

# BITRI NEWSLETTER

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## MISSION

To conduct needs-based technology research that provides sustainable innovative solutions through co-creation and collaboration with local and international stakeholders.

## VISION

To be the leading technology solutions provider that transforms lives.



### Teamwork

We operate and innovate through teamwork, and although we expect individual expertise, the team performance takes priority. The value of innovation through teamwork includes behaviour such as valuing contribution, accepting diversity, pro-active approach, collaboration and co-creation.



### Excellence

We expect and encourage unquestionable technical and operational excellence in planning, executing, monitoring and continuously improving everything we do.



### Empathy

We interact, operate and generate solutions that optimally balance the interest of all stakeholders

**Botswana Institute for Technology Research and Innovation (BITRI)**

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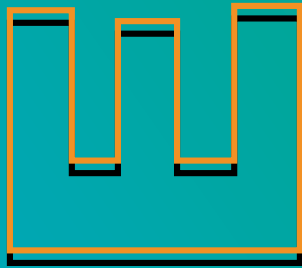


# Foreword

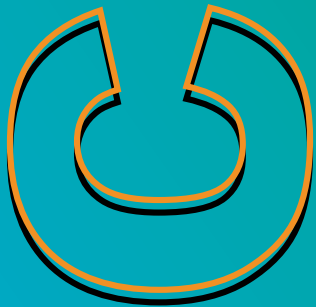


Welcome to another exciting edition of the BITRI quarterly newsletter.

The BITRI Board of Directors, Management and staff welcome the of Minister of Tertiary Education, Research, Science and Technology (MOTE), Honourable Dr. Douglas Letsholathebe and based on our recent interactions, we are hopeful of a progressive relationship as the Minister explicitly expressed his ambition to lead and facilitate the achievement of success for BITRI and other institutions and functions under his portfolio.



This period marks the end of the 2019/20 financial year and last but one year of our 2016 – 2021 Corporate Strategy, and I take this opportunity to reflect on our journey so far. Our operative phrases are ‘**co-creation**’ and ‘**collaboration**’ and in our bid to develop genuine solutions, we ensure that we work in tandem, as equal partners with mutual respect between the organization and those it serves. BITRI through its few years of existence, has managed to evolve and adapt to the changes in the needs of society, which has translated in the improvements of some of our key products, some of which we



have developed in partnership with local, regional and international partners.

BITRI recently donated five hundred (500) units of masks to the Ministry of Health and Wellness to be used in the Corona virus mitigation exercise. The air filtration project, as one of our vital products, with the key components being the nanofiber membranes developed at our CMS facilities, has great potential for commercialization, as well as the creation of business enterprises and employment. The masks have a Viral Filtration Efficiency (VFE) of >99.9%, presenting an opportunity for the manufacture of *health / medical masks* for medical practitioners and areas of outbreak of epidemics like bird flu and Ebola. The masks also have a market potential in mines in Botswana and for export.

Some of the projects that BITRI have made significance progress in, include Signcoach®, the Seding® solar streetlight, Kwibi, KSBB Technology, Mmualebe, the 3D Printing (Additive Manufacturing) laboratory, Nthusa mobile application, the Fleet Management System, as well as the **Climate Smart Agriculture Manual**. This list is in no way exhaustive, but it serves to prove that the organization strives to deliver value, owing to the confidence that

the Government and people of Botswana have bestowed upon it.

BITRI recognizes staff as crucial internal stakeholders, and within the agenda item of empowerment of the girl child that permeates domestic, regional policies and international statutes, the organization recognizes the role that women play and have the potential to play in the STEM and the general advancement of the global village. We at BITRI, also proudly proclaim the #EachforEqual motto, and we commit to ensuring the women within our ranks, reach their full potential and contribute towards the solutions we develop to improve livelihoods of stakeholders in various layers of society, including the most vulnerable.

BITRI is indebted to your continued support, and as a regular reader of our newsletter, and hopefully engaging with us in other platforms, we assure you of our commitment to our Mandate, as well as opening up the channels of communications between you and the organization.

