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**Address, Naledi Pandor MP, Minister of Science and
Technology, Faculty of Education, University of the Free
State, 24 October 2014**

Topic: "Higher-education transformation with particular
reference to the role of science"

Director of postgraduate students, Faculty of Education
Students

This year, 2014 marks the twentieth anniversary of South
Africa's first democratic elections.

I don't think we have given enough credit to the steps we have
taken to promote science in our process of transformation.

Science has played a decisive part in addressing the
unacceptable inequalities and divisions in our society. For
example, South Africans excluded from basic services during
apartheid now enjoy access to electricity, clean water and
sanitation – boosted by the benefits of technology-transfer
programmes. Affordable health services and education are now
available to the majority of South Africans leveraging for
example e-health and e-education platforms. Our investment in
ICT infrastructure not only narrowed but in many instances

effectively bridged the digital divide, ensuring that the information society is not an opportunity for a privileged few.

Science also contributed decisively in less tangible but nevertheless equally important ways. Winning the bid to co-host the Square Kilometre Array (SKA) radio telescope, for example, filled South Africans with pride and did as much to foster national unity as winning the rugby World Cup in 1995. Big science is beneficial to any society in transition such as ours.

International partnerships have done much to bring South Africa back into the fold of the commonwealth of nations. The SKA is one of several global projects benefitting from strong international cooperation. Others include the Group on Earth Observations (GEO) working to strengthen international cooperation in harnessing Earth observation to inform policy- and decision-making for sustainable development. Another example is the European Developing Countries Clinical Trials Partnership (EDCTP) where we collaborate to accelerate vaccine and drug development targeting the major poverty-related infectious diseases such as HIV-Aids, tuberculosis and malaria.

During the past twenty years science cooperation with Europe, America and Asia has played a valuable part in facilitating South African scientists' integration into the global community following the isolation of apartheid. Through multiple training, mobility and networking programmes, international partnerships actively contributed to human capital development for science and technology in South Africa. These are partnerships we greatly appreciate. If South Africa today has a vibrant national system of innovation, with knowledge production consistently

on the increase, this is no small part due to international cooperation.

We now sing the praises of science diplomacy. Indeed, when our President meets with his counterparts in international fora, he consistently salutes the achievements of research and innovation partnerships in areas such as the environment, food security and health. It is not only the scientific output of these projects, which are important, but also their ability to bring people together, improving communication and understanding, building bridges of friendship and understanding. We have, however, to remain vigilant. We live in times when economic pressures and other challenges may encourage nations to become more inward looking, and so we continue to cherish and foster international cooperation.

None of this would be possible without transformation in the higher-education sector.

What have we achieved in the higher education sector?

We have increased and expanded participation in higher education. There has been a huge expansion in the number of women studying in higher education. And there has been a welcome internationalization of the student body, with over 80,000 international students at our universities.

We have established a national quality assurance framework and infrastructure and each university is now subject to a quality audit, which has significantly raised quality issues across the sector.

We have introduced a new funding framework that is goal oriented and performance related. We have adopted a multi-faceted approach to the funding of higher education that includes a combination of targeted funding aimed at the expansion of the system, the production of skilled graduates and enhancing the capacity of the system to deal with the increasing student numbers.

We have begun the process of transforming our universities from insular institutions to open institutions for all.

The aim of the merger process - mandated in 2002 - was to break up the division between black and white institutions, to improve quality through economies of scale, and to improve staff-student ratios.

Yet transformation is an ongoing process and we need to plan ahead.

A strong case must be made for more diverse higher education institutional types that are able to meet appropriate quality benchmarks and satisfy particular labour markets.

In pursuing differentiation as a policy, we must be strategic. Not all universities can be research intensive. This does not mean the relegation of some higher education institutions to a second-class status.

On the contrary, our country needs large numbers of high quality undergraduate institutions focussed on meeting the professional and other skills needs of developing communities and nations.

They, too, like the research-intensive universities, must be appropriately funded.

If we are to continue to support research-intensive universities, we must look towards new and innovative partnerships to realise our vision.

There is a revolution rolling through our universities and we as a country will be the better for it in the years to come.

Are we promoting science?

Yes we are but we can do more. Knowledge and innovation – rather than capital and labour - are the drivers of economic growth in all countries. The current affluence of high-income countries has been massively increased by their investment in science and new technologies.

It is government's role to invest in, to promote, and to catalyse science and technology in South Africa.

First, government invests in the building blocks of science and technology by funding basic research in our universities and public entities (science councils).

South Africa is not a major 'first-mover' in research and development. We are not on the frontier of innovation in most fields. We import technologies from abroad and adapt them for local use. That is not necessarily a bad thing. It is what Korea

did at a seminal moment in its history and what China is doing now.

Second, government promotes private-sector innovation, maintains competitive markets, and nurtures entrepreneurs.

