

THE BOTSWANA'S HONORARY CONSUL GRACES THE BIUST CAMPUS

By: Tshegofatso Teseletso



BIUST Chancellor, His Excellency the former President Dr. Festus Mogae, Botswana's honorary Consul Mr. Charles Frankel and BIUST Vice Chancellor Professor Otlogetswe Totolo

On the 10th of February 2022, Botswana's Honorary Consul based in California, United States of America, Mr Charles Frankel accompanied by Botswana International University of Science and Technology by the Former President of the Republic of Botswana, Dr Festus Mogae who is also the BIUST Councillor paid a courtesy visit to BIUST. The intent of the visitation was for the two dignitaries to appreciate the diverse projects the University is currently engaged in.

The BIUST Vice-Chancellor, Professor Otlogetswe Totolo opened the morning tryst by expressing his gratitude to the Chancellor for continuing to work tirelessly to ensure that BIUST grows and plays a pivotal role in the economic transformation and development of this country.

Prof. Totolo said BIUST is a research-intensive university that specialises primarily in science, engineering and technology. He went on to stipulate that the institution is a deliberate construct by the government of Botswana to become a game-changer; a key catalyst for Botswana's economic transformation and development of this country.

"Mr Frankel our efforts are channelled in the direction of delivering top-end research and innovation in science, engineering and technology to develop and grow local talent that can re-engineer a new and robust economic thrust to facilitate Botswana's transition into a knowledge-based economy and society," he noted.

Prof. Totolo indicated that BIUST is desirous of unleashing the potency of its intellectual property in a manner that facilitates the creation of goods and services through new ideas and the Californian Silicon Valley has proven itself over long years that it is the best model to emulate. "Mr Frankel we believe that we learn a lot from you as an active member of Silicon Valley," Prof. Totolo said.

Stating the BIUST Overview the Vice-Chancellor articulated that the university's primary focus is centred on strengthening the academic value chain comprising three key elements: academic excellence, commercial attractiveness, and social relevance. To enable prevalent and visible progress the institution is guided by a strategic master plan.

Reverting on the Institution's strategic plan, the Vice-Chancellor explained that BIUST is not only committed to producing "industry-ready graduates" but to also playing a significant role in encouraging and inculcating the much-needed acumen of entrepreneurship. "Through our Centre for Business Management, Entrepreneurship and General Education, we equip and empower both students and members of the community in skills development for business start-ups and management," he said. To this end, the university continues to seek for potential partners to assist in research conversion models that can play a pivotal role in the commercialisation of research projects.

Over the years BIUST students have instigated numerous commercial projects such as; Antimicrobial toilet seat, Pyrolysis plant and Smart Hard Hat. BIUST Milestones embodies the Drones for Health and STEM festival. "We are committed and desirous of continuing to work hand-in-hand with you to build strong and effective partnerships to advance our common goals and aspirations in the name of our country and the people," he said in conclusion.

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EDITOR'S NOTE



Mrs. Rebecca Richard

February is a month to show people that they are meaningful to us, that we love and appreciate them hence a time to gift such people and tell them what they mean to us. The Newsletter wishes all our stakeholders a happy Valentine's month.

It is increasingly evident that BIUST postgraduate researchers and scientists continue to enhance research knowledge

value by injecting fresh thinking in the use of Indigenous Knowledge Systems (IKS) as well as assess the sustainability of producing a moderately upgraded biofuel for application in REMOTE/OFF GRID power generation using Heavy Fuel Oil (HFO) infrastructure to resolve challenges facing society today in line with Vision 2036.

As we gradually transition from strict COVID-19 health measures, the University continues to host people from all walks as this edition features the courtesy visit by BIUST Chancellor Dr F Mogae and Botswana's Honorary Consul based in California, United States of America, Mr Charles Frankel.

The University also hosted prospective students in a bid to attract them to compete for space in undergraduate degrees, appreciate the University facilities, and a quick glance into various programme offerings at an early stage in life.

