/24. The results of this increased effort will be evident in the next report.

As the University of Botswana forges ahead, it remains steadfast in its pursuit of research excellence with economic and societal impact. This will be achieved through creation of a cohesive framework that builds research and innovation capacity, guides research priorities, ensures efficient resource utilisation, all underpinned by ethical conduct of research. The University of Botswana research landscape will not be complete without mention of how it creates tangible value for stakeholders.

I extend my sincere appreciation to the University management, faculties, researchers, students, and partners for their commitment and contributions to the University's research mission. Together, we will continue to push the boundaries of knowledge, inspire discovery and shape a brighter future for generations to come.

The University of Botswana Research and Innovation Policy and Strategy will continue to be guided by Botswana's national development plans to remain relevant, impactful and reflective of national priorities.

Thank you



Introduction

The 2023/2024 Annual Research Report presents an overview of research activity and output at the University of Botswana. As the first Annual Report since the development and approval of the University's revised Corporate Strategy - "Creating a Future for the Knowledge Generation", this report is transitional, in that, the research and outputs reported in this publication were guided by the thematic areas articulated in the 2008 -2021 Research Strategy being;

- Culture, the Arts and Society
- Economic Diversification and Entrepreneurship
- Environmental Systems and Natural Resources Management
- Health
- Indigenous Knowledge Systems
- Minerals, Water and Energy
- Social and Political Development

These broad areas, guided by the priorities of the transitional National Development Plan 12 (NDP 12) remained relevant, and will continue to guide University research initiatives pending the development of the new research strategy and associated operational policies and guidelines as the University rolls out its transformation roadmap.

As will be evident from the outputs, impact, and overall ranking, the University has made significant strides in improving its research performance over the recent past years. This improvement in performance is a good early indicator that the University is already on course to achieve its research strategic goal of 'creating and delivering high quality research and innovation', even before the full roll-out of the new Research Strategy.

The report presents the achievements across the eight (8) faculties, research institutes, and centres of excellence, and highlights some projects of national significance. The report also celebrates the individual achievements of researchers and shows the institution's performance in the areas of research engagement, funding, consultancy services, library and other academic services that support research.

Research Profile

The chart below (Figure 1) shows the University's academic profile responsible for the output presented in the report. The majority of the University's academic staff (over 70 percent) hold the rank of lecturer and senior lecturer as illustrated in the chart below. Research scholars and senior research scholars based at the Okavango Research Institute (ORI) represent 2 percent of the academic population.

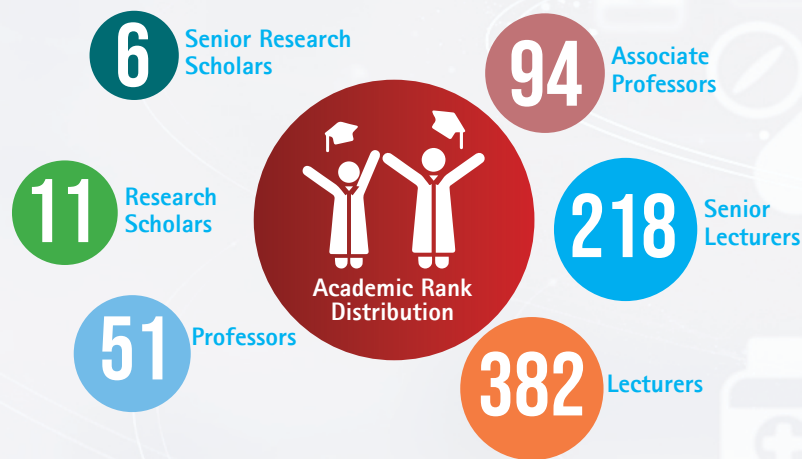


Figure 1: Institutional Research Profile by Split of Academic Ranks



Performance and Rankings – Research Outputs and Impact

The University of Botswana has made notable progress towards its vision of transforming into a distinctive centre of excellence in Botswana, Africa and globally. This is testified by the results of the Times Higher Education (THE) World University Rankings 2023 (figure 2) which ranks universities in accordance with international academic benchmarks. The ranking is based on 18 calibrated performance measures that measure an institution's performance across five (5) areas: teaching, research environment, research quality, industry, and international outlook.

The year under review (2023/24) witnessed a further growth in the number of universities participating in the Times Higher ranking exercise. Out of an estimated total of 29,257 universities that have been established across the world, (2,110 in Africa and 14 in Botswana), The Times Higher Education World University Rankings for 2024 included 1,904 universities from across 108 countries and regions. To be included in the rankings a university must first meet a set of criteria which pre-qualify it to be ranked. A further 769 universities from across the world including 240 from Africa submitted data but failed to meet the criteria.

This places the University of Botswana in the league of globally recognised universities and on the cusp of joining those top tier African universities in the global rankings.

The University has maintained its position as the top ranked university in Botswana. With most of Africa's ranked Universities coming from three (3) populous countries, Egypt, Nigeria, and South Africa, UB's ranking is a significant accomplishment as it represents Botswana's ability as a small state to compete and be visible in Africa and the World.

A central part of UB's Vision is to be a distinctive centre of academic excellence. The Times Higher Education Global Ranking has ranked three (3) subject fields. These are *1) Clinical and Health; 2) Social Sciences and 3) Physical Sciences*. The Subject Rankings uses the same metrics and data as the World University Rankings, but the methodology is calibrated to suit each individual subject. This is set out below for the three subject fields which UB has been ranked, including overall research productivity (Figure 3).

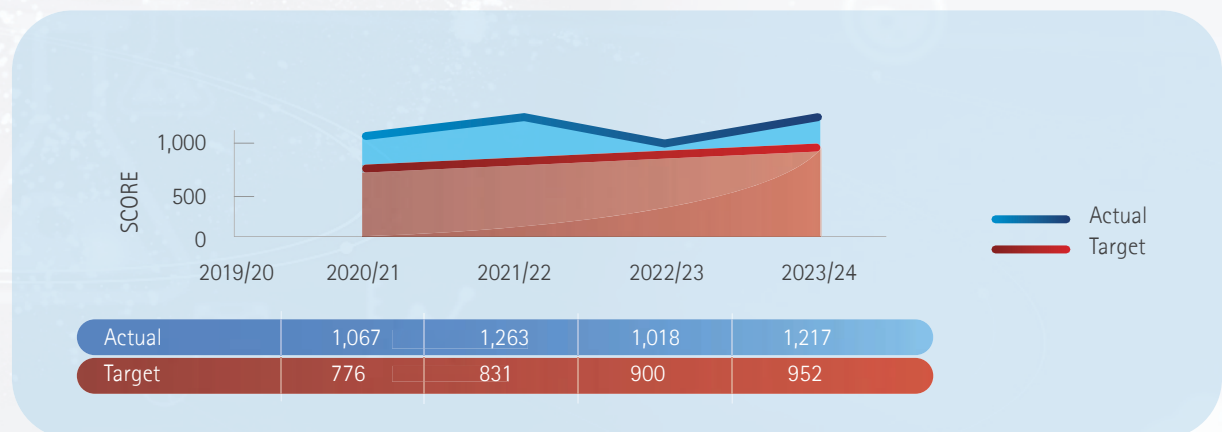


Figure 2: University Global Ranking

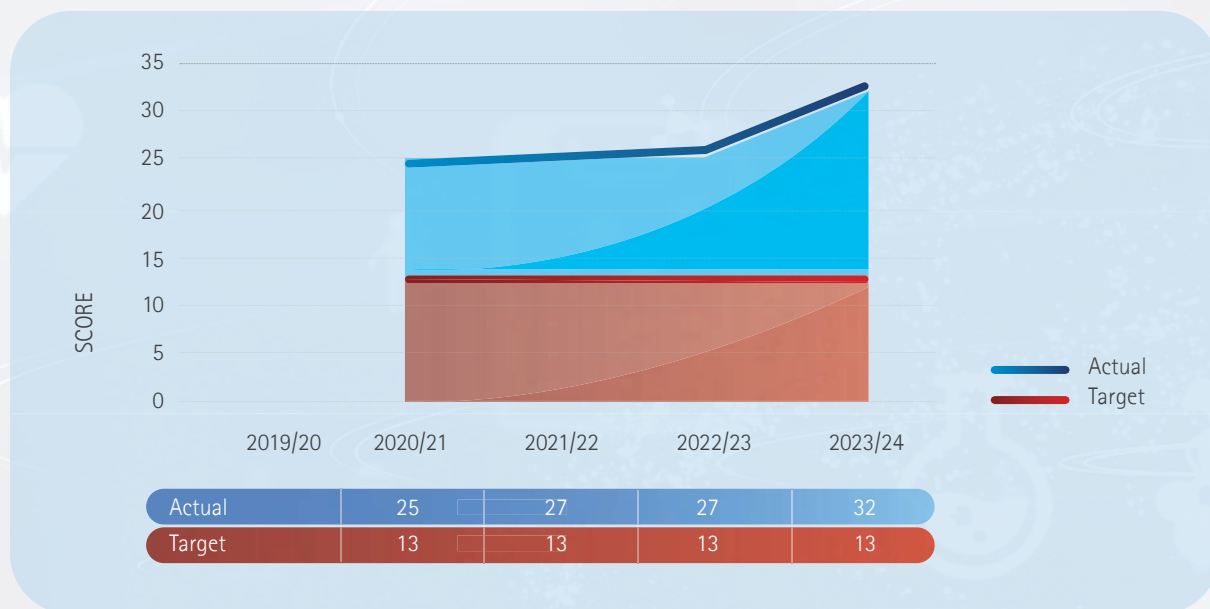


Figure 3: UB Research Productivity

Clinical and Health

The clinical and health subject ranking includes a range of narrower subject areas including (i) Medicine, (ii) Dentistry, and other health related subjects. No university can be ranked unless it has published 1,000 relevant publications over the previous five (5) years. In addition, a publication threshold and an academic staff threshold by discipline must be met. For clinical and health, the threshold has dropped to five (5) hundred papers published in this discipline over the past five (5) years. To meet the staff eligibility criteria an institution needs to have for clinical and health, it must have at least five percent of its academic staff or at least fifty academic staff members in the discipline (Figure 3).

Social Sciences

The Social Sciences subject ranking covers a range of narrower subject areas including (i) Communication and Media Studies; (ii) Politics and International Studies (including Development Studies); (iii) Sociology and (iv) Geography. No university can be ranked unless it has published 1,000 research over the previous five years. In addition, a publication threshold and an academic staff threshold by discipline must be met.



Physical Sciences

The Physical Sciences subject ranking includes a range of narrower subject areas including (i) Mathematics and Statistics; (ii) Physics and Astronomy; (iii) Chemistry; (iv) Geology, Environmental, Earth and Marine Sciences. No University can be ranked unless it has published 1,000 research publications over the previous five (5) years. In addition, a publication threshold and an academic staff threshold by discipline must be met.

The top-ranking universities in all three (3) subject areas ranked by THE are the elite universities in the UK and USA, which are harder than ever to compete with. These are

Oxford (Clinical and Health); Massachusetts Institute of Technology joint first with Stanford (Social Sciences) and California Institute of Technology (Physical Sciences).

Along with the number of universities as well as the number of regions and countries being ranked increasing on a year-by-year basis, this makes UB's performance more than commendable. Clinical and Health clearly excels being ranked amongst the top five hundred (500) global universities in the world. For 2024, all three (3) of the subject areas ranked (Clinical and Health, Physical Sciences and Social Sciences) have improved their performance by maintaining their relative rankings in the face of increasing competition.





Research Outputs And Impact

The institutional level research performance in terms of Outputs and Impact presented in this report is derived from the Times Higher Education World University Rankings Report of 2023. This ranking presents an institution's performance and strength against its peers around the world. Performance on the three Output and Impact measures of i) Research Productivity (Figure 4), ii) Reputation, and iii) Income. While this is an Annual Research Report, it is important to show performance over time, hence the preceding years are included for trend analysis.

Research Productivity: Productivity is measured by counting the number of publications published in the academic journals indexed by Elsevier's Scopus database per scholar, scaled for institutional size and normalized for subject. Scopus is the most inclusive academic performance database). This gives a sense of the University's ability to get papers published in quality peer-reviewed journals.

Research Reputation: University's reputation for research excellence among its peers is based on THE Annual Academic Reputation Survey.

Research Income: Research income is scaled against academic staff numbers and adjusted for Purchasing-Power Parity (PPP).

Research Quality

The University's research quality improved steadily over the past four (4) years. The improvement in citation impact is from 13.7 in 2020/21 to 63.9 in 2023/24, averaging more than a 100 percent per annum. If sustained, this rate of growth should catapult the University to its research intensity goal. The full implementation of a new university strategy and its subordinate strategies for research and innovation will ensure achievement of the institution's research agenda.



Figure 4: Research Quality Trends



Citation Impact: Capturing the average number of times a university's published work is cited by scholars globally.

Three (3) new research quality measures were added in 2023 and are defined as follows by THE, 2024:

- Research Strength measures how the number of citations received by a researcher's publications compares with the average number of citations received by all other similar publications indexed in the Scopus database.
- Research Excellence is calculated by dividing a field's share of a paper within a given country by its global share.
- Research Influence helps us to understand when research is recognised in turn by the most influential research in the world. The metric recognises that the value of citations is not equal: a citation from an "important" paper is more significant than a citation from an "unimportant" one. The method measures the importance of a paper by counting the number of citations and considering the importance of the citing papers and the research subject, as different disciplines have different citation patterns.





Industry Pillar Trends: This measure typically looks at the institution's Industry Income and was recently augmented with patents as a new metric. Following modest but steady improvement between 2020/21 and 2022/23, a decline was noted in this reporting period.

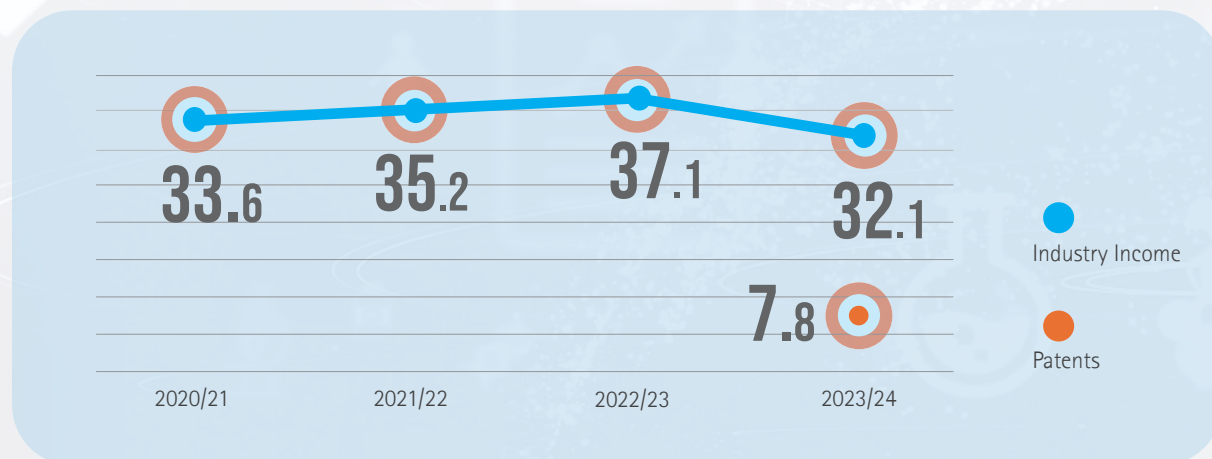


Figure 5: Industry Pillar Trends

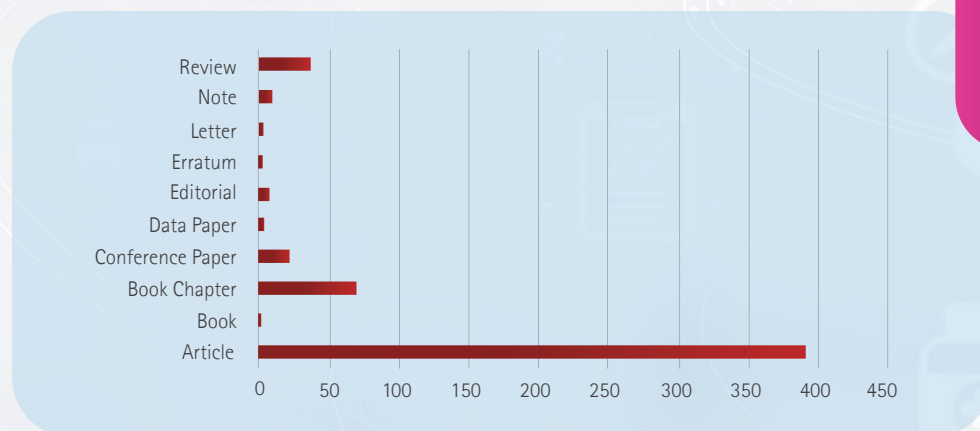
16

Industry Income: A university's ability to help industry with innovations, inventions and consultancy. The metric captures such knowledge-transfer activity by looking at how much research income an institution earns from industry.

Patents: A new metric introduced in 2023, defined as the number of patents from any source that cites research conducted by the University.

Scopus Outputs

Figure 6 shows a summary of all outputs as reported on Scopus for the year. A total of 549 outputs were produced, with journal articles leading the list followed by book chapters.



*A total of
549 OUTPUTS
were
produced*

Figure 6: Number of Outputs in Scopus by Type in 2023



Figure 7 presents the top 10 University of Botswana authors on Scopus, from faculties of Medicine, Science, Health Sciences and Engineering.

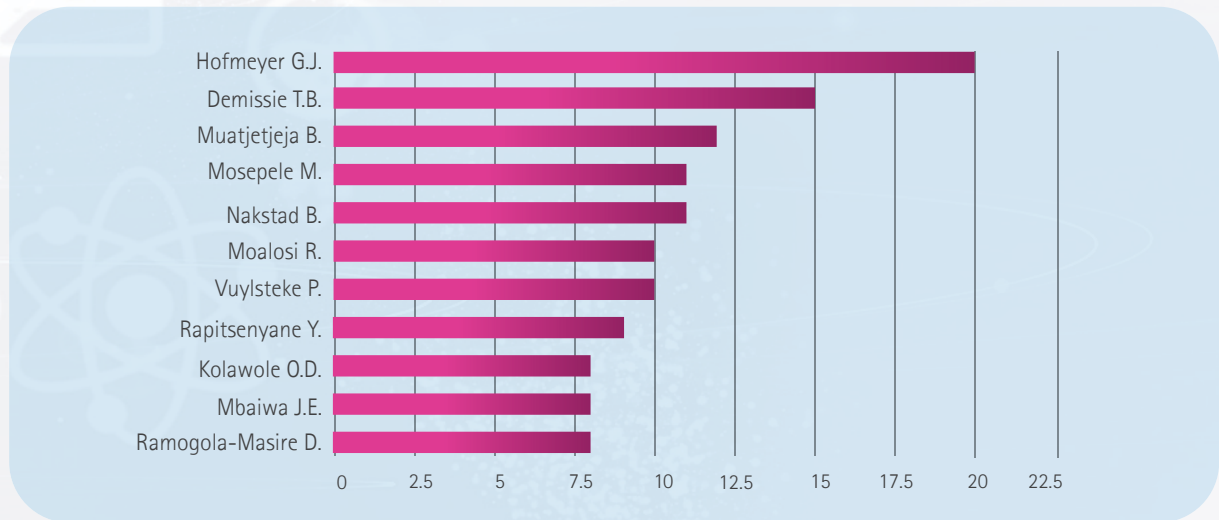


Figure 7: 2023 Top Ten Publishers

Internationalisation

Figure 8, below shows the University's Top 10 international collaborations for research and teaching. The University has practical collaborations with universities across the globe, especially in Europe and North America, many of

which are not listed below. UB's international footprints are also evident in the external sources of its research funding which predominantly comes from United States of America, Canada, Australia, European Commission and other external funders like the United Kingdom Research and Innovation (UKRI) research fund.