Prof Shedden Masupe PhD,  
SMIEEE, Pr.Eng  
**Chief Executive Officer**



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*"#EachforEqual", says Mma Setshwaelo and BITRI women, during the 2020 International Women's Day commemorations at Maranyane House.*



# BITRI Celebrates 2020 International Women's Day

**Botswana Institute for Technology Research and Innovation (BITRI) commemorated the International Women's Day (IWD) under the theme 'I Am Generation Equality: Realising Women's Rights' at the organisation's head office at Maranyane House in Gaborone. BITRI Women from all levels of operations and from all its branches, gathered for the annual event.**

The Guest Speaker Mrs. Ntombi Setshwaelo address them on the theme. Mma Setshwaelo, as she is commonly addressed, is a gender activist, Counsellor and one of the co-founders of Emang Basadi Women's Association regaled the audience on the motivation for the formation of the association, the challenges and advancements the organisation has made over the thirty years of existence, and as well as the opportunities that

an environment of equality presents for women at BITRI and the society at large. Mma Setshwaelo said, she and her compatriots formed the lobby group in 1986 due to an environment and plethora of laws that discriminated against women in Botswana.

Since its formation, the organisation has successfully spearheaded amongst others, the 1982 Citizenship Amendment Act, which sought to deny women married to non-citizen men the

right to pass their citizenship to their offspring. Some of its other notable achievements have resulted in growth in numbers of educated young Batswana women, successes in pushbacks on gender-based inequalities, mainly exacerbated by capitalism, as well as gender-based violence and other issues pertinent to women in specific locales.

With that context, and in line of the **#EachforEqual**, slogan, Mma Setshwaelo implored on the women to strive for equality through meaningful thoughts and actions, every day. The slogan implores all to contribute towards building a gender equal world. Mma Setshwaelo took the opportunity to encourage BITRI women, especially in their youthful years, to get involved in gender equality issues and advocacy bodies.

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She also presented that there is a mixed scorecard in the fight for women's rights, noting that even though a significant number of women rise up the corporate ladder, their representation in decision-making and law-making positions across the corporate sector and global landscape, reflected a picture of lack of achievement in gender parity. The achievement of gender parity, argued Mma Setshwaelo, will take the formation of a strong lobby groups and networks of both men and women to strive for gender inclusivity at local, national and global levels. She further implored the women to look at ways they can have impact and influence outside the confines of structures of power and authority in organisations, including in workplaces.

During the networking and Q&A session, the women concurred on critically assessing constraints that held them back in the past, their role in society, potential to hold positions of influence, as well as ways of empowering other women and the girl child. Another important take home from the discussions was that, the achievement of gender parity

is not meant to disenfranchise men, and the boy child should be brought on board and empowered so that they can function and have an understanding of the empowered girl child.

The IWD has been commemorated since 1911, and is now is intended to celebrate the social, economic, cultural and political achievements of women, and also marks a call to action for accelerating women's equality. IWD, celebrated at the United Nations, and across many countries and territories gives an opportunity to recognise the fact that securing peace and social progress and the full enjoyment of human rights and fundamental freedoms require the active participation, equality and development of women. BITRI as an institution that subscribes to equality as part of human rights, through the support of the Board of Directors, and the Management has been commemorating the day for the past five years.



The BITRI Finance Manager, Ms. Maitshoko Molelekwa, handing over a token of appreciation to Mma Setshwaelo.





BITRI's Dr. Neo Mokgolodi, giving Welcome Remarks during the International Women's Day commemorations at Maranyane House.



BITRI Board Secretary/ Legal Services Manager, Ms. Keamogetse Molefhe.



The Guest Speaker Mrs. Ntombi Setshwaelo addressing BITRI women on the theme 'I Am Generation Equality: Realising Women's Rights' during 2020 IWD.



BITRI Associate Researcher, Climate Change, Ms. Penny Lesolle gave a rousing Vote of Thanks and encouraged women to be intentional in their contribution towards the advancement of society.



BITRI Palapye Administration Officer, Ms. Galeboe Kefalotse, posing with ICTAssociates Kefalotse Kehulakae and Thandie Xhike.



