

Proceedings of the First

NATIONAL UNIVERSITY OF LESOTHO
INTERNATIONAL SCIENCE, TECHNOLOGY
AND INNOVATION CONFERENCE & EXPO

Maseru, Lesotho
(NULISTICE 2018)

23rd to 26th January 2018
‘Manthabiseng Convention Centre



Foreword

Prof. Ngosa L. Mahao

Vice-Chancellor, National University of Lesotho

In the month of January this year, the National University of Lesotho successfully hosted the National University of Lesotho International Science, Technology & Innovation Conference & Expo, NULISTICE 2018. NULISTICE 2018 was the first ever international conference in Lesotho that was primarily focused on Science and Technology-based research. Alongside NULISTICE, the second Renewable Energy Research & Innovation Symposium, RERIS 2018, was also hosted.

Given its position as the only public university in Lesotho, the National University of Lesotho is also the only institution that focuses on research-based education, especially in the fields of science and technology in the country. NUL has engaged itself not only in pure scientific and technological research but is committed to also address some challenging contemporary societal issues.

Last year, the University participated in the successful development of the Solar-Thermal Roadmap for Lesotho in partnership with Bethel Business and Community Development Centre (BBCDC) under the SOLTRAIN project funded by Austrian Development Agency.

Recently, an Energy Research Centre, or ERC, was also established to deal with the crucial issues of energy. Funded by the Africa-EU Renewable Energy Cooperation Programme (RECP), a series of week-long short-courses on various aspects of sustainable energy were successfully offered throughout the year. A number of participants, primarily from the corporate and public sectors, benefitted from this training exercise. From the encouraging feedback received from them, the ERC is now going to start a Master's Programme in Sustainable Energy under the Department of Physics & Electronics.

A Low-Cost Flat Plate Solar Energy Collector developed at NUL won the BIE*-Cosmos Prize at Expo 2017 for "Future Energy" in Astana, Kazakhstan. Precisely one year back in September 2016, the same project had won the Second prize at International Conference on Solar Technologies & Hybrid Mini Grids to improve energy access held at Bad-Hersfeld, Germany.

Very soon NUL is going to establish the Water Institute also to address the water related issues and research in the country. The proposal has already been approved by the University's governing bodies, the Senate and Council. Another important proposal to start the School of Engineering has already been tabled for stakeholders' consultations.

Apart from these training activities and technological research, a number of researchers at NUL have focused mainly on basic science research. They have been working at par with their global peers in some topical areas, such as nanotechnology, energy-materials, etc. For example, cheaper methods have been proposed for the treatment of wastewater under sunlight using nanocomposites that were synthesized here at NUL. Investigations on nano-materials for potential applications of their electrochemical properties in energy efficient devices, production of bio-gas from algae and many other interesting and relevant research-projects have been undertaken by various groups in the University. They have been publishing their findings regularly in journals of international repute and their works have been frequently cited by a number of researchers from all over the world.

Recently, the University has also managed to convert some of its projects into business. NUL is gradually, but very certainly, becoming a brand. A number of products developed at the University have either already hit the market, or are in a process of being launched. The AfriQuartz and Lefika stones; Sebatso yogurt, fresh and sour milk; Bohlale biscuits; Mashimi wine; Mohalalioe soaps; and Pius XII automatic egg incubator are just to name some of them. The ability to produce such commodities locally would definitely moderate the over-dependence of Lesotho on neighbouring countries.

The resounding success of NULISTICE is still visible months after. A definite change in perception of the outside world about the University has been experienced. Inside the University, the success has helped boost the morale and self-esteem of staff members. For its future use as reference and for records, it is my pleasure to release the Proceedings of NULISTICE2018.

* Bureau International des Expositions

NATIONAL UNIVERSITY OF LESOTHO INTERNATIONAL SCIENCE, TECHNOLOGY AND INNOVATION CONFERENCE & EXPO (NULISTICE) 2018

In the recent global economic meltdown of 2008, Lesotho as a small nation experienced a serious decline in the job market for graduates. This posed a serious challenge to the National University of Lesotho to respond to this 'national crisis' as declared by His Majesty King Letsie III, the Head of State, who is also the Chancellor of the University. Following this, the University shifted its research focus from purely basic to the applied, innovative and impactful research that addresses the economic challenges of society. It is in this pursuit that the University held two Science and Technology Research and Innovation Expos in 2015 and 2016 showcasing 60, and 180 projects, respectively, that had potential of driving entrepreneurship in the community and hence, stimulating economic growth for thousands of graduates who would otherwise be lost into poverty. These two expos also exposed the need to infuse international views and expertise; and thus, the idea of hosting an international conference originated. This 2018 NUL International Science, Technology and Innovation Conference & Expo is meant to provide an opportunity to turn ideas into action. It is expected that the attending scholars from all over the world will share their basic research findings, lessons in university-industry cooperation, successes and failures in commercialization and policy recommendations in any of the thematic areas mentioned here.