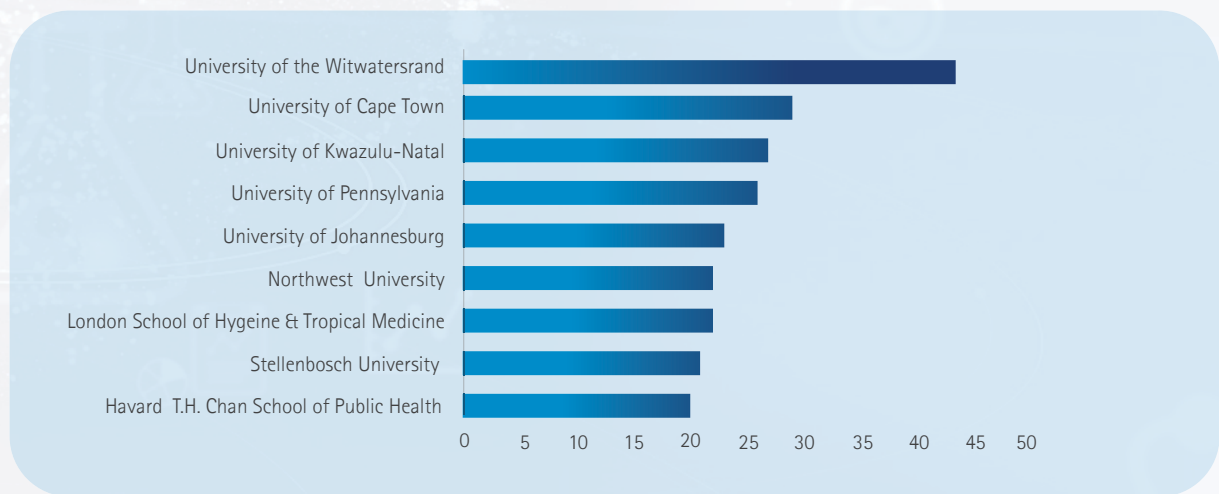


Figure 8: Top UB Collaborators, (source Scopus 2024)



While there was a dip in international joint publications in the reporting year, the University continued to maintain its above-target performance as appears in Figure 9.

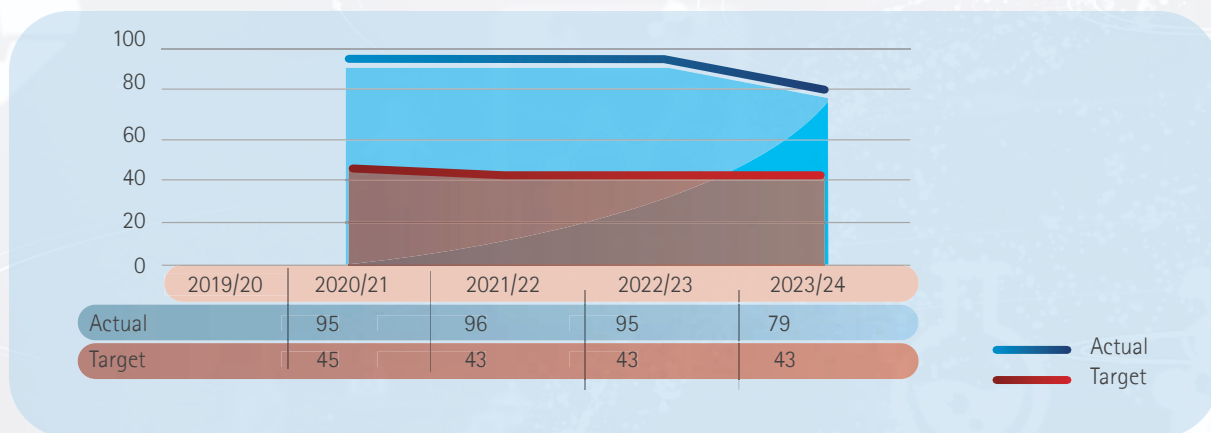


Figure 9: International Joint Publications by Year

Conference Funding

To support and enhance scholarly work, the University annually provides conference funding for academic staff. The purpose of this funding is to support researchers' international dissemination of their research findings and gain the necessary input and feedback from international peers while creating visibility and awareness of the University of Botswana's research output in the global

research space. Conference funding is distributed to faculties based on the past year's research output performance. Funding is allocated as a faculty's percentage contribution to the overall output performance for the year.

As per Figure 10, the bulk of the funding went to Faculty of Science, followed by Social Sciences, Education, Engineering, Medicine, and Health Sciences.

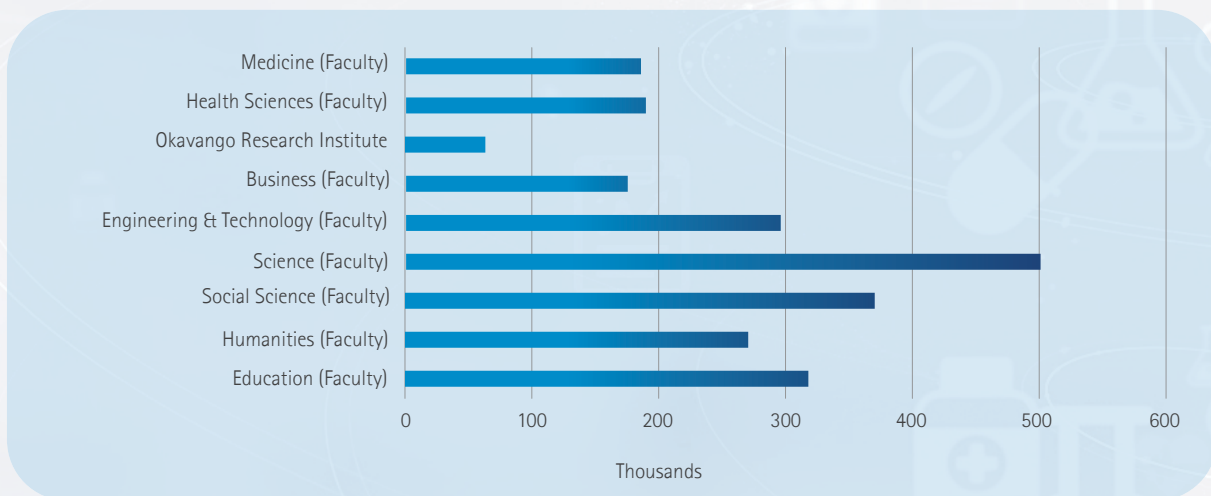


Figure 10: Distribution of the Conference Funds



Office of Research & Development



Acting Director ORD
Mr. Olebile Bolobilwe

Formerly under the Division of Academic Affairs, the Office of Research and Development (ORD) is the central coordination function for University research and implementation of the research strategy. Through its three (3) core functions, the ORD continued to be the research coordination function of University research under the new Division of Research and Innovation. The three (3) core functions include Research Funding, Commercialisation and Consultancies, and Research Ethics, all supported by an Online Systems Management. These functions provide research support and management services

across the research value chain from funding application to protection of research outputs and are supported by a Central Administration function.

Research Funding

The Research Funding unit coordinates all research funding processes and activities from pre-award applications to post-award contracts management. This includes providing guidance and support in external research collaborations for funding. The unit continued to support external funding applications and agreements and administered the University's internal research funding scheme funded through the annual Government subvention. Internal funding supports staff and postgraduate research and serves as a capacity building mechanism for early career researchers while promoting internal multi-disciplinary collaboration.

Figure 11, presents the external funding trend between 2019 and 2024. This represents the total funding amounts received from successful funding applications submitted to international research funders (Grants awarded). This includes sub-applications with other institutions and organisations. The general trend indicates growth in research income, which is expected to increase further in 2024, especially due to the new funding calls introduced by Ministry of Communications Knowledge and Technology's (MCKT) at the beginning of 2024.

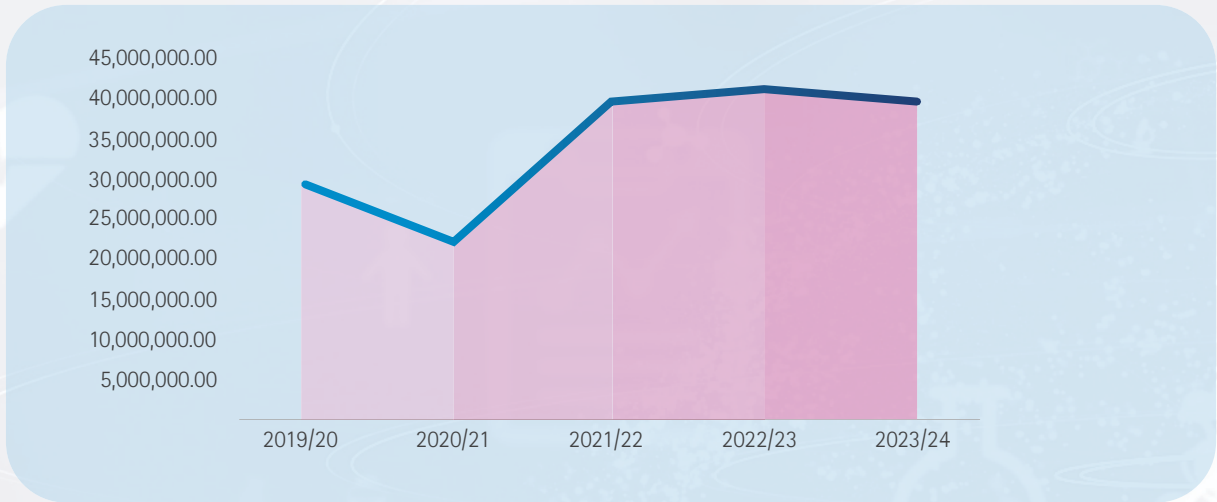


Figure 11: 5-Year External Funding Trend

Research Ethics

The Ethics Unit is responsible for ensuring that all research at UB involving human participants, animals, and hazardous materials, regardless of the source of funding, adheres to internationally accepted ethical principles, the laws of Botswana governing research, as well as UB policies. To ensure the ethical conduct of research at UB, three (3) research oversight sub-committees: the Institutional Review Board, Hazardous Materials, and Animal Care and Use have been established. These standing sub-committees of UB provide oversight for all research conducted by UB staff, students, and affiliates involving human beings, animals, and hazardous materials. Figure 12, shows the number of applications received and cleared for issuance of research permits. The eight (8) applications not cleared in Biomedical department were still undergoing review.

For the year 2023/24, the Unit received about 1,451 submissions for Ethics Review, in addition to amendments, Serious Adverse Events (SAEs), continuing review reports, protocol deviations, and others, ensuring compliance with both international and local ethical standards. These submissions come from a diverse range of stakeholders, including staff, PhD and master's students, as well as undergraduate students, affiliates, and collaborators. Figure 13 shows applications by category. All the applications not cleared were still undergoing review.

Unsurprisingly undergraduate applications represented the bulk of permit applications, which is consistent with their population. It is a requirement for all projects to obtain ethical clearance before implementation.

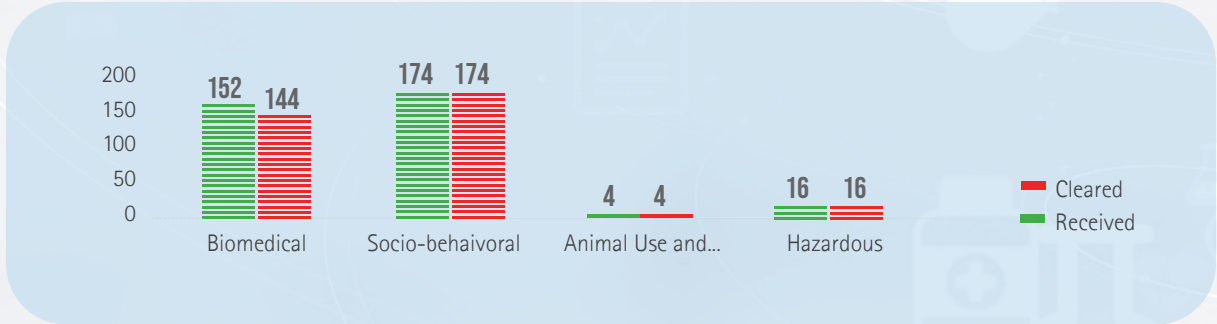


Figure 12: Research Permit Applications by Area

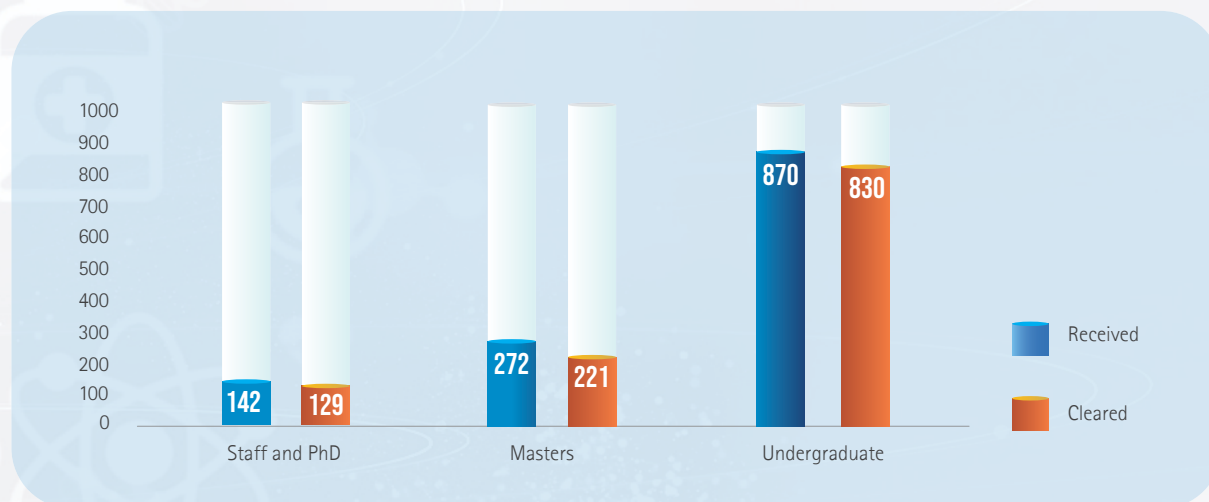


Figure 13: Research Permit Applications by Category

The Ethics Unit benchmarked its ethics review processes against those of the George Washington University (GWU) and the Medical Research Council of Zimbabwe (MRCZ) during a workshop organized by GWU and the Kinshasa University School of Public Health, Democratic Republic of Congo (DRC). Following this exercise, several initiatives aimed at enhancing ethics review processes at the University of Botswana are now under consideration.

The unit anticipates significant expansion to meet the needs of the new research strategic goals, going ahead. This restructuring is expected to lead to the increase in the staff establishment of the Unit, thus enabling the expansion of services. The enhanced capacity will especially provide the necessary oversight, training, education, and support across the entire research spectrum and ensure the integrity of research conducted by the University.

Research Commercialisation and Consultancies

Research commercialisation refers to the process of translating academic research findings and innovations into commercially viable products, services, or processes that benefit society and generate economic and societal value.

Consultancy Services

Consultancy services at University of Botswana leverage the diverse expertise across disciplines, from Arts and Humanities, Social Sciences, Education, Business, Science, Engineering and Technology, to Clinical Medicine and Health Sciences. Staff members provide practical solutions and innovations, including knowledge transfer, industry engagement, while generating revenue. Consultancy clients include Government ministries, parastatal organisations, financial institutions, private companies and international agencies including international development Agencies (FAO, WHO, UNICEF, UNFPA, UNWTO), MasterCard Foundation, SADC, GIZ German Development Cooperation and The World Bank.

The University provided consultancy services to various client groups during the reporting year. The bulk of the consultancy requests were from the private and non-governmental sectors as evident in Figure 14.

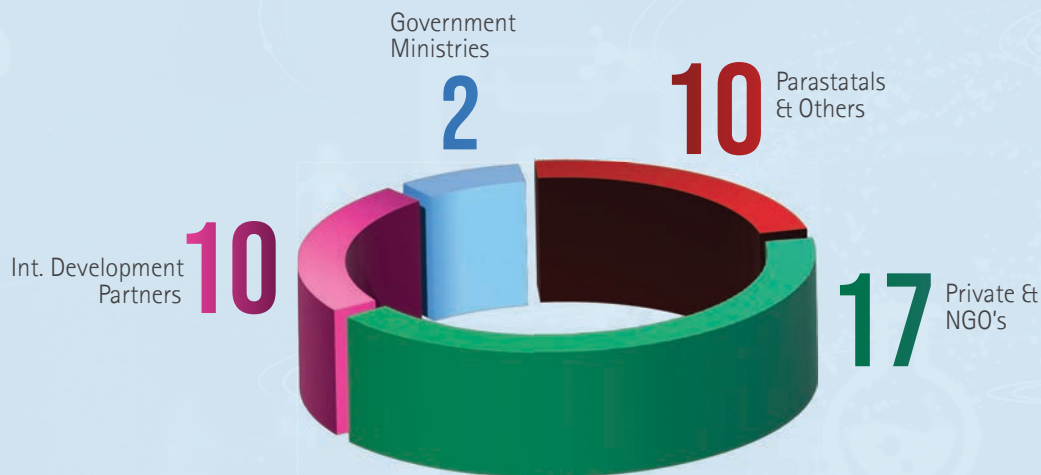


Figure 14: Consultancies by Client Sector

Beyond direct research management, the Office of Research and Development provides other administrative support services through its administration function. The suite of professional services will be greatly expanded in the new strategy in line with the University's research intensification objectives, and desire to increase third stream income.

Research Support Engagement

- The Office of Research and Development significantly participated in the 2023 Strengthening Research and Innovation Management (SRIM II) Conference by leading three (3) workshops on Research Ethics, Research Funding and Collaborations, and Intellectual Property.
- The University, through the ORD, was co-organizer and participant of the SRIM II Symposium held from the 9th - 11th August 2023 in collaboration with the Ministry of Communications, Knowledge and Technology (MCKT). Three (3) research management units led three (3) pre-conference workshops at Botswana Innovation and Technology Research Institute (BITRI) and made 10 presentations at the

main conference at Phakalane Golf Estate.

- The ORD hosted and facilitated a national workshop on "Technology Transfer – Building a Strong Foundation". The session was presented by Dr. Andrew Bailey from the Southern African Research and Innovation Management Association (SARIMA) and was attended by UB researchers and others.

Research Capacity Development

The University's ability to deliver high quality research depends on the capacity of its researchers and support services, which need to be continuously developed and nurtured. This happens through skills development as well as exposure to advanced research environments and infrastructure with the aim of adopting any transferable best practices to UB by its researchers. In 2023, the University took advantage of its wide network of collaborators, to send two (2) of its researchers on research fellowships to the United States of America (USA). This was done through direct financial support for travel and living expenses at two (2) American Universities. A research management (research ethics) professional also started a postdoctoral fellowship at the end of 2023, which ended 31st May 2024.



Senior Research Fellow
Prof. Sununguko Wata Mpoloka

Research Fellowship at University of Pennsylvania

Prof. Sununguko Wata Mpoloka of Biological Sciences, Faculty of Science went on a three (3) month attachment at the University of Pennsylvania (UPenn), in the United States America (USA) from March 2023, as a Research Fellow on animal diseases vaccine. Prof. Mpoloka's current research is focused on Foot and Mouth Disease and Lumpy Skin Disease. The full costs of the three (3) months' attachment were funded by the University of Botswana (UB).

During his stay at UPenn, Prof. Mpoloka was affiliated with the Genetics Department under the Tishkoff Lab, as well as the School of Veterinary Medicine under the Infectious Diseases Institute in Drew Weissman's Lab. He took part in a series of seminars and attended some lab meetings. His focus in the Weissman Lab, was to understand the mRNA technology which is fundamental in the production of mRNA vaccines.

Mpoloka also had an opportunity to meet other faculty members at UPenn to build linkages and potential collaboration avenues. One such meeting was with the Director of the Penn Center for Global Health at the University of Pennsylvania Perelman School of Medicine Glen Gaulton. He discussed therapeutics, the possibility of looking at joint grant applications, and potential for grant management training.