The editorial team urges its esteemed readership to continue observing COVID-19 protocols and do all possible to contain the virus before it is too late. Be arm ready to get

your job and booster now. Concern was raised by Health officials that there is reluctance to get boosters despite availability of supply and constant reminders to comply and save lives.

If you want to be part of this publication, please email barutir@biust.ac.bw or gachalaw@biust.ac.bw.

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Chemicals, Materials and Metallurgical Engineering

Introduction

Chemical engineers are principally involved in the production of a wide range of chemicals such as soaps, dyes, polyethylene, detergents, fertilizers, cement, bricks etc., foodstuffs such as cooking oil, margarine, beverages and pharmaceuticals as well as petroleum products, but they are also involved in production of potable water, pulp and paper, cars, steel, mineral resources processing, production of energy, textiles, beverages, waste processing and minimization, river, water, soil and air pollution and treatment.

Modules

Chemical and Metallurgical Engineering Thermodynamics • Chemical Reaction Engineering • Green Energy Engineering • Process Control and Instrumentation • Chemical and Metallurgical Engineering Design • Extractive Metallurgy • Heat and mass transfer • Mechanical Metallurgy • Polymer and composite technologies.

Career and Graduate Study Opportunities

Chemical and materials processing plants, minerals, metal production and metal forming industries; food and beverage industries; biotechnology, production of bio-medical materials, manufacture of polymeric materials, ceramics and composites. Associated functions such as energy utilisation, environmental protection, health and safety, disposal of hazardous waste, process control and quality management.

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INAUGURAL CHEMICAL, MATERIALS & METALLURGYICAL PhD STUDENT GRADUATES

By Gratitude Charis



Gratitude Charis

The thesis title "SUSTAINABLE PRODUCTION AND USE OF A CRUDE BIOFUEL FROM LIGNOCELLULOSIC BIOMASS: A TECHNICAL AND SOCIO-ECONOMIC STUDY" came after three R's: reading, research and many reconsiderations! It is funny yet so true, how my main supervisor, Prof Muzenda, used to say that the first full year is for defining what you exactly want to do. I am grateful to both my supervisors for their mentorship and patience.

The research borders around lignocellulosic biomass wastes: acacia encroacher bush from Botswana and Pine sawdust waste from Zimbabwe. The main aim was to assess the sustainability of producing a moderately upgraded biofuel for application in REMOTE/OFFGRID power generation using Heavy Fuel Oil (HFO) infrastructure.

Since HFO is already being used in Medium

Scale power generation, substituting it with a cleaner alternative (Bio-oil) could constitute reductions in emissions and costs (including heating and pumping) while presenting a good case for the valorization of such wastes. My methodology involved characterization of the wastes, pyrolysis experiments using the pilot plant in BIUST, characterizations of products, sustainability evaluation and sustainability improvements implemented through process simulations. With minimal CAPEX and optimized operating conditions with high yields (60-80%) and good quality products, it could be possible to produce a Bio-oil at \$0.19-0.25/L compared to the global market price of HFO of \$0.45. Blending bio-oil with HFO can also reduce pumping and heat energy requirements due to its significantly lower viscosity compared to HFO.

Most of my foundation in education and research was laid in Zimbabwe, my home country. I went on to do my undergraduate degree in Chemical Engineering (2009) and MEng in Manufacturing Systems and Operations Management (2012). I worked at the National University of Science and Technology for three years as a tutor, then lecturer (2010-2013); then later on in 2017, I was selected to be a part of the University Council of the same institution for two years. From 2014 to 2017, I was privileged to experience research at the commercial front when I worked for a consultancy company that handled funding proposals for EU based SMEs, largely toward H2020 instruments. These laid a good foundation for my research and writing career.