Accounts Officer, Kebaeditse Mompoti, Palapye Administration Officer, Galeboe Kefalotse and Accountant Nado Dorothy Notha in a jovial mood during the BITRI IWD celebrations.



BITRI Lead Researcher - Specialty Chemicals, Prof. James Darkwa handing over the masks to the Manager - Central Medical Stores, Ms. Keletso Israel.

## BITRI Donates 500 Masks to MoHW

BITRI donated five hundred (500) units of masks to the Ministry of Health and Wellness to be used in the Corona virus mitigation exercise. BITRI has partnered with Greenline Technologies, a South African company, in the manufacturing of the masks. Market research had pointed to the fact that users preferred flat masks over cup masks, and as such, the partners will produce the former variation.

The BITRI Lead Researcher, Nanomaterials Division, Prof James Darkwa made a presentation to illuminate on the progress of the project, and the positive attributes of the masks, given the task at hand.

“Instead of using the typical material in masks, we set out to use something that is in the nanometer range when it comes to the pores of the masks so that it may take out very small things, which include viruses. When we look at coal dust, the size of its dust particle is about 90 to 170 microns, and a micron is equivalent to dividing a one metre by one million. The size of bacteria ranges from 1 to 2 microns. So, we are dealing with smaller particles. When we are in the region of viruses, we are talking about 20 to 400 nanometres. So, these are much smaller particles that can sneak through even the finest of materials. But, when we use nanofibers, they are able to prevent even viruses from going through,” said Prof Darkwa.

“At the onset of BITRI, we embarked on the electrospinning process. With electrospinning, we draw very fine polymer fibers by applying high-voltage power. Then, we spin a network of these fibers into whatever nanofiber material we want. We then use our Scanning Electron Microscope; we can see the network that was made from the nanofibers. These nanofibers are woven such that a lot of particles, cannot pass through,” Prof Darkwa elaborated on the manufacturing process of the nanofibers.

In the presentation, Prof Darkwa also touched on the meaning of the 'FFP' acronym that in full stands for Filtering Facepieces Protect. This acronym is usually seen on filtering masks. There are three types of FFP masks in the market, denoting that the masks provide different levels of protection. The FFP 1 can block at least 80% particles as small as 0.6 of a microns. An FFP 2 mask can filter out at least 94% the same size of particles, and the top range masks, under the FFP 3 category, are able to filter out 99% of particles, and this range includes radioactive and poisonous particles. The masks that BITRI has developed are able to filter out particles as small as 0.3 microns, displaying performance that is way above the set standards.

Prof Darkwa shared with the audience that, BITRI tested the prototypes that it had developed against the set dust masks standards using regional and international laboratories, first in mid-2018, and also 2019. In analysing the nanofiber material developed, BITRI further investigated if the material could also be used in health masks. The tests results, conducted by an international independent testing laboratory, have verified that the membranes in the masks developed by BITRI, have a Viral Filtration Efficiency (VFE) of >99.9%. These results mean that the material used to make the membranes can be used to manufacture **health /medical masks** for medical practitioners and areas of outbreak of epidemics like bird flu and Ebola. BITRI also, has plans to test the masks in some mines in Botswana.

"One of the things we pride ourselves as BITRI regarding the membrane we manufacture to go into the masks, is breathability, which means one can wear the mask for a long time since it's easy to breathe while wearing. Normally, when you see people wearing masks in construction site, you will see the mask sitting on their heads, rather than around the mouth and nose because, breathing through that mask is uncomfortable. So, the results from the tests we conducted show that the BITRI mask improves breathability by 30 to 40%, which is much better than what is available", said Prof Darkwa, highlighting the superiority of the BITRI-developed masks.

The BITRI Chief Executive Officer, Prof Shedden Masupe, Acting Executive Director – Natural Resources and Materials, Prof Nnyaladzi Batisani, and Director Research and Partnerships, Dr Bathsheba Mbongwe, contributed to discussions on the project, the rationale for the donation, as well as avenues for possible collaboration between BITRI and MoHW.