The way forward from the UPenn training is to set up a Core Facility for in vitro transcribed (IVT) mRNA production to service national and regional requirements. Linkages are being established with the African Vaccine Manufacturers Initiative (AVMI) in South Africa and membership has already been requested. The AVMI is looking beyond the provision of vaccines in emergency situations and aims to coordinate efforts of African vaccine manufacturers and other interested parties, who have a vision to see Africa produce its own vaccines and biologicals for both routine and emergency situations.



Research Fellow
Dr Daniel Loeto

Research Fellowship at Edison Biotechnology Institute

In January 2023, Dr. Daniel Loeto in the Faculty of Science completed a research fellowship at the Edison Biotechnology Institute (EBI), a research institute of Ohio in United States of America. The 2.5 months visit, which commenced on the 31st of October 2022 was fully funded by the University of Botswana.

During the fellowship, Dr. Loeto underwent training in the Natural Products Lab headed by Dr Yong Han, assisted by Dr. Raquel Marchan Rivadeneira, working under the auspices of Dr Shiyong Wu's lab in the following areas.
(See page 23)



From L to R: Dr Yong Han, Dr Daniel Loeto, Alendria Montavon, Carolina Portero, Dr Raquel Marchan Rivandeneira.

Data Mining: This training by Dr. Raquel Marchan Rivandeneira, introduced Dr Loeto to time saving and purposeful approach to discovery of microorganisms' biomolecules with novel activity. In this approach, genomics and associated platforms are used to narrow the search to a few microorganisms with a known track of producing bioactive metabolites. This approach saves time and costs, since one skips doing traditional blind-folded searches that use a lot of reagents and takes too long to complete.

Natural Product Research: Led by Dr Yong Han, the training introduced Dr Loeto to detailed processes of natural products research and drug discovery.

He sharpened his skills in conducting molecular biology techniques such as gene cloning, western blot, vector construction and plasmid analysis during the fellowship. The knowledge from the natural research labs has positively impacted his work locally, making it more purpose-driven and cost effective.

The collaborative networks that Dr. Loeto established are expected to lead to more concrete agreements in areas of mutual research interest and research service materials with the Edison Biotechnology Institute. The fellowship has also opened opportunities for collaboration with the EBI in external funding applications in the areas of mutual interest.



UNESCO Chair
Dr. Susan Keitumetse

United Nations Educational, Scientific and Cultural Organization (UNESCO) Chair on African Heritage Studies and Sustainable Development

The UNESCO Chair on African Heritage Studies and Sustainable Development was awarded to the University of Botswana in 2020 and became fully operational in 2021. This Chair aligns with UNESCO's Strategy of prioritising Africa and focuses on two key conventions: the 1972 Convention on the Protection of World Cultural and Natural Heritage and the 2003 Convention on the Safeguarding of Intangible Cultural Heritage.

Objectives:

- Promote research, training, information sharing, and documentation linking African heritage and sustainable development.
- Facilitate collaboration among academics, practitioners, society, and policymakers in Botswana and globally.

Key Activities and Achievements:

- Engaged in UNESCO's World Heritage Centre, Intangible Cultural Heritage (ICH) section, and Education section activities.
- Contributed to the "Zero Draft for a Pact for the Future."
- Mobilised and capacitated government policy and local community members.
- Influenced national policy revisions, including the Botswana Tourism Policy.
- Participated in a national conservation film by the Botswana Wild Bird Trust.
- Successful proposal for "Heritage Place Labs" with Botswana National Museum and community members, focusing on the Okavango World Heritage Site.
- Co-creating a Strategic Framework for Higher Education and Technical and Vocational Education and Training (TVET) in SADC.
- Online Training of Trainers course on new periodic reporting for ICH.
- Facilitating heritage projects in Manyana and Kasane communities.
- Participation in a 2024 documentary film on the Okavango Delta.

Future Outlook:

- The Chair will be working on securing funding for cultural practitioners' residencies at the University of Botswana.
- Publishing a book on post/colonial heritages in 2025.
- Identifying student funding for heritage research.





United Nations
Educational, Scientific and
Cultural Organization

UNESCO Chair on African Heritage
Studies and Sustainable Development
University of Botswana
Botswana

General Objective

The purpose of the Chair shall be to promote an integrated system of research, training, information sharing and documentation of the link between African Heritage and Sustainable Development by facilitating collaboration between academics, practitioners, society, and policy makers in Botswana and around the world.

Specific Objectives

- 1 Create and maintain platform to disseminate knowledge on the UNESCO 1972 Convention on World Heritage and UNESCO 2003 Convention on Safeguarding of the Intangible Cultural Heritage (ICH).
- 2 Build capacity on heritage conservation for sustainable development.
- 3 Conduct research on heritage conservation and disseminate results.
- 4 Promote cross-sector and cross-boarder interaction and collaboration among relevant stakeholders in heritage and sustainability matters;
- 5 Cooperate closely with UNESCO and other UNESCO Chairs in relevant Programme activities

Block 101

 **ubheritageunesco@ub.ac.bw**
(+267) 355-5829



Assistant Director for Research Ethics
Dr. Dimpho Ralefala

Bioethics Post-Doctoral Fellowship

Dr. Dimpho Ralefala, the Assistant Director for Research Ethics at the Office of Research and Development, received an award of advanced Bioethics Post-Doctoral Fellowship. This 18-month programme was offered by the Johns Hopkins Berman Institute of Bioethics (BI),

Makerere University College of Health Sciences (MakCHS) and the University of Oxford Ethox Centre (Ethox). Funded by the Fogarty International Center, National Institutes of Health, USA, the fellowship focuses on global health ethics, allowing fellows to specialise in areas such as global infectious disease ethics or advanced international research ethics.

The fellowship, which commenced in January 2024 with a 4.5 months residency at Johns Hopkins University, involved the completion of activities across multiple institutional contexts. This included a one (1) month residency at MakCHS in Kampala, Uganda, and one (1) month at Ethox in Oxford, United Kingdom (UK). The remaining 11.5 months will be spent at her home institution.

As a fellow in the programme, Dr. Ralefala has opportunities for Bioethics mentorship, coursework, seminars, grant writing and networking. She is expected to conduct independent and collaborative research under mentorship and engage in academic writing. Additionally, she will attend international conferences on global health and research ethics. As part of this fellowship, Dr. Ralefala currently serves on the Planning Committee for the 2024 Oxford Global Health and Bioethics International Conference. Furthermore, she will develop and implement a funded leadership project focused on global health ethics.



School Of Graduate Studies



Acting Dean
Prof. Agreement L. Jotia

Dean of Graduate Studies Statement

The School of Graduate Studies (SGS) is mandated with coordination of all aspects of graduate student programmes, from admission to graduation. Since enrolment of its first PhD candidates in the academic year 1995/96, our graduate school as evident in its programmes offering, has grown immensely. The school prides itself in a diversity of academic paths offering Masters, MPhil, and PhD programmes. The SGS experienced significant increase in its graduation output in 2023, surpassing all the past four (4) years (table 1). In total, the SGS graduated a total of 333 students (313 Masters, 3 MPhil and 17 PhD) in 2023.

Year	2019	2020	2021	2022	2023
Total Graduates (All Programmes)	260	273	304	275	333

Table 1: Number of Graduates/Year

These statistics are directly linked to the deliberate current UB strategy on Creating a Future for the Knowledge Generation 2020-2029. Taking a lead role in the production of the skilled human capital for the knowledge-based economy, to nurture the national development agenda is

at the core of this strategy. The statistics also cements the University of Botswana's mission statement, *"To provide quality education, research, innovation and engagement for sustainable national development and global impact"*.



Figure 15 presents the University's PhD enrolment over the five (5) years from 2019/20. The Figure shows a recovery in the current reporting period from the 2021 – 2022 dip.

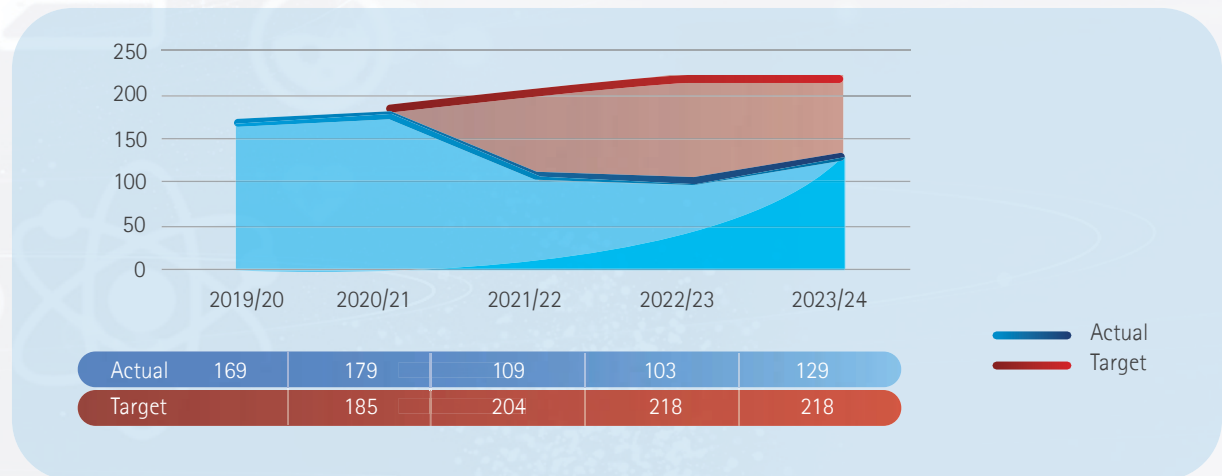


Figure 15: PhD Students Enrolment by Year

The university produced 149 master's degrees and 16 PhD graduates in 2023. Faculties of Education and Social Sciences, followed by Engineering and Technology, and Medicine produced most of the graduates. Overall, 165 postgraduate awards were conferred.

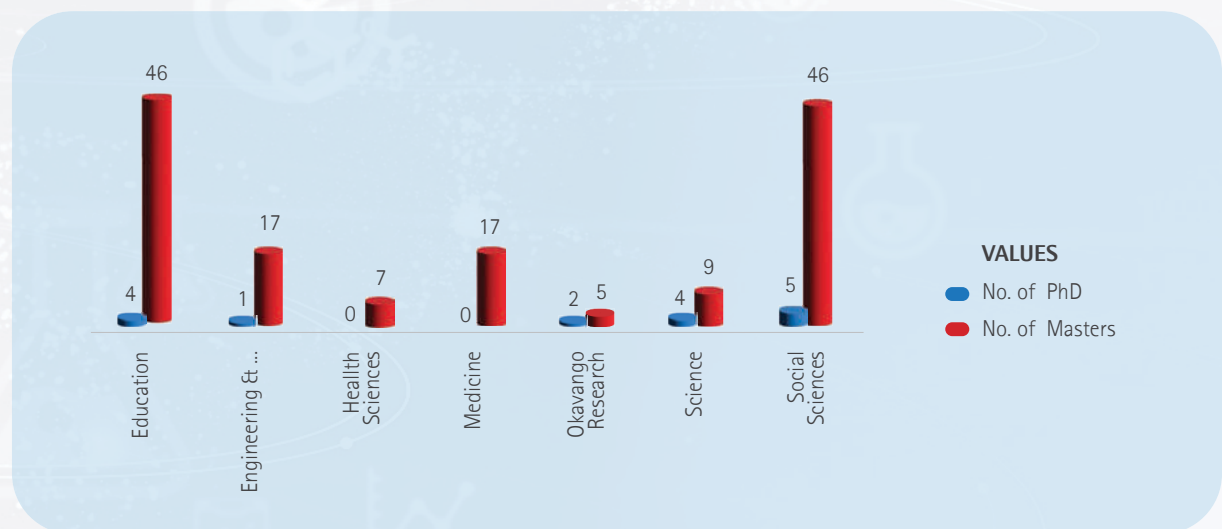


Figure 16: Postgraduate Awards by Faculty



A person wearing a white lab coat is holding a large, clear glass flask with both hands. The flask has two side arms with stoppers. The background is a blurred laboratory setting. A green rectangular box with white text is overlaid on the center of the image.

Faculty of Science



Acting Dean
Prof. Moffat P. Setshogo

From the Dean's Desk

The Faculty of Science conducts research across its diverse disciplines. Research in the faculty has progressed quite significantly in the last decade to become multidisciplinary, thus enabling a multipronged approach towards a better understanding of societal challenges, come up with solutions to the identified problems addressed. The main focus areas of faculty research are HIV/AIDS, natural products chemistry, and climate change. The challenges brought about by opportunistic infections, antiviral and antibacterial resistance of pathogens to medicines has necessitated a search for a better understanding of these.

Microbial resistance to synthetic drugs has also meant that focus now shifts to the search for active ingredients in natural products. This has enabled researchers to exploit indigenous knowledge on disease cures, creating the need for collaborative work between scientists and indigenous knowledge holders.

Effects of climate change are being felt world-wide, and no less so in Botswana. Livelihoods are at a risk of being

lost, hence the need to come up with relevant mitigation and adaptive measures. Climate impact is particularly felt in the agricultural sector because of erratic and reduced rainfall. Some of the research in the faculty therefore focuses on these areas to influence policy on climate smart adaptations.

Long term research in the Faculty of Science is geared towards achieving the goals set out in the Botswana's Vision 2036, principles of the African Agenda 2063 and the United Nations Sustainable Development Goals (UNSDGs). The main theme of the nation's Vision 2036 is prosperity for all, and this is being guided by four (4) pillars. The Faculty of Science research straddles the various pillars, more especially pillars one (1) to three (3) being sustainable economic growth, human social development, and sustainable environment. The faculty, therefore, has ongoing research on health and social wellbeing, sustainable use of natural resources and climate change. The aim is to pursue research that is guided by societal needs and hence influence policy and programmes.

The Faculty of Science conducted research across its six (6) Departments as illustrated in Figure 17 below. The leading department by research output during the reporting year was the Chemistry Department with more than 40 outputs. The outputs include journal articles, book chapters, books and bulletins. Research output per staff member averaged 0.99 per capita based on total outputs divided by total number of staff (146/148).

Research Outputs

The Chemistry Department produced the bulk of the journal articles followed by Environmental Science and Biological Sciences. Environmental also produced the bulk of the Faculty's book chapters, around the same number as journal articles.

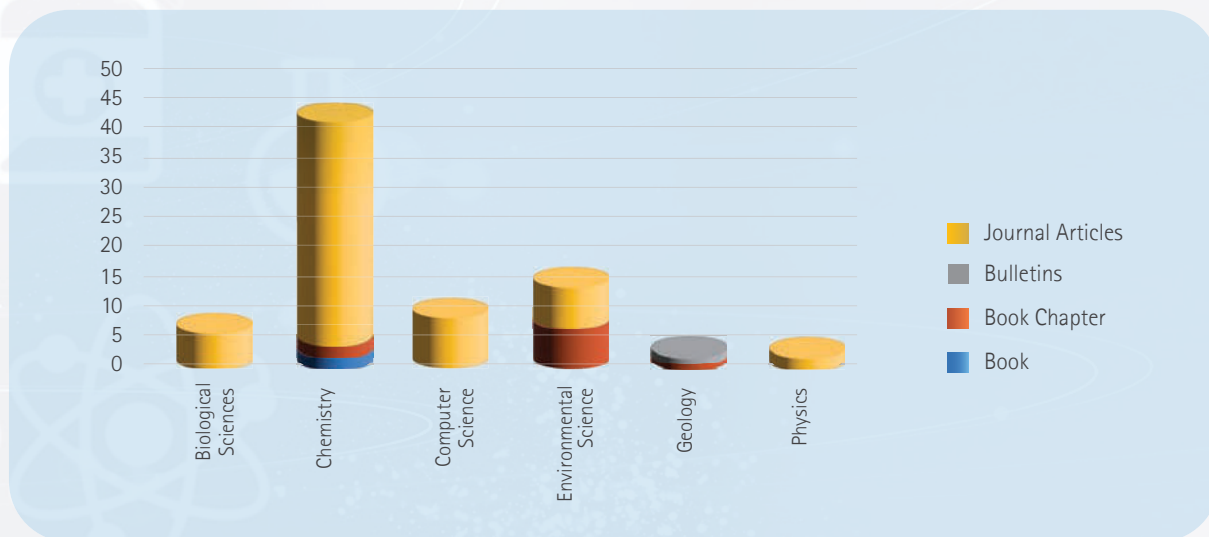


Figure 17: 2023 Total Outputs by Department

Funded Research Projects

The Faculty received the research grants listed below from external funders as well as the University. External funding was received in different foreign currencies and

converted to BWP for standardisation purposes. The amounts represent the total awarded amount which will be disbursed over the life of the project.





	Project Title	Total Funding (BWP)	Principal Investigator	Funder
1	Utilising data science to predict and improve health outcomes in paediatric HIV (DSpace Project)	9,644,355.00	Dr. Gaone Retshabile	National Health Institute
2	Phytochemical Investigation of Kniphofia Species for Antimalarial Compounds	249,269.00	Prof. Taye Demissie	University of Botswana
3	Phytochemical investigation of selected medicinal plants used traditionally to treat diabetes in parts of Botswana	249,532.00	Prof. Taye Demissie	University of Botswana
4	Focus on African Space science and Technology for Future development (FAST4Future)	1,513,169.00	Dr. Rapelang Simon	European Commission, ERASMUS+
5	Production and application of green surfactants for bioremediation strategies	242,248.90	Dr. Japheth Ombito	University of Botswana
6	Educational Partnership for Innovation with Communities (EPIC)	107,756.00	Prof. H. Masundire	US National Science Foundation
7	Towards Open Science Communities Development in Sub-Saharan Africa Region	1,708,159.00	Dr. A. Masizana	European Commission
8	Development of eHealth Enterprise Architecture for Botswana, Global Health Sciences at the University of California San Francisco	565,885.00	Dr. A. Masizana	Centers for Disease Control
9	Development of a machine learning-based model for COVID-19 Mortality Prediction in Botswana	103,000.00	Dr. A. Masizana	University of Botswana
10	Climate change and climate change community knowledge exchange	385,836.00	Prof. J. Perkins	Global Challenges Research Fund
11	Conversion of petrol-powered vehicle to electric vehicle	181,500.00	Dr. M. Moidaki	University of Botswana
12	Exploring the factors controlling the occurrence of groundwater in the Khakhea-Bray Transboundary Aquifer, South-East Botswana	165,000.00	Prof. R.T. Ranganai	Southern Africa Development Community

Table 2: Research Grants Received



Major Projects



Prof. Hillary Masundire

The EPIC Project – a Triple Helix Collaboration

The Educational Partnership for Innovation with Communities, (EPIC), is a collaborative project between Gaborone City Council (GCC), and the University of Botswana through the Faculty of Science. The project led by Professor Hillary Masundire, is a result of a Memorandum of Understanding (MoU) that GCC and UB entered in 2019, to enable continuous knowledge sharing. The EPIC Model is premised on a tripartite partnership involving University staff and students (UB), local authority (GCC), and communities (Gaborone City dwellers). The model is student focused.

Cooperation on the project is to be achieved through various activities including:

- Research cooperation in areas such as waste management, environmental sustainability, and climate change.
- Skills development through long- and short-term training needs for the Gaborone City Council (GCC) leadership and staff.

- Develop Gaborone as a Learning City.
- Explore areas that could increase tourism to attract tourists' traffic to Gaborone.
- Collaborate on cultural, activities that promote the rich history of Gaborone and Botswana.
- Collaboratively use Gaborone open spaces to enhance the city's landscape.

Since February 2020, the project has conducted several training sessions for GCC leadership and staff. Ten UB academic staff from various Departments and Faculties (Biological Sciences, Computer Science, Chemistry, Environmental Science, Physics, History/Archaeology and Social Sciences) took part in the training that was led by two (2) colleagues from the EPIC- Africa Network Leadership. Following the joint training course, GCC identified a list of challenges that UB could find solutions to, which include:

1. Development of Sustainability Strategy and Model for the city.
2. Waste Management.
3. Fleet Management.
4. Integration of Planning of Design of Infrastructure Development.
5. Develop and manage open spaces to enhance city landscape.
6. Rates Collection Strategy.
7. Collaborate and develop a pot-hole patching technique.
8. Street Lighting.