My vision is to contribute to the socio-economic improvement of, especially, Southern Africa through engineering innovations. I obtained some research funding from BIUST, where I am currently working to produce cleaner solid fuels from waste with minimal or zero external fuel requirements. I derive much satisfaction from participating in commercially relevant research. I also recently got an offer for a Post-Doctoral position in Sweden, for a consortium that received EU H2020 funding for the valorization of the acacia encroacher bush within Southern Africa, showing that the encroachment problem is real and being globally considered.

...Continues from page 1

For his part, Dr Mogae expressed pride at the evolving BIUST. "I rejoice as I observe the great progress that this University is making, first of its kind in Botswana; I marvel at its prospect," the delighted Chancellor said. He added that it was with pride that he invited Mr Frankel to BIUST, as a man with an in-depth background in science, innovation and technology, and someone who have had Botswana's welfare at heart for over 25 years years. He also denoted that BIUST has proven to be an impactful institution hence he proudly invited him to appreciate the change projects they are engaged in as someone who shares a similar vision as BIUST.

Dr Mogae wound up by appreciating both the Vice-Chancellor and the BIUST community for the marvellous job they were currently doing.

Furthermore, he highlighted that there were some Batswana citizens who had and continue to visit California Silicon Valley institutions through Silicon Valley Innovation program. The main objective of this program is to empower them with practical knowledge. "It is extremely exciting to see the magnificent institution BIUST has blossomed into, not only in terms of its structure, the academic programs they offer but also practical projects they are engaged in," he acknowledged.

He advised that BIUST and Botswana as a whole must utilise experienced senior intellectual lawyers and venture capitalists as they play a

pivotal role in ensuring success in development initiatives. "Nature and nurture are vital in the knowledge economy as it sparks invention and innovation that this country is driving towards," he said before he concluded by imploring Batswana to develop a financial centre and utilise the Internet to reach its vision.

When giving the closing remarks BIUST Deputy Vice-Chancellor, Research development and Innovation Professor Abraham Atta Ogwu stated that BIUST was not only centred around academic excellence, but it also stood to play a pivotal role in leading fundamental research, and knowledge transfer. The knowledge that speaks to Botswana's national 2036 vision. "BIUST is currently engaged in a whole spectrum of prevalent activities that will see to the realisation of a knowledge-based economic transformation," he said.

He thanked the two dignitaries for coming to appreciate the development progress of BIUST and its projects. He appreciated their wisdom, "We will embrace your wise advise moving forward".

The illuminating and fruitful visitation was wrapped up with a campus appreciation tour to different laboratories; starting with the Faculty of Engineering (pyrolysis lab) and Faculty of Science (Biotechnology lab) where the two delegates were briefed on diverse research projects the university is currently engaged in.

THE INDUSTRIOUS BIUST; ADMIRE KHULUMO HOISTS BIUST FLAG UP HIGH

By: Tshegofatso Teseletso

Mr Admire Khulumo a BIUST Year 4 BSc Computer Science and Software Engineering student was recently awarded a six months industrial training by Volvo Cars, a Swedish multinational manufacturer of luxury vehicles.

When explaining how this scholarship came about, BIUST International Linkages and Partnerships Ms Gadibotsile Chakandinakira, delineated that they made an application on behalf of the University and submitted Mr Khulumo's name as a nominee.

She said that the nominee competed against six other nominees from around the world and came first. Mr Khulumo started his program on February 08th, and his attachment will end July 15 2022.

This opportunity came through the International Association for the Exchange of Student for Technical Experience (IAESTE), where BIUST is a new member, after joining mid-last year. IAESTE is a European non-profit association based in Luxembourg that provides students with the opportunity to gain internship opportunities in Europe. The internships are open to students who have not completed their degree programmes and require technical work experience to attain credits to graduate. The internship is paid and usually tenable for six months.