NULSITICE 2018 Thematic Areas:

- Biotechnology and food safety
- Environment and natural resource management
- Agriculture and climate change
- Entrepreneurship and information technology
- Materials science and nanotechnology



A beautiful drone view of the conference venue 'Mantabiseng Conention Centre, Maseru

Photo by: Dr. Dirk Steuerwald



NULISTICE-RERIS2018 Group Photo

Photo by: Mr. Thapelo K. Sephiri



The Core Organizing Committee with the Hon. Ministers

[L to R: Dr. Mosotho George, Mr. Niklas Hayek, Vice-Chancellor Prof. Nqosa Mahao, Hon. Min. of Education Mr. Mokhele Moletsane, Hon. Min. of Comm. Sci. & Tech. Mr. Joang Molapo, Pro Vice-Chancellor Prof. Manthoto M. Lephoto, Prof. Himanshu Narayan and Dr. Timothy Thamae]

Photo by: Mr. Thapelo K. Sephiri



Welcome Remarks

Prof. Manthoto H. Lephoto

*Pro-Vice-Chancellor, National University of Lesotho
& Chairperson of the NULISTICE 2018*

It is a great pleasure and honour to welcome you to this auspicious occasion of the NUL International Science and Technology Innovation Conference and Expo (NULISTICE) 2018, featuring the second edition of the Africa-EU Renewable Energy Research & Innovation Symposium (RERIS) 2018. Innovative ideas through research and technology have emerged over the past two decades in a multidisciplinary approach to solve the problems of society and create jobs in the global economic agenda across all sectors. Sustainable use of resources with

responsible entrepreneurship action represents a significant advance in understanding how innovation and business practices can help improve living standards of the society. Such a result is more predictable in its positive sense that the business environment between innovator, researcher and entrepreneur has to be supported by flexible policies to encourage all stakeholders to hold them accountable to reasonable standards and to be more creative for societal benefit. This joint conference offers an opportunity to turn ideas into action. It is our collective duty to promote responsible business practices by mobilizing resources and assisting entrepreneurship actions in each sector to ensure self-employment and job creation amongst the youth to develop our nation and continents. One of the key messages to be conveyed here is that responsibility cannot be outsourced. We have to develop flexible policies that would help in promoting ideas and give confidence and support to those who want to build the future. Entering into business means taking responsibility to adopt sustainable business practices that take into account both the bottom line and the impact of their activities on society. Academia, governments and civil society organizations have the responsibility to improve and provide a forum for dialogue, peer learning, standard setting, analysis, and best policy recommendations to promote the innovative practices in Lesotho, the African continent, and the world in general. We hope that such a joint international conference and expo on science, technology and innovation will allow us to take joint actions to assist the youth in our respective countries to bring positive changes in societal development and protect the environment.

We wish you an enjoyable stay in the Mountain Kingdom of Lesotho!



Closing Remarks

His Majesty King Letsie the III of Lesotho
Chancellor, National University of Lesotho

It is my pleasure to join you for this Gala Dinner which also marks the closing of NULISTICE Conference and RERIS Symposium.

During the past two-and-a-half days, we had the opportunity to witness and listen to the presentations and discussions from eminent scientists and experts, not only from the region but also from other countries.

It was extremely satisfying to note that a number of academicians and researchers representing institutions from within the country, especially from the host National University of Lesotho, also took part and presented their interesting findings to the

world. I believe they were, by no means any less than their peers, in terms of the quality of work. It clearly shows that even under severe limitations and adverse conditions, the fire of passion to do something original and to create something innovative, keeps burning non-stop. This never-say-no attitude of our scientists is highly commendable.

Yesterday, I had been to the NULISTICE Expo at Pioneer Mall. It was extremely heart-warming to meet so many young innovators and future entrepreneurs, and witness their talent and enthusiasm. I believe that they just need a launching-pad and some support to take off to their promising fortunes. Congratulations to National University of Lesotho for successfully bringing together all these small efforts that eventually summed up into this mega event of NULISTICE 2018.

The University deserves applause for a number of other activities too. As recently as last year, they successfully launched an Energy Research Centre and pushed the proposed Water Institute up to the stage of implementation. Another proposal to establish a School of Engineering is also passing through various stages of approval and we hope to see it materialize into reality pretty soon. These are examples that clearly show that the University is moving in positive direction.