The University identified waste management as an immediate research focus and worked with the Environmental Health Department of GCC and management of the Gamodubu Regional Landfill site. GCC organised a tour of the Gamodubu Regional Landfill for UB staff and students in February 2023. A group of four (4) staff from Biological Sciences Department; Prof Barson, Dr Ditlhogo, Prof Mpoloka and Prof Masundire are supervising seven (7) undergraduate students working on waste management projects - six (6) on the Gamodubu Regional Landfill Site in Kweneng District, and one (1)



on wastewater from Glen Valley Wastewater Treatment Plant. The EPIC-Africa Network provided US\$8000.00 to support the research costs for these undergraduate research projects.

Gaborone City Council contributes 65 percent of the solid waste delivered at the landfill site. This has increased from 62 percent in 2021 to 65 percent in 2023.

The seven (7) students presented results of their work at an EPIC Seminar that was attended by staff from GCC Gamodubu Landfill Management staff as well as Kweneng District Council.

The student projects are on:

- Is there life in the leachate pond at Gamodubu Landfill site? – *Changu Morelle*
- Heavy metal contamination of soil fauna – *Bonno Mauza*
- Heavy metal contamination of herbaceous plants – *Tshepang Thuthuka*

- Heavy metal contamination of woody plants – *Keitumetse Frank*
- Presence of heavy metals in ground water – *Onkemetse Shimane*
- Diversity of birds at the landfill site – *Gonte Connie Kgalalelo*
- Molecular characterisation of gastrointestinal parasites in wastewater effluent – *Bontle Ngazimbi*
- Antibiotics in wastewater – *Gosego Serema*

The results revealed that, despite several challenges, the Regional Landfill is functioning well. The leachate from the landfill does not contain the excessive amounts of heavy metals as observed in landfill leachate elsewhere. This is most likely because more than 80 percent of the solid waste is domestic and builders' rubble. There are not many potential sources of heavy metals. The lining at the bottom of the solid waste cells, and of the leachate dam is effective in preventing contamination of soil and groundwater. There is no significant contamination of the soil or vegetation.



Wastewater

There are two (2) aspects of wastewater under investigation:

1. To investigate antibiotics and gastrointestinal parasites in raw sewage and treated wastewater discharged from the Glen Valley Wastewater Treatment Plant. Concern in this regard stems from the fact that treated wastewater is being used to irrigate various horticultural crops including leafy vegetables.
 - Commonly used antibiotics were found to be present in treated wastewater effluent, even as far as 10km downstream from the discharge point.
2. Two (2) gastrointestinal parasites, that are responsible for diarrheal diseases, Giardia and Cryptosporidium, are being investigated. Only Giardia was identified using a microscope. More work still needs to be done to characterise these parasites using molecular techniques.

The strength of the EPIC Model lies in that:

- It is student-centred; students carry out research on real life issues, thus contributing to solutions to problems faced by the community.
- University academic staff guide and supervise this research thus making the University relevant to its society.
- Council get work done at minimum cost compared to what Council would pay for the same work to be done by private consultancy teams.
- The GCC-UB MoU provides an enabling environment for this kind of collaboration to flourish.

Prof Masundire presented the UB EPIC project results at the Sustainable Research and Innovation (SRI) Conference that took place from the 21st - 24th May 2024.

The Learner's Voice

"Participating on this project helped me to gain hands-on experience in environmental sampling, laboratory analysis, and data interpretation, develop specialized knowledge in soil ecology, biodiversity, and heavy metal

contamination, enhance your resume and academic credentials with a significant research project and to collaborate with experts in environmental science and waste management." – Bonno Mauza

"Personally, this project helped boost my confidence and sense of accomplishment as I was able to contribute knowledge in my area of interest. I was able to apply myself in both the field and indoors during presentation. This project has opened my eyes of the necessity of 3R (Reduce, Re-Use, Recycle)." – Tshepang Thuthuka

"EPIC has given me extreme benefits, and these involve the provision of sponsorship that covered our transport fees and materials that were needed to undertake the research. EPIC also has helped me have insight into real life situations. The programme has helped me indulge my skills on environmental impact." – Keitumetse Frank

"Participation in this project helped in equipping me with the skills in bird identification and quantification, and it also helped me to acknowledge the importance of birds in our environment from the literature that I considered during data analysis. It also enhanced my resume, working in a project under EPIC as one of the researchers was a privilege" – Gonte Connie Kgalelelo





Other Research Engagement Activities

1. A Regional Workshop on Improving Climate Change Adaptation and Resilience in the Kalahari Basin with Earth Observation Data was opened by the British High Commissioner and held at the UB Conference Centre, 11th–13th December 2023.
2. Prof. O.P. Dube and other researchers produced the Science and Technology Vision Paper, April 2023 for World Meteorology Organisation (WMO) in her capacity as a member of the organisation's Scientific Advisory Panel (SAP). SAP provide forward-looking strategic advice on emerging scientific challenges and opportunities to Congress and to the Executive Council on matters concerning WMO research strategies and the optimal scientific directions to support the evolution of its mandate in weather, climate, water, and related environmental and social sciences.
3. Prof. O. P. Dube and 14 other members of the Independent Group of Scientists, appointed by the United Nations Secretary General, produced the United Nations Global Sustainable Development Report of 2023 (UN GSDR2023) on Times of Crisis, Times of Change, Science for Accelerating Transformations to Sustainable Development. <https://sdgs.un.org/gsdr/gsdr2023>. The report was produced in September 2023.
4. Prof N. Tafesse, Prof R. Mapeo and Dr K Laletsang, have been investigating the Hatsalatladi and Ditshukudu villages ground fissures since 2022.
5. Prof N. Tafesse, from Geology department is currently undertaking a study and design of saline/brackish groundwater use options project in the Kgalagadi District since 2020.
6. Prof N. Tafesse and Dr K. Laletsang, have been conducting Monganakodu Ward Seepage Investigations in Taung Village since 2022.



Research Excellence Awards and Appointments

- ABSA Bank Water Sustainability Award (in collaboration with BITRI), BWP200 000.00 (Dr. Kabomo (Chemistry) & BITRI).
- Prof Ben Muatjetjeja, Department of Mathematics was appointed Extra-Ordinary Professor by the University of North-West, South Africa.

Looking Forward

- The Faculty will upgrade the e-Health Research Unit in the Computer Science Department to an e-Health Research Centre
- Currently Prof J. Perkins in the Department of



Environmental Science is working with Prof G. Kiker and Prof J. Judge at the University of Florida and WildCru to develop the Kalahari-Rift Valley (KALARIVA) concept with funding from the National Aeronautical Space Administration (NASA).

- The Faculty is working on several initiatives to facilitate and enhance research activity and output:
- Formation of research groups.
- Facilitation of postgraduates' intake.
- The Mathematics Department will lead the promotion of research mentoring.





Faculty of Engineering and Technology (FET)





Acting Dean
Prof. Edward Dintwa

42

From The Dean's Desk

The Faculty of Engineering and Technology (FET) boasts several strengths that enable it to engage in impactful research and innovations. The faculty boasts:

- A critical mass of experienced researchers with phd qualification to engage in meaningful research across many disciplines.
- A good number of experienced senior academics (professoriate) to lead research teams in various disciplines.
- Sufficient facilities and space for conducting laboratory experiments and fabrication of experimental set-ups.
- An academic team that is very eager to engage in research, and
- dynamic and innovative students who can be harnessed to provide research manpower.

The Faculty's key research niche areas are:

- Clean Energy systems (Biofuels, Wind and Solar, and their intelligent integration into the national power grids).
- Climate Change, Water and Sanitation Systems.
- Manufacturing Systems and Productivity Improvement.

- Mechanisation & Innovative Technologies.
- In Situ Urbanization and Land Use.
- Climate Change, Water and Wastewater Systems.
- Rapid Prototyping/Additive Manufacturing.
- Computational Modelling Computational Fluid Dynamics.
- Design Practice and Design Education.
- E-mobility systems.

In the immediate to medium term, the following shall be the Research Priority Areas in the Faculty:

Clean Energy Systems

- Solar Energy Systems, Biofuels
- Development of high-temperature thermal energy storage battery using locally sourced Botswana sand.

Circular Economy

- Non-ferrous metal recycling (e.g. aluminium, copper, nickel, lead, zinc recycling) potentials.

Computational Modelling Computational Fluid Dynamics

- Computational Particle and Fluid Dynamics of Inhaled Particulate Matters (PMs) in the Human Airway Systemic Regions.

In Situ Urbanisation, Land Use, Real Estate, Space Design

- Optimising Land Use Planning: Value Dynamics Modelling in Land Administration Domain Models.
- Transcending Profitability Modelling: Navigating Broader Impact Issues in Feasibility and Viability Appraisals.
- Investigating the Spatial Implications of Domestic Events Tourism in Botswana: A Case Study of the Khawa Dune Challenge & Makgadikgadi Epic Events.
- Sustainable land and housing delivery in urban and peri-urban areas of Botswana.
- Greening the Built Environment Curriculum through Sustainability Lens: A Pre-Post Evaluation Agenda.
- Space Management in Religious Settings through the Lens of Pew Ergonomics and Musculoskeletal Disorders.



Mechanisation & Innovative Technologies

- Development of an integrated ventilator and oxygen concentrator.

Climate Change, Water and Wastewater Systems

- Investigating the factors for full adoption of the Water-Energy-Food nexus in Botswana's farming enterprises.

Research Output

The Faculty of Engineering and Technology, with 77 academic staff spread across five (5) departments, produced an overall per capita scholarly output of 2.03. The referred per capita output for referred journals was 1.03 for 2023 (Figure 18).

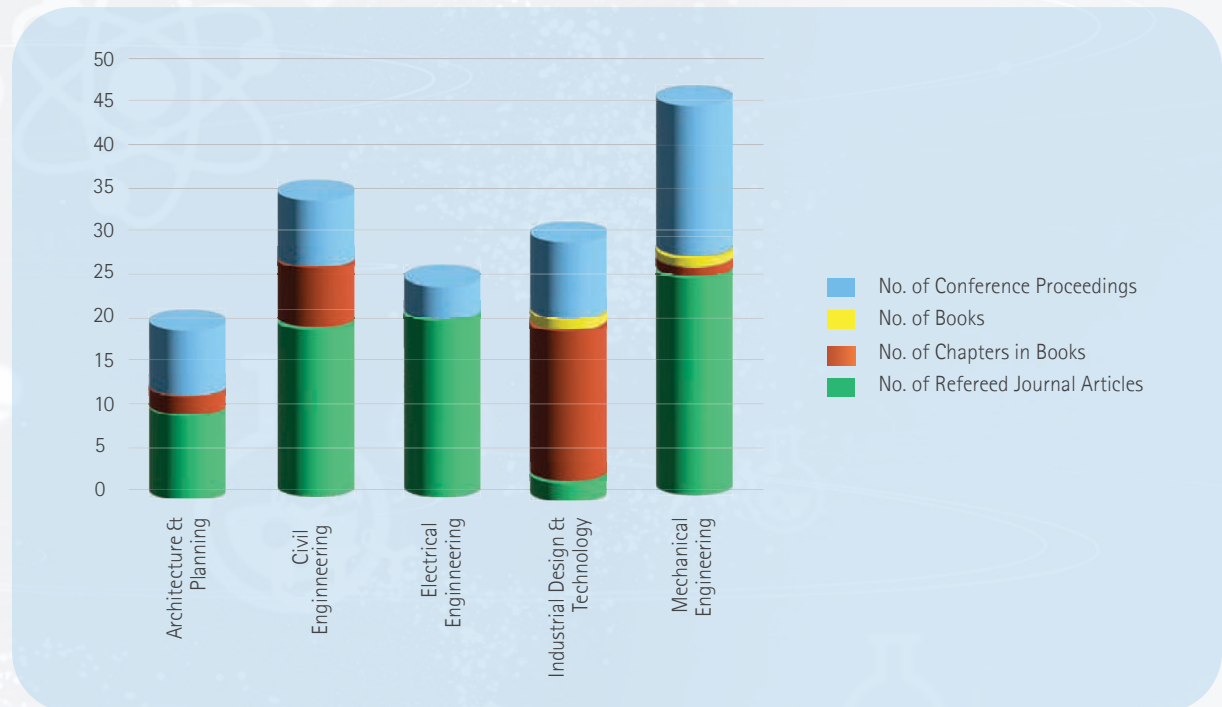


Figure 18: 2023 Total Output

The Department of Mechanical Engineering led in overall and referred journal per capita output, followed by Electrical Engineering and Industrial Design and Technology (Figure 19).

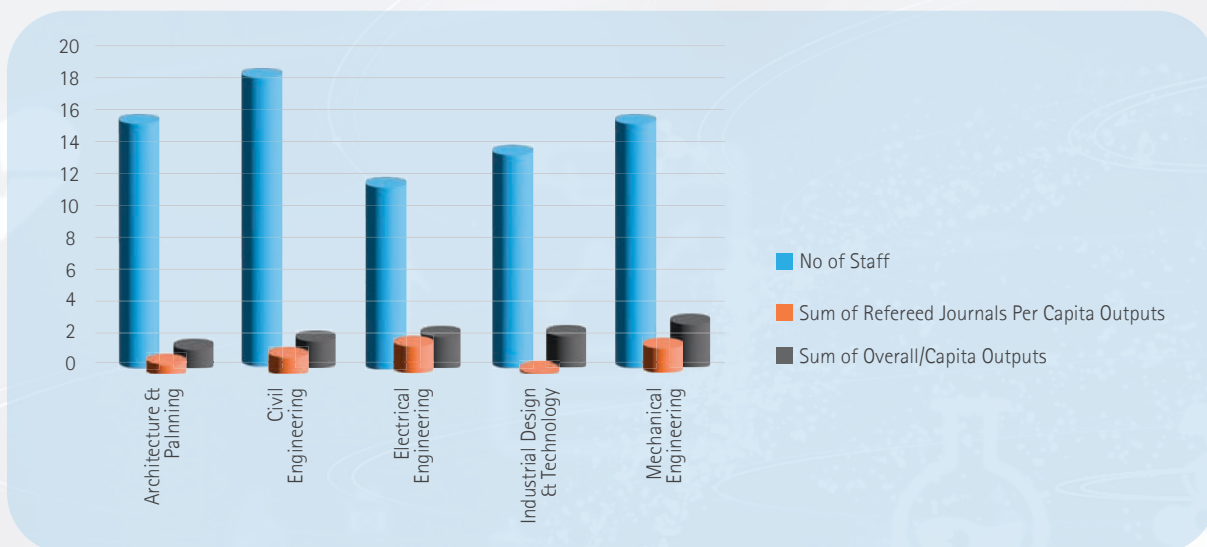
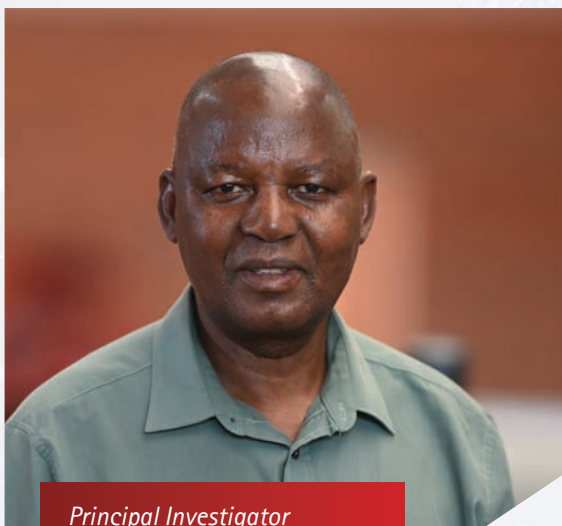


Figure 19: Total Number of Staff and Per Capital Output



Principal Investigator
Prof. Clever Ketlogetswe

Major Projects & Innovations

i) The Biodiesel Project

The Biodiesel research project led by Prof. Clever Ketlogetswe as Principal Investigator of the Department of Mechanical Engineering in the FET, is a long-term collaborative research projects between the University of Botswana and the former Department of Agricultural Research now National Agricultural Research and Development Institute (NARDI).

In May 2019, Department of Energy (DoE) sponsored Biodiesel Research Project to the tune of BWP 18.7 million (Botswana Pula) (US\$ 1.22 million). The Research was undertaken by UB in collaboration with Natural Agricultural Research and Development Institute (NARDI). The project is aimed at production of biodiesel using locally available plant and animal feedstock. The project is the best example of a project that has gone through the full cycle from basic research to a market-ready product. The research was motivated by what could be considered a low hanging fruits:

- Potential Biodiesel Feedstocks in Botswana.
- Vast sunflower fields In Pandamatenga Agricultural Lands.
- Steady increase in volume of used cooking oil in Botswana.

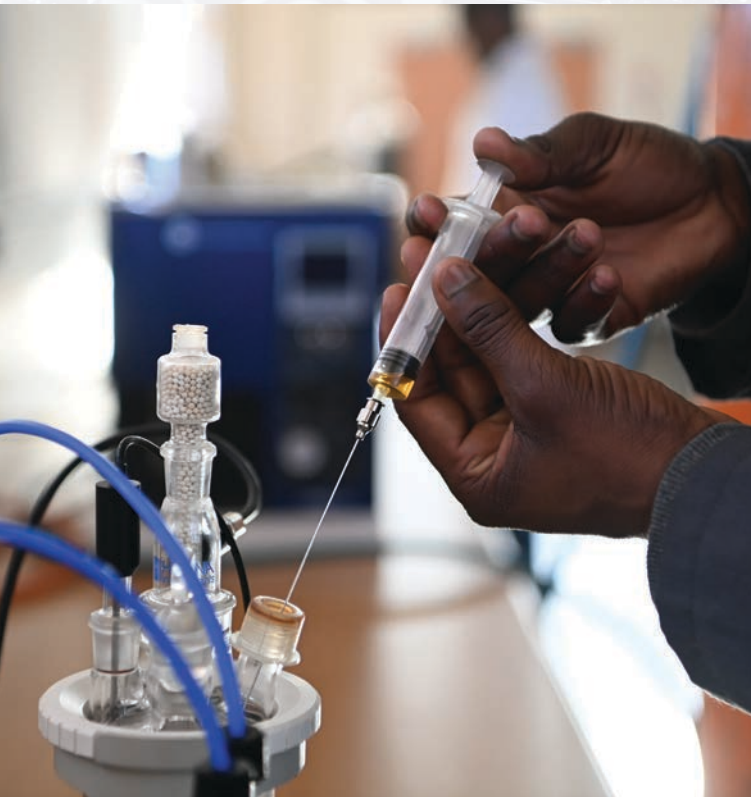
Objectives

- Resource Assessment in terms of efficiency of feedstock that has a potential for use in the Production of Biodiesel in Botswana.
- Evaluation of Socio-Economic and Environmental Impact of Biodiesel Production from Various Feedstock.
- Produce and perform all the Necessary Quality Tests Following the American Standard for Testing Materials (ASTM) Biodiesel Standard.



- Set-Up Pilot Biodiesel Facility at the University of Botswana.
- Continue Engagement Processes at Local and International Levels to Stimulate Development of Biodiesel Sector in Botswana.

The University of Botswana has established strong links with selected major economic plays in the country including Jwaneng Mining Company due to their higher level of commitment towards green economy demonstrated by their Decarbonisation Strategy.



Achievements

From its inception in 2019, the project has produced the following results and outputs:

- Four (4) PhD graduates.
- Four (4) MPhil graduates.
- Development of Biodiesel Testing Laboratory.
- Quality Facilities at UB (For Biodiesel Testing – Selected).

A National Biodiesel Conference and Expo was held on the 6th of March, 2024, to disseminate the research results. While the research part of the project has been concluded, there are still four (4) more students at the level of PhD and MPhil expected to complete their studies. These students are at their final stage of their dissertations and thesis.