The donated flat masks will be used in the exercise to mitigate and control the coronavirus disease (COVID-19) that was first reported from Wuhan, China, on 31 December 2019, and has since developed into a global pandemic, with countries across the globe affected, albeit to varying degrees. Botswana has since developed a response strategy to the pandemic, led by MoHW.



*BITRI Chief Executive Officer, Prof. Shedden Masupe, demonstrating how the mask is worn.*

Greenline Technologies currently has a license to supply the Botswana market; hence the BITRI/ Greenline mask can be commercialized and sold using Greenline certification, as long as the mask has Greenline logo. Greenline and BITRI are exploring the possibility of setting up a dust mask production plant in Botswana, using the BITRI developed filter materials, and have engaged pertinent stakeholders such as the Botswana Investment and Trade Centre (BITC) to discuss investment opportunities. Production to include health/medical masks is also under exploration.

## BITRI Hosts Minister Letsholathebe for a Familiarisation Brief

The BITRI Chief Executive Officer Prof Shedden Masupe and his Executive Management, hosted the Minister of Tertiary Education, Research, Science and Technology (MOTE), Honourable Dr. Douglas Letsholathebe and MOTE Management team for a meet and greet session.

The session, which is part of the Minister's tour of Departments and parastatals under MOTE, was intended to brief the Minister on the mandate of BITRI, and the significant projects the organization is undertaking and those in the pipeline.

Prof Masupe gave an overview of the organization, the research focus areas, as well as the important projects such as the Climate Smart Agriculture Lessons Learnt manual, Seding® solar lights, the Kgalagadi Sand Building Block/Brick (KSBB) Technology, investigations of the potential of local raw

materials to produce portland cement clinker, dust masks made from nanofibers, water purification filters made of various media, as well as other projects under the Information Systems and Technologies (IST) focus area.

Minister Letsholathebe when presenting his vision of the Ministry, and BITRI reiterated the Government's commitment towards a knowledge-based economy, which accordingly, BITRI must lead. The Minister added that the realization of this ideal should yield an inclusive economy that would benefit a wide section of the nation and society. The Minister also implored the Management team to keep him informed on the progress and challenges BITRI face so that he is better able to articulate them at higher decision-making platforms.

The Minister's team were also taken on a conducted tour of the Centre for Materials Science.



Minister Letsholathebe and the team listening attentively during Electron Microscopy Scientist Mr. Stephanus Hermanus Coetzee's demonstration of the Scanning Electronic Microscope, which is part of the Centre for Material Science laboratory facilities.



The BITRI Chief Executive Officer, Prof Shedden Masupe, briefing the Minister and his team on the BITRI Mandate, key projects and achievements.



The Minister of Tertiary Education, Research, Science and Technology Dr. Douglas Letsholathebe presenting his vision to the BITRI Executive Management team. To his right, is Deputy Permanent Secretary - Policy Development & Research Mr. Oupa Masesane, who was part of the Minister's contingent.



The Guest Speaker, Dr. Vaikuntam Iyer Lakshmanan presenting on the topic **“Nickel Mining Industry: Potential Enabler for Energy Storage”** during a recent BITRI Public Seminar.



The Acting Permanent Secretary to the President Mr. Elias Magosi, when delivering the Welcome Remarks, commended BITRI for holding the Public Seminar on a pertinent topic that address climate change and clean and renewable energy technologies.

## BITRI SEMINAR TOUTS ENERGY STORAGE CAPABILITIES OF NICKEL

BITRI recently held a seminar on **“Nickel Mining Industry: Potential Enabler for Energy Storage”** The guest speaker was **Dr. Vaikuntam Iyer Lakshmanan, Vice-Chair and CEO, Process Research ORTECH (PRO) Inc. in Ontario, Canada.**

When delivering the Welcome Remarks, the Acting Permanent Secretary to the President Elias Magosi, commended BITRI for the topic of the seminar as it was pertinent since Botswana, just like other countries is grappling with climate change, and priority is to advance on clean and renewable energy technologies.

