South Africa contribution
Nanotechnology development in South Africa
The views presented here are the participants’ and do not necessarily reflect the views and the position of the United Nations or the United Nations Conference on Trade and Development.
Introduction

The development of nanotechnology in South Africa is guided by the National Nanotechnology Strategy which was approved by the cabinet in 2005. The strategy outlines the purpose of South Africa’s development of nanotechnology. In terms of this strategy the country has to position itself to take the potential advantages of this field of science to (i) address some of the social challenges it is faced with and (ii) confer competitiveness to some of the country’s industries. The social challenges that nanotechnology will have to help address are in the areas of health, water and energy. The industries identified for enhancement of their competitiveness are mining & minerals, advanced materials & manufacturing and chemical & bio-processing. To operationalize the strategy, a 10-year strategy implementation plan has been developed. This implementation plan identifies projects and programmes to be pursued in advancing the realization of the strategic objectives.

Nanotechnology Development Programmes

Through the implementation of the strategy, as guided by the implementation plan, several programmes have been put in place. These programmes are aimed at the development of human capital with the necessary skills to conduct nanotechnology research, building the necessary infrastructure and creating an environment for nanotechnology innovation. The human capital development programmes include the appointment of research chairs in the field of nanotechnology. Also, the process for the establishment of a nanoscience centre, whose focus will be on the teaching and training of nanoscience, is well underway.
With regards to infrastructure, two Nanotechnology Innovation Centres have been established. Such centers are aimed at establishing and maintaining multi-user facilities to provide researchers with advanced instruments for design, synthesis, characterization, modeling and fabrication. They further should foster an environment of intense and focused research, which is multi-disciplinary and solution driven. An equipment acquisition programme, which focuses on the acquisition of necessary research equipment for placement at research institutions, has also been put in place. Universities and other research institutions across the country have already benefited from the programme.

Efforts are also being put at ensuring that the development and application of nanotechnology are done in a responsible manner. To this end, a nanotechnology health, safety and environment (HSE) research platform is being established at one of the science councils. This research platform is aimed at positioning the country well to be able to identify and assess potential risks of nanotechnology, and also be able to take the necessary precautions in mitigation of these risks. In addition, a Nanotechnology Ethics Committee has been constituted to ensure that the research, manufacturing and application of nanotechnology occur in an ethical manner, in accordance with international best practice.

The strategy requires that the development of nanotechnology be done in a manner that fosters open debate and public access to information. In line with this requirement, a public engagement plan has been developed and is in the process of being rolled out. Its purpose is to create awareness around nanotechnology and educate the public to enable the taking of informed decisions about the technology. The development of this plan was informed by the nanotechnology public engagement framework developed by the OECD’s Working Party on Nanotechnology. Our participation in this and other global
organizations, which we use to benchmark best practices, has helped shape some of our programmes.

3. Example of Projects with Impact

Support is also being offered for nanotechnology flagship projects. The purpose of flagship projects is to demonstrate the benefits of Nanotechnology within a reasonable period. As such, these projects have a product/service as their end goal. One of the flagship projects is the development of a more effective and efficient nanotechnology based drug delivery system for the enhancement of the efficacy of the existing tuberculosis (TB) drugs.

TB is currently one of the leading causes of death in adults in South Africa. Annually, approximately 250 000 new cases of TB occur in South Africa and it is ranked 5th amongst the top 22 high burden countries of the world which collectively accounts for over 80% of all TB cases. A major reason for the escalation of the TB epidemic is the evolution of the AIDS epidemic. It is estimated that approximately 85% of adult TB cases aged 15-49 years are HIV infected and approximately 1.7% of new cases are multi-drug resistant. Although an effective therapeutic regimen is available, patient non-compliance resulting in treatment failure, as well as the emergence of multi-drug resistant (MDR), and extreme drug resistant (XDR) strains of TB exacerbate the situation.

To address patient non-compliance in TB control programmes, this project seeks to reformulate first line anti-TB drugs into nano-particulate oral dosage form for controlled release over extended period in order to reduce total doses and treatment period. This will in turn improve patient compliance to treatment and greatly reduce costs. Clinical trials for this antibiotic, Rifanano are scheduled for 2012 and the drug should be available in government clinics in 2016.
The project has received global attention, with some of the international experts in drug delivery having become involved in it. The appointment to the project leader to the Developing Countries Coordinating Committee (DCCC) of the European Developing Countries Clinical Trials Partnership (EDCTP) is another indication of the acknowledgement by the global community of the good work the project team is doing.

Recently, the team working on this nanotechnology-based drug delivery system for TB treatment, walked away with the laurels at the South Africa’s Bio Plan Competition. The South Africa Bio Plan Competition is organized by the Innovation Fund in collaboration with the biotechnology regional innovation centres and in partnership with Emory University of Atlanta, Georgia USA. The competition encourages the development of biotechnology businesses in South Africa. Participating teams worked closely with a team of mentors to fully develop a strategy and business plan that is evaluated by an international panel of experts. The TB nano drug delivery team made a clean sweep, walking away with the 'Best Presentation Award', the 'Best Presenter Award' and an opportunity for an internship in the USA for winning the 'best science to business opportunity.'

4. Conclusion

A flagship project such as the one elaborated is an excellent example of the impact nanotechnology could have to improve health and quality of living in developing countries, and certainly merits international support. The project has potential to save millions of lives because of its innovative mechanism for an easier, more convenient drug delivery mechanism, through the application of nanoscience. Rifanano, for example can be taken just once a week for two months and holds no adverse reactions. Most TB antibiotics must be taken daily for up to six months and often cause side effects, such as nausea and fatigue.
The new nano drug delivery system involves coating the existing anti TB drugs with biodegradable polymer into nano-sized particles that are in turn coated with chemicals that make them stick to the intestine wall, enabling the drug to be far more easily absorbed. TB is a poor man's disease, which means it's not a popular choice for development by commercially driven pharmaceutical companies. Local science and technology skills in South Africa are used to make an existing treatment more effective and affordable.