Principal Investigator
Prof. Kevin Nwaigwe

ii) Southern African Renewable Heating & Cooling Training & Demonstration Initiative (SOLTRAIN+) Project

Southern African Renewable Heating & Cooling Training & Demonstration Initiative (SOLTRAIN+) is an international project funded by the Austrian Development Agency (ADA) and implemented in five (5) SADC countries – Botswana, Namibia, Lesotho, Zimbabwe, and South Africa. The project is coordinated internationally by AEE-Institute for Sustainable Technologies (AEE INTEC) Austria, regionally by the SADC Centre for Renewable Energy and Energy Efficiency (SACREEE) Namibia, and nationally by the Clean Energy Research Centre (CERC), University of Botswana.

Led by Prof. Kevin Nwaigwe at the University of Botswana, SOLTRAIN+ contributes to the transformation of the energy system to a sustainable, affordable, and carbon-free system, through the implementation of Renewable Heating and Cooling (RHC) systems in targeted sectors – buildings, industry/commerce, tourism, and hospitals and enables this through holistic capacity building Renewable Heating and Cooling. (RHC) technologies are solar thermal, heat pump, and energy efficiency (EE) by waste heat recovery (cooling via heat-driven absorption). To

achieve this, we focus on the following main outcomes:

- Capacity building via tailor-made training activities for the addressed technologies and sectors.
- Enabling a gender-balanced community by defining and operating a gender & diversity plan.
- Demonstration and monitoring of low-exergy RHC/EE concepts and systems.
- Awareness raising for all relevant stakeholders on scientific and non-scientific levels.
- Utilisation and expansion of SOLTRAIN+ beyond the project and to additional SADC countries.

The target group includes:

- Experts in RHC/EE in terms of trainees
- Industry practitioners (plant engineers/operators, plant and facilities managers, etc).
- Trainer/training structures/centres of competence and VTCs.
- RHC/EE technology supplier to hire newly trained experts.
- Industry/commerce/building/tourism/hospitals in terms of RHC/EE.
- Research & Development: curricula, master students and PhDs.
- Policy makers, administration, and the financial sector.
- Social institutions and other eligible entities including NGOs.

Direct beneficiaries are in total about 5,870 participants, subdivided into 930 trainees/trained trainers, 1,118 addressed stakeholders, 242 addressed experts for utilisation, 3,500 participants at SOLTRAIN+ conferences and webinars, and 80 gender managers. Another 195 demonstrators will lead to a further increase in this number, subsequently about 5,000 persons affected by the decarbonisation of the energy system and the reduction of energy costs. In the last phase, 2,447 people took part in the 134 trainings, courses and workshops. A total of 337 demonstration systems with a collector area of 2.298 m² corresponding to 1.6 MWth were installed and commissioned.



Activities and Achievements of SOLTRAIN+ Project in Botswana

Policy Development

As part of the mandate of the project, the following policy support has been undertaken:

- Development of the Botswana Solar Thermal Roadmaps and Implementation (BSTTR) Plan.
- Development of a Bankable Proposal for the Implementation of the BSTTR.

Demonstration Systems

An outstanding component of the SOLTRAIN+ project is the support for the installation of solar water heating systems. SOLTRAIN+ supports these installations with funding up to a maximum of 50 percent of the total cost for the system and its installation to eligible beneficiaries. Installations co-funded in Botswana include:

- Design and Installation of forced-circulation solar water heating systems in Maruapula School,

Gaborone.

- Design and Installation of forced-circulation solar water heating systems in Laundry Africa, Mogoditshane.
- Design and Installation of forced-circulation solar water heating systems in Botswana Defence Force (BDF), Glen Valley barracks.
- Design and Installation of forced-circulation solar water heating systems in Botswana Defence Force (BDF), Village Garrison.
- Design and Installation of thermosyphon solar water heating systems in Platinum Hotel, Tlokweng.
- Design and Installation of thermosyphon solar water heating systems in SOS Children's Village, Tlokweng.
- Design and Installation of thermosyphon solar water heating systems in Camphill Trust, Otse.
- Design and Installation of thermosyphon solar water heating systems in Pudulogong Rehabilitation Centre, Mochudi (ongoing).
- Design and Installation of forced-circulation solar water heating systems in the University of Botswana (ongoing).





Training/Awareness Activities

The SOLTRAIN+ project has trained several professionals, including Technicians, Engineers, Experts and practitioners in the solar thermal sector. Targeted solar thermal companies including Grit Tech, Hydrocon Green, So Solar, Capricon Solar, Solahart, and Solar One, government agencies including the Department of Energy (DoE), Botswana Energy Regulatory Authority (BERA), Botswana Bureau of Standards (BOBS), Botswana Defence Force (BDF), Botswana Police, Botswana Innovation Hub (BIH), Botswana Tourism Organisation (BTO), and Botswana Housing Corporation (BHC), vocational institutions including Botswana College of Engineering Technology (BCET) and CITF, staff of tertiary institutions including Botswana University of Agriculture and Natural Resources (BUAN), Botswana Institute for Technology Research and Innovation (BITRI), Botho University, Botswana International University of Science and Technology (BIUST), and University of Botswana (UB), hospitals including Sedilega Private Hospital, Princess Marina Hospital and Life Gaborone Private Hospital, hotels including Platinum Hotel, Cresta Lodge and representatives of the Hospitality and Tourism Association of Botswana (HATAB), and international/multinational organizations including United Nations Development Programme (UNDP) Botswana and Debswana were also trained.

Upcoming SOLTRAIN+ Activities

- The 8th SOLTRAIN conference to be hosted by the University of Botswana is scheduled for 4 – 6 December 2024, during the SADC Energy Week.
- Gender/Diversity Training and Awareness Activities

As part of the activities of SOLTRAIN+, female practitioners in the solar thermal industry will receive tailored capacity development activities. To facilitate these activities, a Botswana SOLTRAIN+ Gender Club (BSGC), led by Mrs. T. Peter-Ollyn, the Botswana Gender Manager for SOLTRAIN+, has been formed.

iii) Y'AL-SMART Project: Young African Leaders for SMART Infrastructure Development.

The project involves the design and installation of a Structural Health Monitoring System for the Kazungula Bridge as part of an ongoing research for African Alliance Partnership (AAP) project, a US-Botswana Collaborative Research on Youth Empowerment and Education: SMART Infrastructure and Mobility Innovations for Resilient Community Health.

- Informal Rental Housing in Southern Africa Study with case studies in Gaborone and Mogoditshane (Botswana), Bloemfontein (South Africa) and Maseru (Lesotho).
- Limits of Land Rights Titling and Registration in Communal Land Territories: The Botswana Case Study, Application of security deposit in residential properties in emerging economies. Customary land delivery systems in Botswana.
- Discrete Choice Modelling of Willingness to Pay Facility Retrofitting: A Multinomial Logit Model Approach (journal paper under review), Weighing Upfront Costs against Future Savings: A discrete choice analysis of homeowners' risk-time preferences for energy efficiency upgrades.





Major Research Projects Funded in 2023

Table 3 below shows major projects funded in 2023.

	Project Title	Total Funding (BWP)	Principal Investigator	Funder
1.	Smart Manufacturing Engineering Education for Knowledge Economy (SME2KE)	1,411,392.81	Prof. Jerekias Gandure	European Commission
2.	SOLTRAIN+ Project	2,096,322.00	Prof. Kevin Nwaigwe	Austrian Development Agency
3.	Virtual Exchanges Project	2,844,404.00	Dr. Yaone Rapitsenyane	European Commission

Table 3: Funded Research Projects – Engineering & Tech

Research Engagement Activities

The following are some of the research engagements by the faculty during the 2023/24 year:

- Okavango Diamond Company:** a contract to develop a diamond sorting machine for Okavango Diamond Company (ODC) has been signed. Through the UB Innovation Centre, a proposal was submitted to ODC, and the project was awarded and signed in December 2023. Contract Sum: **BWP 1,011,296.50**.
- The SOLTRAN+ project awarded a demonstration project to **Botswana Defence Force** for installation of forced circulation solar water heating systems in BDF Glen Valley and BDF Village. The projects are valued at EUR 19,026.00 (**BWP 282,841**) for BDF Village and EUR 24,196.00 (**BWP 359,698**) for BDF Glen Valley. Installation of the systems at the two sites was concluded.
- SOLTRAIN+ Project Workshops:**
The project conducted the following three (3) workshops for various stakeholder groups.
 - SOLTRAIN+ workshop on Energy Assessment and Thermal Energy Efficiency for Industry & Commerce, held at the University of Botswana from the 29th - 30th May, 2023.
 - SOLTRAIN+ workshop for Experts & Professionals, held at the University of Botswana, 31st May – 2nd June 2023.
 - SOLTRAIN+ workshop for Botswana Defence Force Technicians, held at the University of Botswana, 30th November – 1st December 2023.
- UN GEO-7 Report:** The Clean Energy Research Centre is representing the University of Botswana and the Government of Botswana in the United Nations Environment Programme (UNEP) seventh (7th) edition of the Global Environment Outlook (GEO-7) report. The project started in January 2023 and ends in December 2026. Prof Kevin N. Nwaigwe, a CERC Energy Expert, was selected by UNEP to serve as the Coordinating Lead Author (CLA) in the Energy Transformation Pathway chapter. The entire project is funded by UNEP and the final project report will be presented to the UN Assembly in 2026.
- National E-Mobility Projects:** The faculty leads the national project on developing e-mobility for adoption in the country. The national project, which is under the Ministry of communications, Knowledge and Technology (MCKT), is geared towards promoting the adoption of e-mobility in a variety of modes including e-boat, e-car, e-bus and establishing the technical capacity by training e-technicians in



Technical Colleges for manufacturing, assembly and maintenance of electric mobility products and infrastructure. The capacity building programme was scaled up in the last quarter of 2023 with another site opening at BITRI Kanye to complement operations at Francistown College of Technical and Vocational Education (FCTVE). University of Botswana, through Faculty of Engineering and Technology leads all the technical and capacity building work, while the project itself is housed at BITRI. Several staff of the faculty regularly participate in the project work locally and internationally. The electric boat is completed and is scheduled to be launched in the first quarter of 2024. Eighty six (86) Mechanical and Electrical and Electronics technicians have been retooled for electric vehicles. This number includes the 20 who were trained in the last quarter of 2023 (electric car in Francistown and electric boat in Maun). The manufacturing phase of the project is also underway with the identification of a partner(s) being finalised. The technical advisor is from the faculty. Benchmarking trips were undertaken to Malaysia, USA, South Africa and China.

An Expression of Interest (EOI) for identification of a manufacturing partner was run but did not bear fruit. Partnership is now being fostered through deliberate efforts with manufacturers from countries where benchmarking was done. In December 2023, two (2) manufacturers were revisited in China for their possible collaborations on their bus and Sport Utility Vehicle (SUV) manufacturing respectively. This assignment was completed in the first quarter of 2024 as the project team visited another manufacturer in Germany in January 2024.

6. **Annual Degree Show:** The faculty hosted the Annual Degree Show on Wednesday 26th July 2023, where final year student projects were showcased. The show, hosted at the UB Campus Indoor Sports Centre attracted a record crowd that included the entire ecosystem of the innovation entrepreneurship in the country.
7. **Y'Al Smart workshop** to train secondary school pupils in for the Alliance for Africa, Y'all Smart,

Young African Leaders for SMART Infrastructure Development. The pupils were introduced to IoT technology to develop smart infrastructure products and services to promote healthy lifestyles and entrepreneurship. The workshop was held 18th - 22nd July 2023.

8. **Y'Al Smart workshops:**

The Y'Al Smart Project conducted the following workshops and engagement activities:

- **Secondary School teachers Workshop:** The workshop was used to train secondary school teachers in for the Alliance for Africa, Y'all Smart, and Young African Leaders for SMART Infrastructure Development. The teachers were trained in IoT technology to run after-school programmes for the students to further develop ideas and introduce other students to IoT technology. The workshop was held 20th - 23rd September 2023.
- **Youth Roundtable discussion:** Through the Alliance for African Partnership funded project "Youth Empowerment and Education: Smart Infrastructure and Mobility Innovations for Resilient Community Health" the faculty hosted a Youth Roundtable discussion at UB Conference Centre on the 25th of July 2023

9. **Technology and Skills Transfer Makeathon:**

The faculty co-organised and hosted the 2nd National Technology and Skills Transfer Makeathon from 24th to 26th October 2023. In collaboration with the Human Resource Development Council (HRDC) and Ministry of Education and Skills Development; Hon. Minister Thulaganyo Segokgo, of the Ministry of Communication, Knowledge, and Technology, officially opened the Makeathon and attended the official closing ceremony.

10. A research partnership between University of Botswana and University of Leoben (Austria), on investigation of the potential for establishment of copper and aluminum waste recycling facilities in Botswana. The University of Leoben paid BWP107, 000 towards research activities at the University of Botswana.



11. Huawei Seeds of the Future Competition:

Student Marang Pholo won a trip to Barcelona Spain following an outstanding performance in the competition.



Trip to Spain Winner
Marang Pholo

12. **Huawei ICT Competition:** Three (3) UB students; Isaac Ross, Keitiretse Michael, and Bofelo Gombgwa, from the Faculty of Engineering and Technology participated in the Huawei Information and Communication Technology Competition and earned a place at the regional finals and a prize money of BWP18000.00.

13. The faculty, in collaboration with the Regional Centre for Mapping of Resources for Development (RCMRD) and Environmental Systems Research

Institute (ESRI), hosted a Workshop on Geographical Information Systems (GIS) for Disaster Risk Management at the University of Botswana in Gaborone from the 28th to 30th November 2023. This workshop explored how GIS provides a common language for disaster risk management. This included the demonstration of the use of Drones in problem solving.

14. **Public Lecture/Seminar:** The Faculty hosted a public lecturer/seminar titled: Scalable Solar-Thermal Synthesis of High-yield Flake Graphite and Hydrogen via Hydrocarbon Decomposition on 27th August 2023. The Seminar was conducted by a renowned Prof. Timothy S. Fisher, Schauerman Endowed Chair in Engineering from University of California, Los Angeles. The seminar was organised in collaboration with the US-Africa Frontiers in Materials Science and Engineering and BITRI.

Looking Ahead

The faculty plans to undertake the following initiatives and activities in the next year to foster its research and innovation mandate:

1. Research Collaboration between University of Botswana and Montanuniversitaet Leoben, Austria, on aluminium and copper recycling (potentials, available quantities, possible processes, energy and mass balances); Evaluation of further potentials (steel, lead) (sites: Tati Nickel, Francistown; Bamangwato Concessions Limited (BCL) Mine, Selebi Phikwe); and Evaluation and characterization of nickel concentrates and by-products.
2. Computational Particle and Fluid Dynamics of Inhaled Particulate Matters (PMs) in the Human Airway Systemic Regions.
3. Development of High-Temperature Thermal Energy



Storage Battery using Locally Sourced Botswana products.

4. Investigating the Spatial Implications of Domestic Events Tourism in Botswana: A Case Study of the Khawa Dune Challenge & Makgadikgadi Epic Events.
5. Towards sustainable land and housing delivery in urban and peri-urban areas of Botswana (proposal stage).
6. Development of an integrated ventilator and oxygen concentrator (submitted for funding).
7. Investigating the factors for full adoption of the Water-Energy-Food nexus in Botswana's farming enterprises (proposal stage).
8. Greening the Built Environment Curriculum through

Sustainability Lens: A Pre-Post Evaluation Agenda (submitted abstract).

9. Space Management in Religious Settings through the Lens of Pew Ergonomics and Musculoskeletal Disorders.
10. Optimizing Land Use Planning: Value Dynamics Modelling in Land Administration Domain Models.
11. Transcending Profitability Modelling: Navigating Broader Impact Issues in Feasibility and Viability Appraisals.

Huawei ICT Competition
Keitiretse Michael
and Bofelo Gombgwa





A photograph of two women sitting outdoors. The woman on the left is wearing a yellow tank top and a black skirt, holding an open book. The woman on the right is wearing a black hijab and a purple checkered shirt over a black dress. They are both looking towards the left. A yellow banner with white text is overlaid on the image.

Faculty of Social Sciences



Acting Dean
Prof. Tachilisa Balule

From The Dean's Desk

The Faculty of Social Sciences (FSS) is a multidisciplinary faculty, consequently, it has potential to develop strong multidisciplinary and cross-disciplinary research collaborations and networking. The faculty is the only one that provides specific training for advanced research methods in social sciences at MPhil/PhD level (through the FSS800 course).

Among others, FSS has research strengths in the following focus areas: Community and Public Health, Indigenous Knowledge System, Human and Wildlife Conflict, Gender and Development, Digital Society and Culture, Climate Change and Sustainable Development, Rural-Urban Linkages and Livelihoods, Migration and Transnationalism, Indigenous Legal Systems and Justice, Poverty and Social Inequalities, Democracy and Governance, Gender-Based Violence.

Because of its multidisciplinary, the faculty's research covers all but four (4) of the Sustainable Development Goals (SDGs). This will continue to be the case and will most likely expand through wider collaborations with the Health and Physical Sciences. The faculty's research currently covers the following SDGs and will continue to be guided by the nation's vision 2036, and the new National Development Plan 12, that will guide the University Research Strategy from 2025:

- Poverty and social inequalities (SDG Goal 1, all targets).
- Agricultural productivity and food security (SDG Goal 2).
- Reproductive and public health (SDG Goal 3).
- Gender and equal opportunity (SDG Goals 5 and 10).
- Water and sanitation management (SDG Goal 6).
- Work, employment and social protection (SDG Goal 8 and 17).
- Rural-urban linkages and livelihoods (SDG Goal 11).
- Environmental and resource governance (SDG Goals 12, 13 and 15).
- Democracy, law and governance (SDG Goal 16).

The faculty of Social Sciences is made up of six (6) departments of Economics, Law, Political and Administrative Studies, Population Studies, Social Work and Statistics. All departments engage in research and postgraduate training at master's and PhD level.

Research Output

Through its six (6) departments, the faculty of Social Sciences produced various research outputs as presented in Figure 20. The department of Political and Administrative Studies led with the most outputs that include journal articles, book chapters and edited books, followed by the departments of Economics and Statistics.

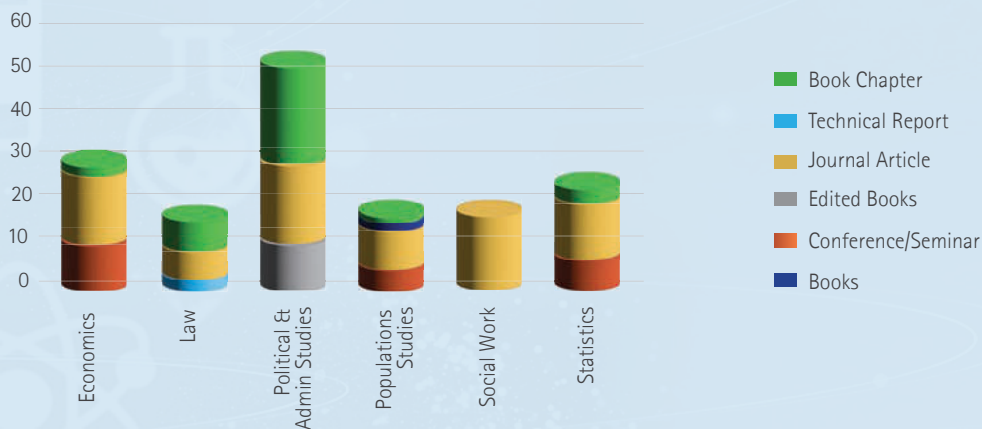


Figure 20: Total Outputs by Department

Research Excellence Awards and Appointments

- Prof. Ramasamy Sivasamy in the Department of Statistics received the Innovation /Technology International Award from the Global Knowledge Foundation (GKF) for contributing Quality and Innovative Research articles in the GKF Journals and providing services as Editorial team member of the GKF journal.

Major Research Projects Funded in 2023

Table 4 presents major funded projects implemented by the faculty in 2023. The projects were mainly contract research consultancies and one collaborative research grant.