*“We all know that Botswana is endowed with natural resources that can be harnessed to augment the energy needs of our country as well as create value add to the minerals. First as a country, we are putting in place strategies that would advance development through the optimization of linkages in the mineral value chain, facilitation of economic diversification, job creation and industrialisation. It is our intention to expedite progress towards knowledge-based economy and contribute to an incremental GDP growth in mineral value addition in line with our vision 2036. Our mineral beneficiation strategy provides a framework that seeks to translate the country’s sheer comparative advantage inherited from mineral resources endowment to a national competitive advantage,”* expounded Mr Magosi.

Mr Magosi explained that the Government of Botswana has emphasised excellence in innovation in the mineral beneficiation arena as central to of transformative agenda set in the Vision 2036 strategy. He also highlighted the importance of BITRI is the realization of this lofty ideal.

“Through research, development and innovation and with collaboration with industry, BITRI as a premier science and technology institution will play the leading role in supporting innovation in our country’s energy and mining sector. The BITRI Energy Division focuses on the development

and adoption of energy technologies for both renewable and non-renewable energies for Botswana, while the Nanomaterials division focuses on research that add value to Botswana's minerals. The Nanomaterials team is currently conducting research on value addition to nickel, especially on the processes to take nickel from low grade ores or concentrates to battery grade" Mr Magosi explained.

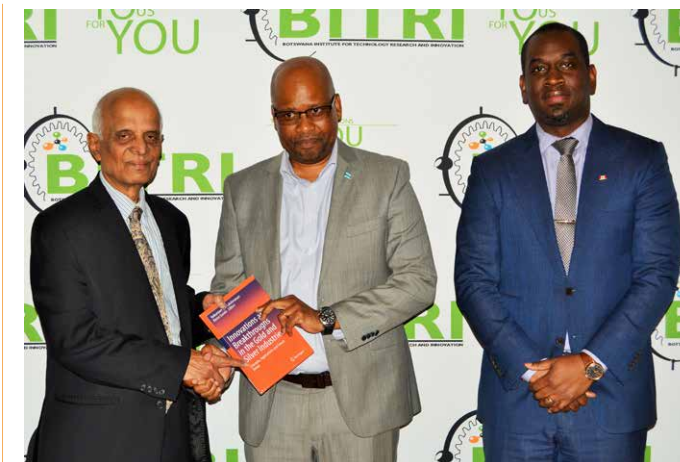
For his part the Guest Presenter Dr Lakshmanan said advancement in usage of Nickel as an energy storage medium has potential to provide Botswana with social, economic and environmental benefits. The presentation acknowledged the context that Botswana is rich in diamonds, gold, copper, coal and nickel, with the latter mainly found in two distinct belts in eastern Botswana, being Tati and Selebi-Phikwe. Although the BCL nickel mining plant in Selebi Phikwe is currently shut down, a breakthrough in electricity storage will play a crucial role in enabling the next phase of energy transition with decarbonisation of the energy market.

With the current nickel processing technologies primarily presenting reliability and environmental challenges, and not being cost effective, the PRO Technology for developing storage capabilities using nickel offers a better alternative, offering high recovery rates for Nickel, Cobalt, Iron, Magnesium, and also has lower capital as well as operating costs. These benefits, according to Dr.

Lakshmanan's presentation, will allow for scalability and decentralisation of power generation and distribution, rural and semi-urban communities to improve Human Development Index (HDI) on areas of health, life expectancy, standard of living and education, as well the communities and local municipalities' capacity to generate income that directly benefits them.

The country is said to be in a good position to benefit from the technology, and the BITRI Nanomaterials team is currently conducting research on value addition to nickel, especially on taking the metal from low grade ores to battery grades.

BITRI established the Seminar Series to share and exchange research ideas on topics of current relevance to our mandate in contributing to Botswana's socio-economic development. The former Minister of Presidential Affairs, Governance and Public Administration, Mr Nonofu Molefhe, the BITRI Board Chair Prof Sesae Mpuchane, members of the BITRI Board of Directors, the Chief Executive Officer of Chamber of Mines Mr Siwawa, the Chief Executive Officer of BITRI Prof Masupe, heads of various government departments, parastatals and private institutions, the media and some BITRI Management and Staff graced the event.