Ms Chakandinakira explained that during this period, Mr Khulumo will be placed at the Volvo Sustainability Centre with the Contamination Team. "He will be part of the team leading a PhD project 'CAE Methodology for vehicle snow packing and sensor availability for active safety and



The industrious Admire Khulumo

autonomous vehicles," she explained. The industrious young man will be spearheading a project that aims to increase the availability of sensors in winter climate by the innovation of simulation models able to predict snow impingement and accretion on car sensors.

Mr Khulumo's specific role will be to implement the developed technologies into already existing numerical tools such that they can be easily used by the Engineers in the team. "He will also have the opportunity

to be supported and guided by Volvo supplier," she said.

Mr Khulumo will be representing both BIUST and Botswana as a whole in Sweden. Ms Chakanandakira concluded by stipulating that institutions and students across the country that have an interest in this initiative can register with BIUST, to be included in the IAESTE Botswana Employers or student pool.



Computer Science and Software Engineering

Introduction

Computer Science and Software Engineering is the study of computational systems involving designing, building, evaluating performance of computer hardware and software. It also involves thinking both in abstract and concrete terms. The necessities of the programme include designing and analysing relevant algorithms and/or application software

Modules

Foundations of Computation • Procedural and Object-Oriented Programming Software Engineering • Databases • Operating Systems • Computer Architecture Data Communications and Networks • Human Computer Interaction • Professional Issues and Ethics • Major Project.

Career and Graduate Study Opportunities

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DISCOVERING A FUTURE IN SCIENCE ENGINEERING TECHNOLOGY AND MATHEMATICS (STEM). By Wandipa Gachala

The Botswana International University of Science and Technology (BIUST) continues to stimulate interest in Science, Engineering and Technology. On the 14th February 2022, BIUST hosted about 90 prospective students from various high schools around Botswana.

The purpose of this visitation of high school students was to accord aspiring undergraduate students firsthand interaction of the University facilities and give them insights into programmes offered, culture and student life. This initiative will aid students to consider BIUST as a University of choice. The visit was conducted under the theme, "Converting raw materials into sustainable and high-performance products".

The Director of Registry Services, Mr Donah Lekwati, extended his appreciation to parents and teachers for allowing the students to honour the University invitation. He highlighted that the event intends to showcase what BIUST offers and appetize prospects to be a part of the excitement the institution offers.

"BIUST is a world-leading and industry-relevant institution that attracts the best students specializing in STEM. Thank you for being of strong faith and befitting to be a part of this occasion," he said.

In conclusion, he employed the Student Representative Council, Minister of Academic

Affairs, Wamorena Mogalenyana to take advantage of the Open Day opportunity and discover more about the University, noting that Wamorena decided to become a Scientist during the same event held a few years back.

Speaking on behalf of the Engineering Faculty, Lecturer, Chemical Engineering, Dr Vepika Kandijou, focused his presentation on Materials & Metallurgical Engineering. He highlighted career opportunities associated with the program upon completion of studies. He noted that upon completion of their studies, BIUST students get opportunities to work with well-established companies such as BITRI, Debswana, Khoemacau, Morupule Coal Mine, Botswana Police Services and BIUST.

Senior Lecturer, Chemical and Forensic Sciences, Dr Pogisego Dinake gave a careers Overview and programmes offered.

The presentations were followed by tours to the Faculty of Engineering Laboratories where technicians inducted the potential students on several topics such as Coal Recovery and Beneficiation by Pyrolysis/Gasification, Recovery of Copper Nickel concentrate by Froth Flotation and Characteristic Aspects of Metal properties: Wear performance of steel for industrial applications.

A third-year Biology Student, Wamorena, described BIUST as a home away from where one's passion is put into practice. "BIUST is a diverse university, the only STEM specialized University," he said, noting that for one to excel at BIUST they need to be passionate, disciplined and committed.

Ms G. Waleboa, Senior Teacher- Guidance at St Joseph's College, closed the ceremony with a vote of thanks. She urged the students to embrace the 21st century for them to be able to thrive in Science, Engineering and Technology.