	Project Title	Total Funding (BWP)	Principal Investigator	Funder
1.	Challenges and Opportunities for a Systems Approach to Skills Development in Botswana. Joint Mind Consult (JMC) Project (2023)	120, 000.00	Prof. Happy K. Siphambe	Joint Mind Consult
2.	Diagnostic Study to Inform NDP 12 (2023)	312, 000.00	Prof. Happy K. Siphambe	Botswana Institute of Development Policy Analysis (BIDPA)
3.	Family Care Giving Study	1,060,654.00	Prof. D. Ntseane	University of Cape Town

Table 4: Funded Research Projects

Looking Ahead

- Social Work Outreach for Research Policy and Practice (SWORPP) plans to conduct a quantitative study to find out perceptions of stakeholders about services offered by social workers.
- The Department of Social Work plans to conduct a tracer study on where social work students go after graduation, what they do, remuneration, fields of practice etc.

A female scientist with dark hair, wearing a white lab coat and blue gloves, is working in a laboratory. She is holding a small glass vial in her right hand and pouring its contents into a test tube held in her left hand. The test tube is held vertically. In the background, there are white shelves with various laboratory supplies, including boxes and containers. A computer monitor is visible on a desk behind her. The foreground is blurred, showing the back of a person's head and shoulders.

Faculty of Health Sciences



Dean
Prof. Ishmael Kasvosve

From The Dean's Desk

The major strength of the Faculty of Health Sciences is its investment in developing human capacity to undertake research that addresses national priority areas. Researchers in the Faculty are collaborating with researchers at institutions in the country as well as abroad to develop synergies that allow for pooling of resources, training, and mentorship. As a result of these collaborations, in 2023 the faculty attracted several international grants worth over US\$400 000. The research themes have varied from non-communicable diseases that are of great concern globally and nationally, to infectious diseases. These themes cut across the research that has been published by the faculty. Cancer and diabetes are two major non-

communicable diseases, and there are collaborative teams in the faculty that are working on these diseases to better understand molecular genesis of these diseases.

The faculty has made investments towards developing capacity to undertake cell and tissue culture research. This facility is expected to undertake basic science research that will lead to drug discovery and development leveraging on indigenous knowledge. The faculty is engaged in systems strengthening research to address unfavourable outcomes in health care, including infant mortality. Researchers have been working on intervention research to improve reproductive health of Batswana youth and their families. The faculty will start offering PhD programmes in Nursing and Public Health soon, which will expand its research throughput.

The faculty comprises four (4) schools of Allied Health professions, Nursing, Pharmacy and Public Health, which are actively engaged in research and contributed to the faculty's research outputs.

Research Output

The faculty produced 54 research outputs (52 journal articles, two (2) book chapters) published in journals indexed in Scopus and/or Web of Science, spread across the 46 academic staff members who were at post for six (6) months or more in 2023. This equates to a per capita output of 1.2. The schools of Allied Health Professions and Nursing led the faculty outputs, journal articles, conference proceedings and book chapters as illustrated in Figure 21.



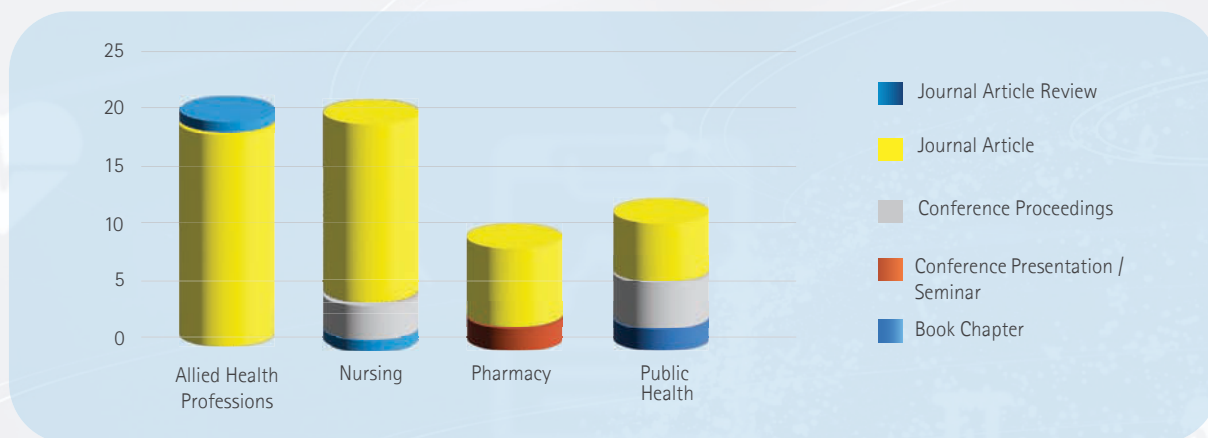


Figure 21: Total Outputs by School - 2023

Figure 22 below presents the total Number of Research Output from UB-Approved Journals (Scopus, Web of Science, IBSS) and other Journals indexed)

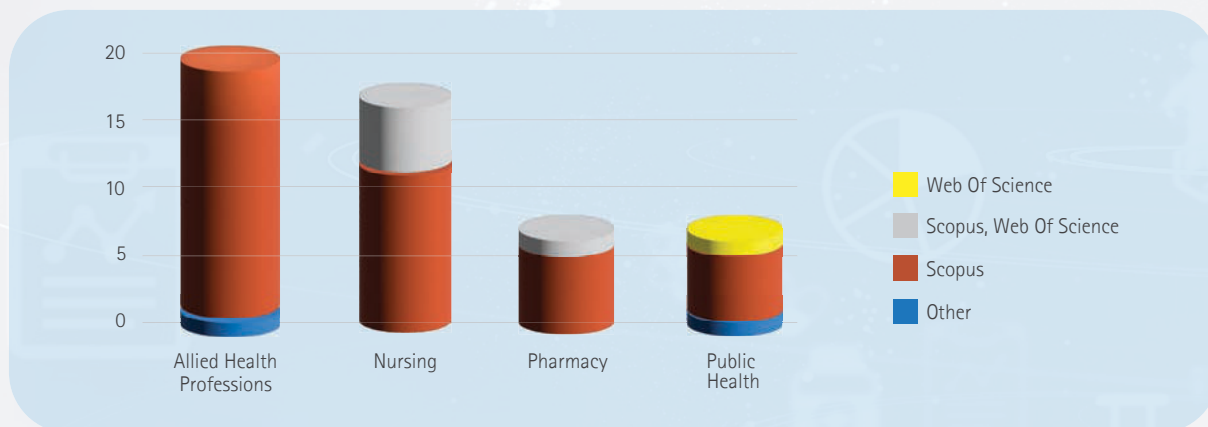


Figure 22: Total Outputs from UB-Approved Journals- 2023

Major Research Initiatives/Projects

The following major projects are currently ongoing in the faculty:

- The role of RH2 blood group in HIV infection and disease progression: long term non-progressors vs rapid progressors.
- Molecular mechanisms of HIV on breast cancer
- Clinicopathological features of prostate cancer in Botswana.
- COVID-19 Vaccine Effectiveness, Vaccine Uptake Determinants, and Impact of Pandemic on Health Programs in Botswana.
- Adverse Event Reporting in Implementation Science Clinical Trials.
- Mopati: A Pilot HIV Treatment Partner Intervention in Botswana.
- Reducing Stigma to Improve HIV/AIDS Prevention, Treatment and Care among Adolescents Living with HIV in Botswana. NIH R21 PAR-18-732.
- Fogarty African Bioethics Consortium Post-Doctoral Fellowship D43TW010512. -I
- Conducting a study on "Improving Reproductive Health of Batswana Youth and their Families" funded by NIH and has now entered its last year and the yearly budget approved.



	Project Title	Total Funding (BWP)	Principal Investigator	Funder
1.	Programme for Covid Vaccine Effectiveness (PROVE)	108,246.99	Prof. N. Phaladze	CDC Africa & MasterCard Foundation
2.	Piloting a Family-Led Infection Prevention Bundle at a Neonatal Intensive Care Unit in Botswana: "FLIPPING" the Infection Prevention Paradigm for Low- & Middle-Income Countries	20,000.00	Dr. Samuel Matula	Children's Hospital of Philadelphia
3.	Flourishing minds-Centering youth as mental healthcare navigators in Botswana: Safe Haven.	60,000.00	Dr. Samuel Matula	Charles Engelhard Foundation
4.	Botswana Smoking Abstinence Reinforcement Trial (BSMART)	193,780.00	Prof. Bontle Mbongwe	National Institutes of Health

Table 5: Faculty of Health Sciences Funded Major Research Projects

The Botswana Smoking Abstinence and Reinforcement Trial (BSMART) Study



A five-year project, the Botswana Smoking Abstinence Reinforcement Trial (BSMART) study to evaluate the effectiveness and implementation of a well-established Screening, Brief Intervention, and Referral to Treatment (SBIRT) intervention across 15 health facilities in Botswana.

Tobacco use is highly prevalent among people living with HIV/AIDS (PLWH), especially in southern Africa where HIV is most heavily concentrated. Among PLWH, tobacco use impacts HIV-related co-morbidities and is also the leading cause of premature mortality from non-HIV related malignancies such as lung cancer, which accounts for 20% of the cancer burden. The project integrates evidence-based interventions, such as Screening, Brief Intervention and Referral to Treatment (SBIRT) into a HIV care system. This presents an important opportunity to establish and evaluate a modifiable cancer prevention strategy into a low- middle-income country (LMIC) setting, where both lay health workers (LHW) and non-physician clinicians are widely used. Demographic Health Surveys from sub-Saharan Africa show that smoking prevalence among PLWH ranges between 12.5-44.3 percent. Yet, Botswana's health care system is highly unprepared to meet the challenge of integrating evidence-based smoking cessation treatment into routine HIV care.



In line with the Government of Botswana's desire for more to be done to assist its citizens in smoking cessation, the BSMART proposes to use a Type 2 hybrid effectiveness-implementation study design to evaluate the effectiveness and implementation of a well-established SBIRT intervention. The intervention consists of the 5"A"s, (Ask, Advise, Assess, Assist, Arrange) delivered by trained LHW case managers, followed by referral to treatment with varenicline (a medication demonstrated to be efficacious for smoking cessation among PLWH prescribed and monitored by trained nurse prescribers/dispensers, in the network of outpatient HIV care facilities in Botswana, specifically Sefhare Hospital in Sefhare, Tutume Hospital in Tutume, and Nyangabwe Hospital Itsekeng Clinic, and Masego Clinic in Francistown.

The study objectives are to:

1. Assess the *Reach* and *Effectiveness* of BSMART.
2. Assess the *Adoption* and *Implementation* indexed by quality and consistency of intervention delivery.
3. Assess whether the intervention becomes *Maintained* as part of routine practices.
4. Determine the preliminary cost-effectiveness of BSMART.

Expected Impact: Addressing the syndemic between tobacco use and HIV infection in a coordinated manner aligns with Botswana national priorities for non-communicable disease control among PLWH in a high HIV prevalence setting. This study is significant because it integrates smoking cessation interventions, which are lacking in sub-Saharan Africa (SSA) including Botswana, into a real-world HIV care system that has been underpinned by a robust PEPFAR/CDC program and leverages long-standing partnerships with Ministry of Health and the University of Botswana's Anti-tobacco Network for population, health system, and policy level impact.

Intervention: BSMART uses the Screening, Brief Intervention, and Referral to Treatment approach. This is a well-studied, comprehensive, public-health approach that delivers early intervention and treatment services to persons with substance use disorders. Further, BSMART uses the 5 As:

1. Asking eligible clinic clients about smoking
2. Advising them to quit smoking
3. Assessing their motivation to behavior change particularly their readiness to quit smoking
4. Assisting those who would benefit with a referral for a Varenicline eligibility assessment and prescription
5. Arranging follow-up for clients not yet ready to quit.

This intervention will be compared to a standard of care, consisting of a brief counseling session and a brochure.

Study Launch

The study was launched in Gaborone on the 12th of May 2023 at an event attended by key stakeholders. The launch activities included a public lecture by the lead Principal Investigator, Prof. Manhattan Charurat of University of Maryland Baltimore (UMB). The launch titled "The Challenges of Non-communicable Diseases Among People Living With HIV, was held at the University of Botswana.

A Stakeholder Advisory Group for project sustainability was also established.

Study Enrollment Update

Study enrollment commenced in June 2023 with the Step 1 sites. 1752 participants were screened for smoking, and out of these 202 (11 percent) were smoking currently with more males (22 percent) than females (3 percent). The study reached the study sample size of 125 in the first five sites within a few weeks of enrolment. Of the 125 enrolled participants, majority-113 (90 percent) were male. 35 percent of enrolled participants were aged between 35 and 44 years of age. On a scale of 1 to 10, 26 percent of enrolled participants were ready (at 10) to quit smoking. Participants were followed up for 24 weeks and retention in the study remained high at above 90 percent.

The study team is preparing for the intervention phase for Step 1 sites and enrollment for Step 2 sites, slated to begin in July 2024.



Summary

In conclusion, this study resonates well with current research which shows that most smokers in Botswana are willing to quit smoking but have been unsuccessful in their quit attempts due to limited treatment options. Stakeholders and family members of enrolled participants have expressed support for the study and desire for the expansion of the project outside the current target group on account of the negative health, social and economic impacts of tobacco use on individuals, families, and communities. The analysis for the primary endpoints of the study is anticipated for 2027.

Research Engagements Activities

The FHS undertook several engagement activities geared towards direct impact to society. The following activities were implemented:

- Surveillance of Hospital-Associated Infections and Antimicrobial Resistance (SHARE) Study in collaboration with Centres for Disease Control and Prevention (CDC) and Botswana-UPenn Partnership (BUP).
- AMR in sub-Saharan Africa - Improving Diagnostics and Understanding Risk Factors - A project of the COMBAT AMR in Africa Network
- Neonatal sepsis and the microbiome in Botswana in collaboration with BUP.
- Implementation of saline gurgles sample collection for Covid-19 diagnosis in Botswana in collaboration with Botswana Harvard Partnership (BHP) and the BC Children's Hospital, Centre for International Child Health (CICH).
- World Cancer Research Fund International - Regular Grant Programme, Phase 1, Pilot testing has been done on 50 children at UB preschool.
- Global Tobacco Industry Interference Index received **US\$8,000** funding.

Research Excellence Awards and Appointments

- Prof Modisa S. Motswaledi was awarded the Most Established Researcher Award at the National Research and Excellence Awards 2023.

Future Research Outlook/Plans

The FHS plans to undertake the following activities and initiatives in the coming year:

1. Investigation of anti-cancer activity and herbal extracts against breast and cervical cancer.
2. Multi-drug resistant organisms (burden, mechanisms of resistance, laboratory detection).
3. Clinicopathological features and survival outcomes of mutations and protein expression in breast cancer.





Faculty of Medicine





Acting Dean
Prof. Billy M. Tsimba

Dean's Statement

Faculty of Medicine (FoM) research and outputs during the reporting year originated from all its departments, with concentrations from the departments of Paediatrics, Medicine, Obstetrics and Gynaecology, and Surgery. The research reports reflecting a diverse range of research areas have been active in recent years, including cancer (gynaecological, breast and head and neck) (22), obstetrics care and outcomes (15), medical education (10), infectious diseases (9), neonatal (7), health and climate change (6), mental health (6) and antibiotic/ antiviral resistance and stewardship (5).

The faculty continues to generate research through strong collaborations across medical disciplines and through inter-organisation partnerships with research intensive institutions and Universities, almost universally around medical education, diseases, and health service delivery concerns relevant to Botswana. Through external grant awards, several locally and globally relevant research studies continue to make progress, working hard to answer questions not only about what interventions work to improve health outcomes, but also, through cutting-

edge implementation science techniques. These studies include the InterCARE study (Integrating Hypertension and Cardiovascular Diseases Care into Existing HIV Services Package in Botswana); the Thotloetso Study (Behavioural activation/problem solving vs standard smoking cessation counselling for HIV in Botswana); the Thibang Diphatlha study (Testing adaptive strategies to close the gap from cervical cancer diagnosis to treatment in Botswana); and the SAFER and ELICIT school eye health implementation studies (PEEK Practice-based Evidence Framework).

The FoM is naturally geared towards addressing Sustainable Development Goal 3 (Good health and wellbeing) and will continue to focus on improving our nation's understanding of the changing profile of both infectious and non-communicable diseases (NCDs) affecting it. In addition to the studies mentioned above, preparation and inception is already underway for future work in vaccine effectiveness modelling NCDs amidst an aging HIV population; robotics-optimised stroke rehabilitation; improving timely effective treatment of throat infections; reducing stigma among mental health patients; Vitamin D deficiency and uterine fibroids; and bone tissue regeneration.

The FoM has a staff compliment of 86 spread across the Anaesthesia and Critical Care Medicine, Biomedical Sciences, Emergency Medicine, Family Medicine & Public Health, Internal Medicine, Medical Education, Obstetrics and Gynaecology, Paediatrics and Adolescent Health, Pathology, Psychiatry, Radiology and Surgery departments. All departments engage in research and contribute to the faculty's research output.

Research Output

The bulk of the publications from the faculty were in Web of Science, while the rest were in both Web of Science and Scopus. The rest were in other databases (Figure 23).

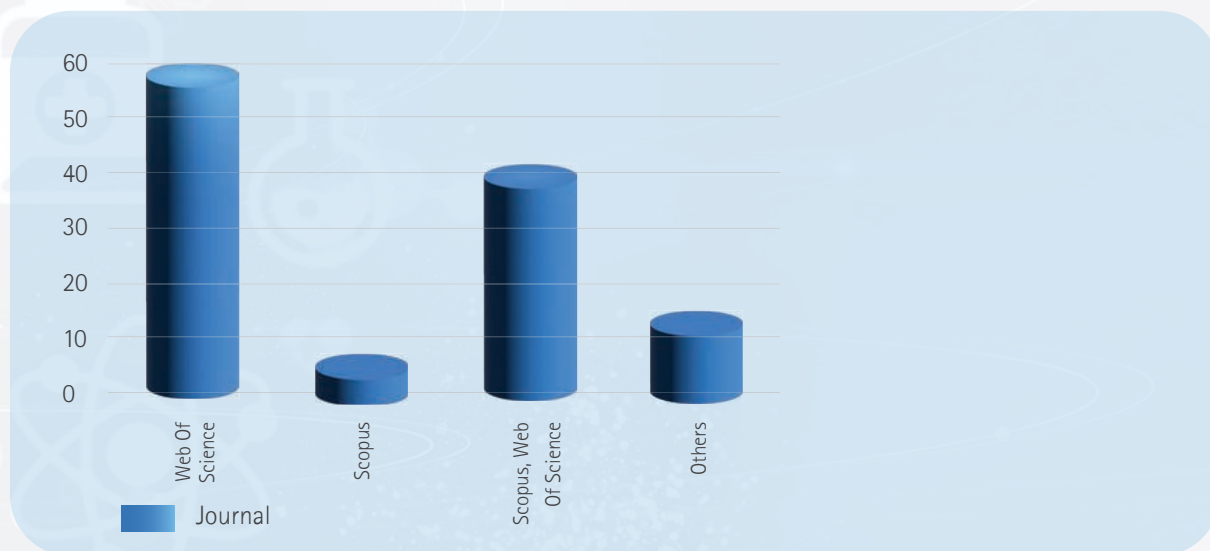


Figure 23: 2023 Total Research Output by Journal Article Index

Research Engagement Activities

The Faculty provided free basic first aid training to Sir Ketumile Masire Teaching Hospital employees.

Funded Research Projects

Table 6 presents research initiatives and projects being implemented by the faculty across its departments. These are nationally and internationally funded projects, including collaborations with other Universities and non-collaborative projects.