Dr. Vaikuntam Iyer Lakshmanan (left) presenting one of the books he has authored on the subject of energy, to BITRI Chief Executive Officer, Prof. Shedden Masupe (centre). Looking on, is the Co-Founder and Chief Executive Officer of Sub-Saharan Africa Healthcare Initiative, Mr. Jacques NdoutouMve.



High level delegates, amongst them, former Minister Mr. Nonofu Molefhi (seated, far left), the BITRI Board of Directors, and Guest Speaker Dr. Lakshmanan (fourth from left) posing for a group photo during a recent BITRI Public Seminar.

# BITRI Sensitises Selibe Phikwe SMEs on Technology Transfer

**Botswana Institute for Technology Research and Innovation (BITRI) in collaboration with the Selibe Phikwe Local Enterprises Authority (LEA), organised a Technology Transfer forum on the 17th March 2020. The forum attracted over thirty-eight Small and Medium Enterprises from Selibe Phikwe and surrounding villages, who were sensitised on current and future technology transfer and commercialization opportunities available in BITRI. The SMEs were from different sectors of the economy, but, mainly from manufacturing and services.**

The areas discussed comprised of BITRI's approach to technology transfer, the modes of and the role SMEs can play in technology transfer and commercialisation of BITRI technologies. The SMEs were informed that they can leverage upon BITRI technologies to enhance and cement their competitiveness since, BITRI technologies are intellectual property rights protected.

The SMEs were also briefed on BITRI existing technologies available for uptake mainly Seding, Nthusa, and various products under the Nanomaterials research focus area. The briefing also touched on services which can be rendered to SMEs through BITRI's specialized laboratories, amongst them, the Centre for Material Science (CMS), Building Material Science testing laboratory and the 3D printing laboratory, as well as Contract Research and Consultancy Services.

Giving vote of thanks one of the SME operators, expressed gratitude for the collaboration between LEA and BITRI as it has informed them on various exploitable opportunities and tools to use to ward off competition, grow and increase their market share. He further said, BITRI should attain and maintain a balance between researching and developing high end technologies and simple technologies that can quickly improve the quality of lives of Batswana. He also urged BITRI to engage with their sectors frequently as they are potential early adopters of technology from BITRI.

*The SMEs were advised to diversify their portfolio by investing in commercialisation of BITRI technologies. BITRI emphasised that even though the SMEs currently operated at a small scale, they stood a better chance of upscaling to transform into multinational companies, through working together with other likeminded industry players such as BITRI.*



# The Seding® Solar Light Assembly Plant Hosts Chichi CJSS

Over one hundred and sixty pupils from Chichi Community Junior Secondary School visited the BITRI Seding® Solar Street Light assembly plant in Kanye to learn about the operations of the plant. The cohort, principally comprising pupils in the Art and Design and Technology streams, gained exposure on careers in the design and manufacturing vocations, and the potential of their areas of study.

The group, accompanied by their teachers, were hosted by David Chabi and Nobuhle King, who supervise the Seding® solar streetlight Assembly and Manufacturing plants' day to day operations, respectively.



BITRI's Manufacturing Plant Supervisor, Ms. Nobuhle King (in a blue shirt), demonstrating the energy saver cook stove to Chichi CJSS pupils during a recent of the plant in Kanye.

The Seding® solar streetlight assembly plant produces lights for sale to large scale buyers, including central government, local government authorities, local multinational corporations including mines, the tourism and agricultural sector, as well as for domestic consumers.

The plant has employed a total of five Batswana as of date, with more expected to join as the production expands with demand. The project will also create business opportunities for distribution and retailing of the lights.

The Manufacturing plant supports the design division with manufacturing of prototypes and other BITRI products like components of the Seding® solar streetlight and the energy efficient cook stove. This section of the plant employs three Batswana, and is equipped with various industrial machines, including two Computer Numerical Control machines for milling and turning, respectively.



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**SUSTAINABLE**  
*Innovative Solutions*

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