"We learnt a lot today, and I believe that the students here today are a special group. You will be privileged if you pass with quality grades and are admitted here at BIUST. This is a global university that creates global employment opportunities," she concluded.

LETSHWITI EXPLOITS ELECTRICAL AND ELECTRONICS TO BRIDGE A GAP IN FARMING SECTOR.

By: Tshegofatso Teseletso



Letshwiti Mangoye, BIUST Senior technician, Electrical and Electronics

BIUST Newsletter scribe, Tshegofatso Teseletso caught up with the ingenious Mangoye Letshwiti who is working on an innovation that aims to address energy problems that affects production in the farming sector. Below is the question and answers derived from the interaction.

Question: Firstly introduce yourself to our readers, and also introduce the project you are working on?

Answer: I am Letshwiti Mangoye, BIUST

senior technician, Electrical and Electronics with 32 years of experience. I am building an automatic egg turner using solar energy as the source of energy. My vision is to produce it in large quantities. I was given this problem by Dr Mangwala to solve.

Q: Can you elaborate more on this project to our readers?

A: This project is an incubator that will assist in the hatching of eggs.

Q: Why this particular project; which gap/gaps does it stand to bridge?

A: This particular project came as a request from Dr Mangwala who approached me and said to me that there is a problem of hatchery in most farms (poultry) since some farmers do not have access to electricity. The project stands to bridge the problem of the production of poultry in large quantities to meet the demand in the poultry industry without bothering about electricity.

Q: Who will benefit from this project?

A: The poultry industry will benefit from this project and Batswana at large mostly farmers.

Q: What are some of the challenges that you have encountered and how did you

overcome them?

A: As this is a one-man project, I face some financial challenges, I think this problem will be solved by some other directorates that are in line with research since they are willing to assist financially. Lastly, as we know we do not manufacture, it takes time to get some components we order from manufacturers outside Botswana (finance and availability of components) are also the biggest challenges.

Q: Which strategies have you put in place to ensure that this project does not only succeed but leaves a lasting mark within our borders and globally?

A: Strategies put in place include good quality products, modification to meet the standards, production on a large scale and employing more Batswana and exporting to other countries. This is achievable with good quality components/ right components.

Q: Any last words to our readers and people that have supported your project?

A: I would like to thank other departments like Wood Section for letting me use their material and workshops i.e applying my D and T background and my department as a whole.

DESCRIPTION OF CATALYTIC MECHANISM IN PHOTOSYNTHESIS

By: Dr Bernard Baithuti



Since the world is facing a huge challenge of sustainably delivering on our energy needs, hydrogen promises to be a major clean energy contributor. Hydrogen is the fuel for the future. Using electrolysis to convert water into

hydrogen is costly because it must use continuous grid power. Photosynthetic water oxidation and oxygen evolution in higher plants, algae and cyanobacteria are some of the most fundamental bioenergetic processes on earth. Photosynthetic organisms use the sun's energy to convert water into oxygen and hydrogen, and this natural electrolysis is the most efficient method known and depend on a catalyst ('chemical spark plug') called the oxygen-evolving complex (OEC) also known as water oxidizing complex (WOC). We can develop an alternative fuel source from water by mimicking the natural photosynthetic process. WOC contains four manganese atoms and a calcium atom. A debate about how the atoms that comprise water are used in the photosynthesis process has been ongoing for decades. The way plants split water has been poorly

understood. If we can steal nature's secrets and understand how the WOC performs its chemistry, then we can learn how to make hydrogen more efficiently. We recently published a paper titled "A Computational Study of the S2 State in the Oxygen-Evolving Complex of Photosystem II by Electron Paramagnetic Resonance Spectroscopy"

Research continues to be the core mandate of the university's existence as our researchers and innovators endure publishing books and working with other industry-related institutions. -Molecules 2021, 26(9), 2699; <https://doi.org/10.3390/molecules26092699>, contributing to the ongoing debate regarding the understanding of a complete description of catalytic mechanism in photosynthesis.

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