	Project Title	Total Funding (BWP)	Principal Investigator	Funder
1.	Behavioural activation/problem solving vs standard smoking cessation counselling for HIV in Botswana: a type I hybrid Implementation Science trial (Thotloetso study)	1,857,772.00	Prof. Billy Tsimba	National Institutes of Health (NIH)
2.	"Integrating Hypertension and Cardiovascular Diseases Care into Existing HIV Services Package in Botswana" (INTERCARE)	45,413,153.00	Prof. Mosepele Mosepele	National Institutes of Health (NIH)
3.	Enhancing Belmont Research Action to Support EU Policymaking on Climate Change and Health (ENBEL)	1,590,085.00	Prof. Britt Nakstad	ENBEL
4.	Investigating Antimicrobial Stewardship Practices in Southern Africa (MOSAIC)	701,530.00	Prof. Mosepele Mosepele	Centres for Disease Control (CDC)
5.	The Peek Practice-based Evidence Framework	7,500,642.00	Dr. Keneilwe Motlhatlhedhi	The Wellcome Trust
6.	PENN CFAR	301,632.00	Prof. Billy Tsimba	National Institutes of Health (NIH)
7.	RCT of an intersectional stigma intervention to sustain viral suppression among women living with serious mental illness and HIV in Botswana	3,279,944.00	Dr. Philip Opondo	National Institutes of Health (NIH)
8.	Thibang Diphatlha: Testing adaptive strategies to close the gap from cervical cancer diagnosis to treatment in Botswana	12,860,403.00	Prof. Doreen Ramogola-Masire	National Institutes of Health (NIH)
9.	Knowledge for Action to End Violence Against Women and Violence Against Children	1,474,132.00	Mr. Ari Ho-Foster	Sexual Violence Research Initiative (SVRI)
10.	Adverse events reporting in Implementation science clinical trials	1,434,291.00	Prof. Mosepele Mosepele	National Institutes of Health (NIH)
11.	Affordable Robot-Based Assessment of Cognitive and Motor Impairment in People Living with HIV and HIV-Stroke	495,194.00	Dr. Maikutlo Kebaetse	National Institutes of Health (NIH)
12.	Projecting the age shift in HIV prevalence in sub-Saharan Africa: a necessary epidemiologic step to prepare for the "silver tsunami" (Tsimba Maryland Stafford R21)	625,617.00	Prof. Billy Tsimba	National Institutes of Health (NIH)



13.	Evaluation of the impact of Botswana's 2-dose Human Papillomavirus (HPV) vaccination program	4,516,135.00	Prof. Doreen Ramogola-Masire	CDC Foundation
14.	Reducing Mortality in Adults with Advanced HIV Disease (REVIVE)	143,258.00	Prof. Mosepele Mosepele	Population Health Research Institute (PHRI)
15.	HAIs, AMR, & Pandemic Preparedness/Response Botswana (HAP-Net Botswana) Project	860,795.00	Prof. Mosepele Mosepele	Centers for Disease Control (CDC)
16.	Addressing The Role of Stigma in Cervical Cancer Care in Botswana	314,464.00	Prof. Doreen Ramogola-Masire	National Institutes of Health (NIH)
17.	Accelerated aging in women with SMI and HIV	318,413.00	Dr. Philip Opondo	National Institutes of Health (NIH)
18.	Cost And Cost-Effectiveness of Managing Heart, Lung, And Blood Comorbidities in People with HIV in Botswana	848,973.00	Prof. Mosepele Mosepele	National Institutes of Health (NIH)
19.	Preventing avoidable treatment-related harm with assessment of yield of standardization of Antibiotics in a Paediatric Surgical Unit in Botswana	265,702.00	Prof. Alemayehu Bedada	CHOP Global Health Center Pilot Grant Program
20.	Facilitators and barriers of blood pressure (BP) control in treated patients attending primary health care (PHC) clinics in Gaborone, Botswana	66,425.00	Dr. Vincent Setlhare	National Institutes of Health (NIH)
21.	Cross-cultural adaptation and validation of the Androgen Deficiency in the Aging Male (ADAM) Questionnaire in men living with HIV: planning for a Botswana male obesity hypogonadism study	66,425.00	Dr. Onkabetse Julia Molefe-Baikai	National Institutes of Health (NIH)
22.	New approaches for the diagnosis of Kaposi's Sarcoma	182,377.00	Dr. Sajini Souda	National Institutes of Health (NIH)
23.	Flow cytometric immunophenotyping of peripheral blood in atypical and abnormal FBC results, A Pilot Study	464,323.00	Dr. Bokang Maswabi	Department of Research, Science and Technology (DRST)
24.	Low INR to Minimize bleeding with mechanical valves Trial (LIMIT)	533,579.00	Dr. Julius Mwita	Population Health Research Institute (PHRI)
25.	Injury and Trauma Research Training Program for Botswana	1,536,308.00	Dr. Mooketsi Molefi	National Institutes of Health (NIH)

Table 6: Funded Major Research Projects - Medicine



Innovative Projects



Principal Investigator
Dr. Shathani Nkhwa

Sustainable Bone Tissue Regeneration of Composites Derived from Locally Available Materials

The project, led by one of the early career researchers in the Faculty of Medicine, Dr. Shathani Nkhwa, recognises the prevalence of traumatic injuries, a significant global cause of mortality that disproportionately affects low- and middle-income countries, including Botswana. This places strain on the country's healthcare system, especially in relation to head traumas. The over 200 commercially available bone grafts globally remain inaccessible to developing nations, including Botswana. The project therefore recognises the need to prioritise affordable biomaterials tailored to these contexts, using local resources, an approach that could lead to cost-effective clinically translatable biomaterials, crucial for equitable healthcare provision.

The Principal Investigator of the Regenerative Medicine Lab, Dr. Nkhwa, was awarded a P4, 4 million grant by the Ministry of Communications Knowledge and Technology (MCKT) in the first quarter of 2024, following a successful proposal. This funding will support a groundbreaking

project aimed at using locally available resources, which will be pivotal in developing biomaterials for bone tissue regeneration, thereby developing a clinically viable technology to repair, regenerate and enhance bone healing across bone defects. Future works will involve expansion into regeneration of other tissues such as skin. This initiative holds promise for significantly advancing Botswana's medical field, reducing dependence on imported biomaterials.

Empowering the Regenerative Medicine Lab

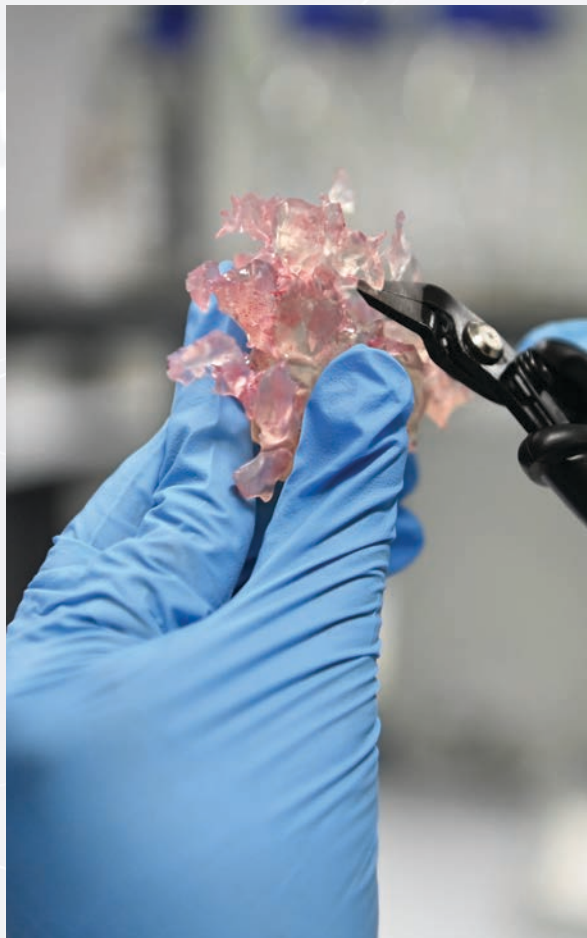
Before the MCKT funding, the Regenerative Medicine Lab, a relatively new establishment, struggled with inadequate funding for essential equipment, limiting its operational capabilities. The grant will mainly fund vital equipment necessary for the development, fabrication, and bio-functionality assessment of biomaterials. The grant will also facilitate the establishment of a human cell bank, ensuring safe storage of cells essential for ongoing and future research in tissue regeneration.

Significance and Future Impact

This research project is poised to transform Botswana's medical landscape by providing locally sourced and produced biomaterials. The initial focus on bone tissue regeneration, with plans to expand into skin tissue regeneration, addresses critical medical needs and opens new avenues for medical treatments. The establishment of a fully functional Regenerative Medicine Lab will, beyond enhancing local research capabilities, also contribute to global scientific advancements in regenerative medicine.

By leveraging Botswana's local resources, this project will pave the way for innovative solutions in tissue regeneration, reducing dependency on imported biomaterials, and fostering local scientific development. This initiative represents a significant step forward in medical research and development, promising substantial benefits for both the local, regional, and global medical communities.





Research Excellence Awards and Appointments

- Prof Lynnette Kyokunda was appointed as Reviewer for the following journals: African Health Sciences Journal; African Journal of Laboratory Medicine; Forensic Science International; Blood; Hematologica.

Looking Ahead

1. The current portfolio of research activities is expected to continue. Emerging research plans will be influenced by the outcome of numerous research funding applications currently under review.
2. The current research activities expected to continue. Continue to support collaboration with Bokamoso Private Hospital on the Cardiothoracic Registry.
3. Botswana will host the international 2024 African Conference on Emergency Medicine (AfCEM) conference (November 6-8, 2024) - <https://www.afcem24.org/>:
4. Strengthen research initiatives by looking at research on climate change and health, research on management of chronic lifestyle diseases through the six (6) pillars of lifestyle medicine (nutrition preferably with whole foods diet, restorative sleep, stress management, maintaining social relationships, tobacco cessation and physical activity).
5. Host a Public Health Conference leveraging on the Botswana Public Health Association currently undergoing re-registration.
6. Penn CFAR pilot grant for 2024. Diagnostic utility of artificial intelligence and digital scanning of diarrheal stool specimens collected from HIV-exposed and unexposed infants and children in Gaborone, Botswana.
7. Quality Improvement Projects
 - a. Technology at SKMTH.
 - b. Specialist scientists in molecular techniques.
8. Quality control
 - a. Health cost saving projects.
 - b. Consultants to help with diagnoses (hematopathology).
 - c. Training research scientists to be able to provide diagnostic and research studies.

Radiology is a newly constituted department within the FoM. The faculty is establishing research contacts with a variety of research groups within Botswana (BITRI) and outside of Botswana (Botswana Harvard Health Partnership (BHP), University of Pennsylvania, and Duke University). The faculty hopes to leverage these to develop a robust local radiology research group that is supported by local and international expertise.



guides to French texts
Wolfgang van Emden, David Williams

coming volumes:

de Bergerac: L'Autre

de Troyes: Erec et

L'Alouette and Pau-

on. Les Réveries du

céros.

erre et Jean.

la Méthode.

tions.

ems.

s. Du

ste.

oit

843.5 D10

843.5 D10



Faculty of Education



Acting Dean
Prof. Maria S. Nnyepi

From The Dean's Desk

The Faculty of Education is made up of seven (7) departments that include Educational Foundations, Family and Consumer Sciences, Languages and Social Sciences Education, Life-long Learning and Community Development, Mathematics and Science Education, Primary Education, and Sport Science.

Research Output

As evident in Figure 24, the departments of Sports Science, Primary Education, and Educational Foundations led the faculty in the most outputs produced. The departments produced at least 25 outputs, mostly journal publications and conference presentations.

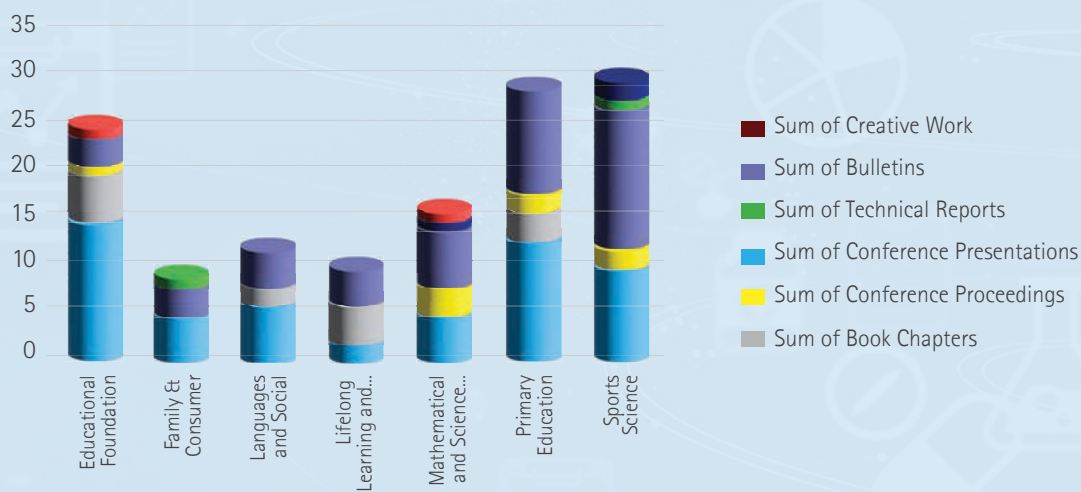


Figure 24: 2023 Total Outputs by Department

A young woman with dark hair and a hoop earring is smiling and looking upwards. In the background, another person is visible with their hand raised. The text "Faculty of Humanities" is overlaid on the image.

Faculty of Humanities



Acting Dean
Prof. Fidelis Nkomazana

78

From The Dean's Desk

Faculty of Humanities' research strengths and alignment to priorities of the nation's Vision 2036 and the principles of the Sustainable Development Goals (SDGs) focus areas, which contribute to societal advancement, cultural preservation, and the well-being of communities are outlined as follows:

Cultural Preservation and Innovation: to preserve and revitalise indigenous cultures and languages; explore the intersection of technology and traditional arts, popular culture, promote cultural exchange and innovation and document language and oral histories and traditions to safeguard intangible cultural heritage.

Social Justice and Equity: to investigate the impact of historical injustices on marginalised communities and proposing reparative measures; to examine socio-economic disparities and developing strategies for inclusive growth and opportunity and advance research on gender equality and minority representation in literature, media, and society.

Environmental humanities: to study the relationship between human societies, religion and the environment through historical, cultural, and philosophical lenses; to promote environmental stewardship and sustainability through interdisciplinary research and community engagement and to explore narratives of environmental crisis and resilience to inform policy-making and public awareness campaigns.

Digital Humanities, Technology and Media Ethics: to investigate the ethical implications of emerging technologies on society, culture, and identity; to develop digital archives and tools for preserving and analysing cultural artifacts and historical records and indigenous knowledge systems and to examine the role of digital media in shaping narratives, identity construction, and collective memory.

Global Citizenship and Intercultural Dialogue: to facilitate cross-cultural understanding and cooperation through intercultural dialogue and exchange programs; to study migration patterns, diaspora communities, and transnational identities in a globalised world and to address issues of cultural diplomacy, conflict resolution, and peacebuilding through interdisciplinary research and collaboration.

Creative and cultural industries for sustainable development and creative economy.

By focusing on these priority areas, the Faculty of Humanities can play a vital role in advancing the nation's 2036 vision, while upholding the principles of sustainability, inclusivity, and social justice. The Faculty of Humanities delivers research through its eight (8) departments as illustrated in Figure 25.



Research Outputs

Theology and Religious Studies and English departments led the faculty in the total research outputs produced for the year. Major outputs were journal articles, conference presentations and book chapters.

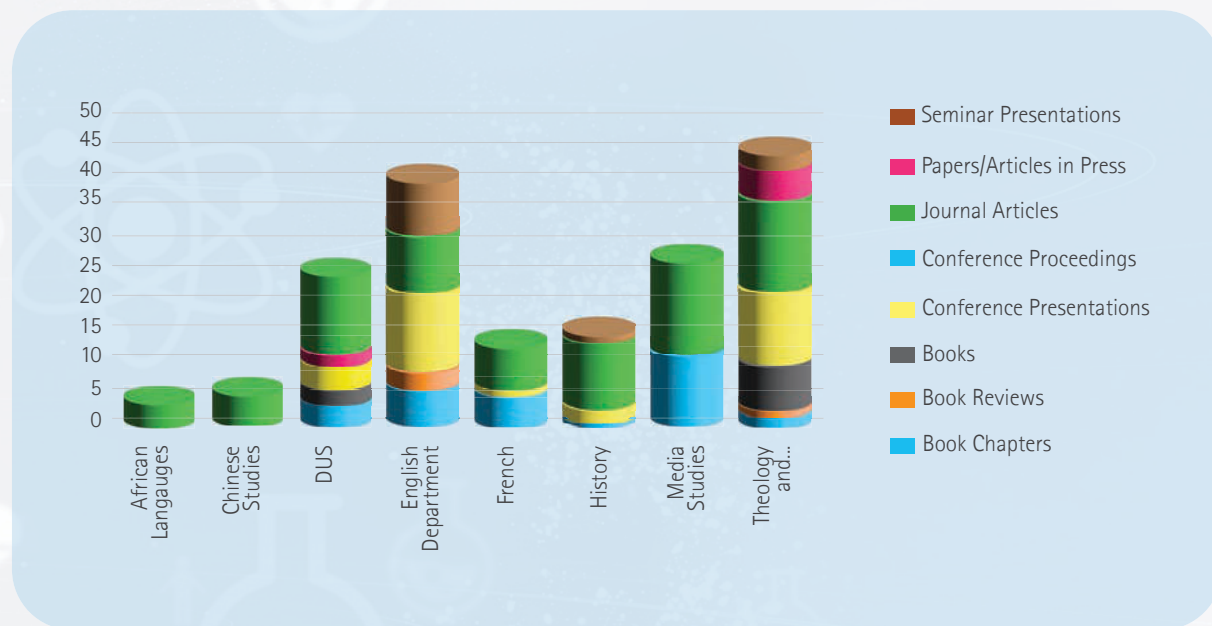


Figure 25: 2023 Total Outputs by Department

An aerial photograph of a university campus. In the foreground, there is a large, modern building with a white facade and a curved glass section. To the left of the building is a large, leafy tree. In the bottom center, there is a small, circular hut with a thatched roof. Behind the building is a parking lot filled with cars. In the background, there are rolling hills and a clear blue sky.

Faculty of Business





Acting Dean
Prof. Jaloni Pansiri

From The Dean's Desk

The faculty's strength is in its multidisciplinary nature which if harnessed appropriately could yield better results. More collaboration between faculty members is needed to enhance its research output.

This reporting year, the Faculty of Business published 21 articles in high impact journals. These articles were largely

in tourism (conservation, policy, nature-based tourism, and indigenous communities), transport and logistics, and the role of information technology, human resource management, marketing, finance, and taxation.

Research in the faculty mainly addresses the Sustainable Economic Development of the National Transformation Strategy, which is Pillar 1 of SDG 8 - Decent Work and Economic Growth. This pillar aims to transform Botswana into a high-income country by 2036, with an export-led economy underpinned by diversified, inclusive and sustainable growth, driven by high-levels of productivity. Some of the topical research areas identified by the National Transformation Strategy are: Economic Diversification Drive, Special Economic Zones Policy, National Trade Policy, Industrial Development Policy, Doing Business Roadmap, Cooperatives Policy, Middle-Class Strategy, National Policy on Agricultural, Development, Tourism, Land and National Minerals.

Research Output

Most of the research outputs were from the department of Management. Consistently journal articles topped the outputs, followed by conference proceedings. The Tourism and Hospitality department and the Marketing departments followed.