I am aware of the involvement of NUL in a number of projects of national and societal interests. Last year, in partnership with other agencies, they developed the Solar-Thermal Roadmap for Lesotho. Their activities in the areas of energy production, utilization and management, such as running short training courses in the areas of sustainable energy and related issues, and starting a M.Sc. Sustainable Energy programme, are relevant not only for the region, but also globally. It is a matter of great pleasure and satisfaction that one of the projects, namely the Low-Cost Flat Plate Solar Energy Collector, won second and first prizes in Germany and Kazakhstan, respectively, against a number of other international entries.

A number of projects running at NUL have been converted into successful businesses. Sebatso yogurt is one of the products that originated from the University and is now winning hearts out in the market. Similarly, products like Bohlale biscuits, Mashimi wine, Mohalalitoe soaps, AfriQuartz and Lefika stones, and Pius XII automatic egg incubators, were all born inside NUL laboratories. Many of them have already started challenging similar commodities from other regional manufacturers in the market, and the others are being fine-tuned to see light of the day.

Apart from these, NUL continues to be the only institution in Lesotho that is engaged in some serious, hard-core research in the advanced areas of basic science and technology. We have already had some glimpses of these investigations in the presentations during last two-and-a-half days. Sometimes it seems hard to believe that scientists from such a small country have managed to keep pace with rest of the world over the years, in terms of cutting-edge research in some very current topics, such as, nano-science and nanotechnology, energy-materials and graphene-research, etc. But their work speaks for itself and the rest is adequately evidenced by the reports and articles published in international journals from well-known publishers.

Science is equally important for everyone. However, its progress strongly depends on substantial investments from all sectors. While the government should be leading, the role of industries and corporate sectors also, is extremely crucial for growth of science and technology. Moreover, it is also a fact that the investments made in education, especially in the higher-level science education, are critical for development of a country. It has often been concluded by economists and social scientists and is generally accepted too. I would like to cite an example from a UNESCO conference held in Dakar in October 2016. UNESCO has repeatedly expressed its commitment to Science, through the promotion of Science Education, and advocacy for Science, Technology, Engineering and the Mathematics (STEM) Education, to make best use of the talents our societies can offer. It was observed in the Dakar conference that investment in Science and Technology is decisive for sustainable development and for economic

growth. Science - as the Director of UNESCO, Dakar reminded - is a tool able to provide us with solutions to the challenges we face, and with its power it can unite people, contributing to peace.

Obviously, scientific knowledge can enable our younger generation with skills and expertise required to tackle very basic problems related not just to food, health, water and sanitation, but also to environment and energy. Interestingly, the two conferences, NULISTICE and RERIS, attempted to cover all these pertinent issues as their themes. Moreover, an exclusive theme focussing on Innovation and Entrepreneurship was like making sense out of all the efforts, because at the end of the day what really matters is that fraction of research output, which gets converted into viable products, solutions to existing problems, and to businesses.

It has been underlined that science, technology and innovation can be "the game changer" for the future development efforts. Scientific knowledge can help enhance the lifestyle of common people and elevate their standard of living. It can contribute to alleviating poverty, creating jobs, reducing inequalities, and enhancing health and general well-being. These features are known to translate directly into better health and improved life expectancy.

In the light of all these points therefore, hosting scientific meetings such as NULISTICE and RERIS in Lesotho was very much warranted and indeed relevant. It should have certainly given the visiting scientists an opportunity to understand the issues as they are in context of a small developing nation. At the same time, researchers who are working within Lesotho must have established some partnerships and collaborations, besides having a glimpse of what the rest of the world is doing in their respective fields.

I can only be proud and grateful for the interest shown by you in these events. Hosting close to 200 participants representing more than thirty different countries from across the globe is not bad at all for a first-timer that we are. But our work does not end here. We should continue the dialogue among all of us so that we can learn from each other. What we all need is to continue working together as we face various challenges. I have been informed that the proceedings of NULISTICE will be published online through the conference website and that of RERIS as a special issue of Proceedings in Energy journal by Springer.

In particular, I would like to take this opportunity to thank all of you here for making NULISTICE and RERIS a success through your valuable contributions and active participation. I would like to thank all keynote speakers, as well as all the moderators, panellists, presenters and attendees.

Finally, I would also like to appreciate the hard work done by various committees that worked so hard with the NUL management to make all of this a great success.

For all of you visiting us from other countries, I hope it had been a memorable trip to the Mountain Kingdom of Lesotho. I wish those who will be flying back in a couple of days, a safe and comfortable journey back home. We will be looking forward to welcome you again in the future.

With these few words, I declare the First National University of Lesotho International Science, Technology & Innovation Conference & Expo, NULISTICE-2018, and Africa-EU Renewable Energy Research & Innovation Symposium, RERIS-2018 officially closed.

Thank you very much.

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