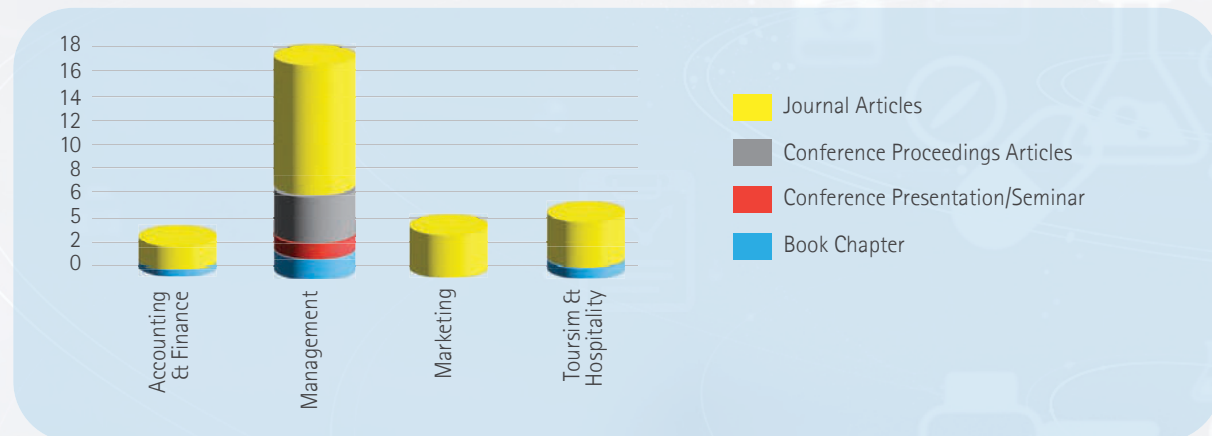


Figure 26: 2023 Total Outputs by Department



Research Institutes and Centres Of Excellence

The University has established a Research Institute and Research Centres as vehicles for increasing research performance, which in turn will lead to making the University a research-intensive institution by the end of the University Strategy for 2020-2029. The University identifies Research Institutes and Centres as critical for the realisation of the University Vision 'Creating a Future for the Knowledge Generation'. Whereas the Research Institute is established to focus on an area of strategic importance and resourced directly, Research Centres are self-sponsoring as they attract external funding in areas of strategic importance and promote multi-disciplinary research groups, international research collaboration, research affiliation, research mentoring and increasing

research quality and output with impact. Currently, the University has Seven (7) active multi-disciplinary Research Centres namely:

1. Centre for Scientific Research and Indigenous Knowledge & Innovation (CesRIKi),
2. San Research Centre (SRC),
3. Clean Energy Research Centre (CERC),
4. Centre for the Study of HIV and AIDS (CSHA),
5. Centre for the Study of Renewable and Sustainable Energy (CSRSE),
6. Engineering Technology Innovation Centre (ETIC) and
7. Transport Research Centre (TRC).

Okavango Research Institute



Acting Director
Prof. Joseph E. Mbaiwa

The Okavango Research Institute (ORI) is the only research institute in the University of Botswana, led by an academic director and dedicated to a multi-disciplinary wetland research agenda. When ORI started, it focused on research; however, with the need to maintain the research pipeline and develop critical expert pool, it has a developed vibrant postgraduate wet-land research programme. Research Centres are multi-disciplinary entities headed by an academic director responsible for the niche research programme and supervision of researchers.

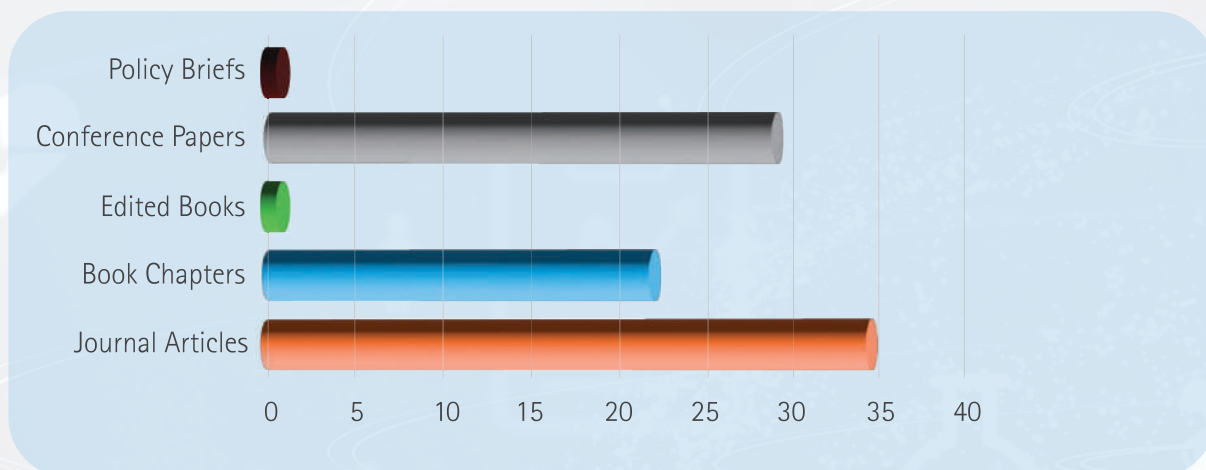


Figure 27: Number of Research Outputs per Type

Major Projects

The ORI has 24 active major projects covering various topics on delta-related research. These are projects that will run for at least five years. Nine (9) of the projects were awarded in 2023 to the tune of **BWP 21,321,000.00**.

Research Engagement Activities

The institute is actively engaged through various community and stakeholder focused activities to demonstrate the University's relevance in local communities and ensure its impact beyond academic work. The following engagement activities were undertaken by the Institute's researchers:

Dr Emily Bennitt coordinated a monthly panel discussion called "Conservation on Tap" sponsored by Kwando Safari. This engagement activity has been ongoing since Isotopic reconstruction of social networks in southern Africa: geochemistry, ethnoarchaeology, and recent history (since 2020)-Partnering with Arizona State University & Botswana Department of Museum.

Prof. Toyin Kolawole participated in the Times Higher Education Interdisciplinary Research Survey on the 10 February 2023.

Prof. Olga L. Kupika was a Contributing project member to the International Union for the Conservation of Nature (IUCN)'s World Commission on Protected Areas (WCPA) Guidelines for Managers, Planners and Policy-Makers on Climate Change Mitigation in Protected or Conserved Areas in partnership with Korea National Park Service (KNPS).

Prof. Olga L. Kupika: Presented on "How can space technology and know-how support be utilized by women in remote communities" for the Space Generation Advisory Council (SGAC) project on Diversity and Gender Equality Project Group of the second edition of the Giant Leap Hackathon, focusing on remote communities.



Research Excellence Awards and Appointments

- **Prof Toyin Kolawole** received Best Researcher in Indigenous Knowledge Systems Category at the Botswana National Research Excellence Awards, 2023 by the Government of Botswana - Ministry of Communications, Knowledge, and Technology (March 2023)
- **Dr Oliver Moses:** In 2023, the International Astronomical Union (IAU) Working Group on Small Body Nomenclature named the asteroid 28623 "Olivermoses", in recognition of Dr Oliver Moses's work on the recovery and study of asteroid 2018 LA. The IAU, headquartered in France, is a non-governmental organization with the objective of advancing astronomy in all aspects through global cooperation. The work culminated in a publication of a journal article co-authored by Dr Oliver Moses (doi: 10.1111/maps.13653).
- Five (5) ORI researchers, Prof. Toyin Kolawole, Dr. Nashaat Mazrui, Dr. Moseki Motsholapheko, Dr. Mangaliso Gondwe, and Kelebileone Kaisara were appointed to the District Commissioner's task force to investigate potential risk factors in the kidney disease problem in Shorobe, Ngamiland District.

Looking Ahead

In the medium term (2024–2029), the Ecosystem Services (ESS) programme will continue to engage in participatory community development and natural resource conservation research and hopes to translate its research findings into products that holistically impact on people and the environment on a long-term basis.

The programme comprises four (4) Research Fellows, one (1) Senior Research Fellow, and one (1) Associate Professor. Two (2) of the members are finalising their doctoral dissertations. Currently, the institute is aiming for a publication output of at least 15 publications per year. This is expected to increase to at least 24 research publications annually, once the two (2) members obtain their PhDs and are promoted to higher cadres. All six (6) staff members will hold the position of full professor, elevating the research output to 30 publications per year. The research plans also include increasing the number of proposals submitted for funding by each scholar.

The tropical region is thought to contribute over two-thirds of the global methane budget with wetlands playing a particularly important role. There are currently high uncertainties on tropical greenhouse gases GHG budgets because of a lack of direct observations and modelling which is often done based on data obtained in better-studied temperate ecosystems extrapolated to the tropics.

Climate change impacts and future projections for the tropical region including the Okavango basin are poorly understood due to lack of data. The current projections for the basin are based on extrapolation from well-studied temperate ecosystems. The Climate Change Programme will intensify application for large collaborative grants for long-term projects in order to generate high quality data for the basin; Grow scope of large herbivore ecology to include post-doctoral associates to assist with progress for more PhD and MPhil students; Apply for larger grants for long-term projects; and Establish and coordinate Carbon Cycling Research Group for Cubango-Okavango River Basin.



San Research Centre (SRC)



Centre Director
Prof. Maitseo Bolaane

The SRC was established in 2008 with a two-fold mission, to become the leading Research Centre for San Studies globally studying the cultural, historical, social, economic and legal situation of the San (Basarwa) of southern Africa, and to ensure that San youth have effective access to higher education.

Projects and Initiatives

- In the year under review, in collaboration with Palms for Life Fund Botswana (PFLFB), the Centre held a two-day National Forum on The Preservation of San Language, Culture and Knowledge in Botswana which was attended by San communities. The forum, funded by PFLDP for **BWP165,880.00** took place within the framework of the UN International Decade of

Indigenous Languages (IDIL, 2022-2032). It developed a National Action Plan (NAP) for the Preservation of San Languages, Culture and Knowledge in Botswana. The action plan will be shared with the Government and other key players for implementation from 2024-2026.

- The project Making Things from Animals: Leather Technologies of the Kalahari - EMKP2020SG12, supported by Arcadia's Endangered Material Knowledge Programme, documented leather production techniques at four (4) locations across Botswana namely, Serowe, Kaudwane, Ncaang and Lokgwabe during October 2022. UB and the University of East Anglia (UK) participated in the project and the Botswana project received **£11,264.00** funded by the British Museum. Research Team: Chris Wingfield, Maitseo Bolaane, Novelette Aldoni-Stewart and Leema Hiri, "Making things from animals: Leather Technologies of the Kalahari", University of East Anglia (UK) and the University of Botswana (Botswana) 2022-2023.
- The Mølmann Øvernes San Research Centre Graduate Scholarship provided postgraduate funding for two MSc San students at the University of Botswana enrolled for two (2) years. A scholarship of **BWP954,546.08** will cover at least three (3) candidates. The Mølmann Øvernes San Research Centre Graduate Scholarship addresses the San Research Centre's mandate of improving San youth access to tertiary education and the move to gravitate from research on to research with and by the San. The donors are, Dr Siv Øvernes and Dr Odd Mølmann



living in Norway. They funded three graduate student to cover the scholarships at the University of Botswana. To date two (2) beneficiaries have been identified and supported for their full programmes. Currently the Centre is in the process of identifying the third candidate and hopefully this will be a female beneficiary, and the Centre will be responding to the gender balance. The last beneficiary is expected to commence in August 2024 and complete in the year 2026

- In addition to the three (3) research seminars held in the year under review, the Centre produced three (3) research impact outputs in the form of policy briefs:
 1. Policy brief on the Socio-Economic Situation of the San in Botswana.
 2. Policy brief on Land and Livelihood for the San in Botswana.
 3. Policy Brief on Inclusive Education for the San in Botswana. This will be used by the Government of Botswana and other stakeholders to guide policy development for the San and will benefit the education sector and their socio-economic upliftment.

Main Research Programmes and Projects

- The British Museum funded a Project titled "The Endangered Material Knowledge Programme (EMKP2020SG12)" to the tune of **£14,947.00** in Botswana.

This project (EMKP2020SG12 -Making things from animals: leather technologies of the Kalahari), supported by Arcadia's Endangered Material Knowledge Programme, documented leather production techniques at four (4) locations across Botswana during October 2022, supported by Arcadia's Endangered Material Knowledge Programme.

Films and descriptions will be made available through the British Museum's Digital Repository at: <https://www.emkp.org>. Research sites: Serowe, Kaudwane, Ncaang and Lokgwabe. The research team collected data (oral interviews and filming) on site. Data analysis & dissemination workshops were carried out in 2023. The project engaged not only local communities at the respective research field sites, but some of the key individuals from these respective communities did the translations for the "Making things from animals: leather technologies of the Kalahari": Isaac Saul (Naro), Mmamaswe Kikonyane (IXoo), Tshisimogo Leepang !G|wii and ||Gana, Nicodemus Cooper (Nama & Shekgalahari) and Scobie Lekhutile (Setswana). Tshisimogo Leepang is currently registered for Masters studies (MPhil) at UB in the Department of African Languages.

- Palms For Life Fund Botswana funded the San Research Centre with BWP165,880.00 to cover the costs of inviting relevant senior Government officials, local San communities' representatives, San NGOs representatives, San leadership, San beneficiaries of the San Research Centre scholarship component, University of Botswana students, Civil Societies representatives and relevant academics and researchers to both the National Forum and the follow-up meeting. Deliverables from the San Research Centre were, Rapporteurs Report (National Forum)-2024, National Action Plan (2024-2026) on Preservation of San languages, culture and knowledge in Botswana, and the Financial Report, 2024.



Research Engagement Seminar Series

- The Centre seminar series continued, with four (4) seminars hosted at the University of Botswana, attracting participation from as far as Europe, since it is offered physically and virtually. This seminar series will continue every month.
- The San Research Centre in partnership with PFLFB hosted a two-day National Forum on The Preservation of San language, culture and knowledge in Botswana on the 15th and 16th November 2023 at Protea Hotel Masa Square in Gaborone. The National Forum took place within the frame of the UN International Decade of Indigenous Languages (IDIL, 2022-2032). The Forum was expected to develop a National Action Plan (NAP) for the Preservation of San Languages, Culture and Knowledge in Botswana to be shared with the Government and other key players for implementation in 2024-2026. A follow-up meeting was held at Protea Hotel, Masa Square in Gaborone on 1st March 2024 to deliberate on the National Action Plan draft for finalisation.
- The Transformation and Revitalization of Culture among Naro Communities of the Ghanzi District: Looking at contemporary art production and modern uses of dances.
- Inter-San ethnic relationships and social attitudes.
- Indigenous Peoples Political Participation, Democracy and Human Rights – Drawing Comparisons Between Botswana and Norway.
- Living in the Shadows of Policy: The case of the San People of Botswana.

The following policy briefs were produced and presented by the Centre Director, Prof. Maitseo M.M. Bolaane:

- Policy Brief on The Socio-Economic Situation of the San in Botswana, (pp. 1-10) – Advancing Rights in Southern Africa (ARISA), and USAID (United States Agency International Development), Johannesburg.
- Policy Brief on Land and Livelihood for the San in Botswana (pp. 1-11) – Advancing Rights in Southern Africa (ARISA), and USAID (United States Agency International Development), Johannesburg.
- Policy Brief on Inclusive Education for the San in Botswana (pp. 1-14) – Advancing Rights in Southern Africa (ARISA), and USAID (United States Agency International Development), Johannesburg.

Other Collaborations

The San Research Centre and the University of Tromsø (UiT), The Arctic University of Norway have a Memorandum of Agreement to cooperate for the exchange of students and/or staff in the context of the Erasmus mobility programme. The MoU is already being implemented, with two master's students from University of Botswana already participating in the exchange programme at the UiT. Karabo Matonkomane a Master of Arts Politics and International Relations student, and Amogelang Mampe a Master of Education Early Childhood student started their exchanges in August 2023 and completed in December 2023 and February 2024, respectively. Two (2) more students from UB will start their exchanges in 2024, doubling the total number of beneficiaries.

Looking Ahead

- Students' Tracer Study (long term)
- San Research Centre' Impact on San communities (long term)
- Research Seminar Series (long term).



Centre For Scientific Research, Indigenous Knowledge And Innovation (CESRIKI)



CesrIKi Expert
Prof. A. K. Marobela

The Centre for Scientific Research, Indigenous Knowledge and Innovation was established in 2006 as an intellectual and cultural centre that draws upon the nation's indigenous knowledge base and promotes Botswana social and cultural heritage. In the year under review, CesrIKi has developed a Biocultural Community Protocol (BCP); an instrument for communities in the framework of the Nagoya Protocol on Genetic Resources (NPGR). The instrument will assist the community to reach their wishes to interact with third parties in relation to their natural resources as they benefit them.

CesrIKi is working on a community development project towards, empowering the Xere Community to sustainably manage their environment and enhance their livelihoods and well-being' in the framework of a three-country project (Namibia, South-Africa, Botswana) to empower San Communities of Southern Africa funded by UNDP/SGP/GEF. Funding Amount: **US\$150,000.00.**

Clean Energy Research Centre (CERC)



CERC Energy Expert
Prof. Oboetswe S. Motsamai

The CERC was established on the 29th of February 2008 and focuses on renewable and sustainable energy research, education, and advocacy. In the year under review the **CENTRE SOLTRAN 4 Project: SOLTRAIN IV** project, valued at **EUR113,350.00**, started in July 2019, and ended in December 2022, with outstanding activities continued into 2023. The project was funded by the Austrian Development Agency (ADA). The course trained experts on solar water heating systems, design, build and Installations for uptake.

The CERC will represent the Government of Botswana in the United Nations Environment Programme (UNEP) seventh edition of the Global Environment Outlook (GEO-7) report. The project started in January 2023 and ends in December 2026. Prof Kevin N. Nwaigwe, a CERC Energy Expert, was selected by UNEP to serve as the Coordinating Lead Author (CLA) in the Energy Transformation Pathway chapter.



A person is seen from the side, sitting at a desk in a library. The background is filled with tall bookshelves packed with books. On the desk in the foreground, there are several books, including a prominent red one. A blue pen lies on top of one of the books. The text 'Department of Library Services' is overlaid in the center of the image.

Department of Library Services



Director
Mr. Alphege Maisiri

The University of Botswana Library provides a robust collection of information resources that effectively support learning, teaching, and research endeavors across all faculties and institutes. These resources are accessible on campus and remotely through Open Athens authentication.

UB Library Catalogue

This is the one-stop search for books and e-books, videos, articles, digital media, and more. The catalogue is available at: https://linyanti.ub.bw/discovery/search?vid=267UOB_INST:267UOB_INST

A-Z Databases

Provide indexing and abstracting for over 1,000,000 records and open access full text for over 15,000 records spanning various subject areas and disciplines. These databases serve as invaluable repositories of scholarly journals, articles, e-books, multimedia materials, and other authoritative sources essential for academic exploration and research endeavors.

Available at: <https://ub-bw.libguides.com/az.php>

Collection Discovery Service

Primo search tool allows researchers to find and access information about a wide range of print and electronic

resources all from a single search point. With Primo, you can search for books, journals and articles from our subscription databases, open access resources, and more, all from one interface. Available at: https://linyanti.ub.bw/discovery/collectionDiscovery?vid=267UOB_INST:267UOB_INST&collectionId=81119869050007641

InterLibrary Loan (ILL)

Provides library users with the opportunity to access materials not available within their local library's collection. Through ILL, patrons can request books, articles, and other resources from libraries worldwide.

Available at: https://linyanti.ub.bw/discovery/login?vid=267UOB_INST:267UOB_INST

Special Collections

The home for local content output which includes the national, university and private archives. Houses the Legal repository in the country; required by law to collect at least one copy of every document published in Botswana. You can access our special collections at the Main library as well as the ORI library.

University Of Botswana Research, Innovation and Scholarship Archive (UBRISA)

Provides Open Access to all research output at UB. The digital repository showcases the University of Botswana research under various communities.

Available at: <https://ubrisa.ub.bw/>

UB Library LIBGUIDES

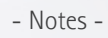
Get research assistance, subject guides, and useful resources compiled by your librarians. Available at: <https://ub-bw.libguides.com/>

LIBRARY SOCIAL MEDIA HANDLES

Available at: <https://www.facebook.com/profile.php?id=100064731938933>

UB LIBRARY ENQUIRIES

Email: ublibcesenquiries@ub.ac.bw
Directorlibrary@ub.ac.bw



- Notes -

94

Pvt Bag 0022
Gaborone, Botswana



Plot 4775
Notwane Road
Gaborone, Botswana



In Pursuit of Academic Excellence

www.ub.bw