We do this primarily by offering a r&d tax incentive and by many other initiatives at provincial and local government level.

We are working across government to improve the financial and legislative environment for small and medium companies. We can do more to encourage start-ups and it's in the IT and high tech sector that we see most of these developing.

Third, government acts as a catalyst for science research in national priority areas. We chose in 2008 five specific areas (we called them "grand challenge" areas) in which we aim to catalyse leading-edge science: global change, renewable energy, space science, the bio-economy, and the human sciences.

These are not simply grand challenges. They are global challenges that need global collaboration and cooperation in solving. Government's role is to catalyse investment in key multi-disciplinary areas that will drive innovation in all sciences. Nano-technology is a key example, as its impact is felt in widely disparate fields, from medicine to electronics to IT.

As a result of our focus on astronomy, partnerships with multinational companies related to information and communication technology engineering required for radio

astronomy are thriving, with African expertise becoming a sought-after source of innovation for these companies.

Are we doing enough to build a new generation of intellectuals?

There has been much recent debate about a successful transformation of the student body set against an unsuccessful transformation of university staff. I don't want to say much about this debate, apart from noting that the DHET primarily and other departments as well have invested huge sums money in what can be called new-blood lectureships.

We need to expand our science system and to do this we need a new generation of intellectuals in our universities.

Currently, out of the 23 universities only 5 - Pretoria, Cape Town, KwaZulu-Natal, Stellenbosch, and the University of the Witwatersrand - produce 60% of all research outputs of the higher education system, a ratio which has remained constant over a number of years.

The Universities of South Africa, North West, Free State, Johannesburg, Rhodes, the Western Cape and Nelson Mandela Metropolitan together produced just over 33% of all research outputs, while the remaining 12 institutions produced 7% of all outputs.

The significant expansion of the supervisory and research productivity capacity of universities is dependent on the proportion of academic and researchers with doctoral degrees.

Currently only a third of all university academics have a doctoral degree. It will require significant and sustained investment to achieve the long-term target of 80% all university academics having a doctoral degree.

We have set a target of 100 000 PhDs by 2030 to improve research capacity. In order to reach this target we need train 6 000 PhDs per annum. We now produce just over 1 800 PhDs per year.

We have recently begun investing in emerging researchers through post-doctoral fellowships in the Thuthuka programme, and research-career-advancement fellowships.

For established researchers we have the South African Research Chairs Initiative (SARCHI), one of the DST's flagship programmes. It has a total of 157 awarded chairs, 128 of which have been filled. Of these, 73% were recruited in South Africa, 21% are women and 28% are black. The initiative has contributed to the transformation of the system by increasing the number of black and female researchers. Since its inception, the number of black postgraduate students has increased by 400%, and the number of female postgraduate students by 450%. We spend R 451 879 on SARCHI this year.

We have established Centres of Excellence to promote interdisciplinary collaboration in research excellence. For example, the South African Centre for Epidemiological Modelling and Analysis (SACEMA) focuses on research in quantitative modelling of disease, with a strong focus on relevance to public health policy. The policy to circumcise men to reduce the HIV infections was a consequence of a SACEMA study/research. Or the Centre of Excellence on TB pioneered the use of

molecular methods to characterize M. tuberculosis strains, and these techniques are now used throughout Africa to gain insight into the mechanisms driving the epidemic. There are now 14 centres, and investment in them has increased at an average of 20% a year since 2010/11. We are exploring a further three centres - in Aids, human settlements and water research, all in collaboration with other departments.

Researchers need students and government has prioritized bursaries for both university and college students. The government expanded the National Student Financial Aid Scheme from just over R21 million rand in 1996 to R8 billion in 2013. We have so far paid bursaries and loans to about 1,4 million students.

Allocation to University and FET Colleges has increased from R2.4 billion in 2008 to over R7.7 billion in 2012, increasing to R8 billion in 2013. Approximately 1.4 million student-beneficiaries from R32.8 billion in loans and bursaries between 1991 and 2012. In 2011 17 000 graduated with loans converted to full bursaries. In 2012 nearly 30, 000 students were assisted through the NSFAS final year programme.

In order to attract young people to science, the DST is implementing a coordinated approach to science education, science awareness and science communication. The programmes – run through the South African Agency for Science and Technology Advancement – will reach about 350 000 learners and about 12 500 to 13 000 teachers per annum.

Our internship programme supports youth development and employment. Between 2012 and 2014, 1 341 unemployed graduates were exposed to work experience in science, engineering and technology institutions. Of these, 58% were absorbed into permanent employment in the same institutions. Others have found employment elsewhere. The DST has allocated R80 million to fund 1 000 science postgraduates in the 2014/15 internship programme.

Our constitutional democracy has advanced the rights and status of women in South Africa.

In school, girls have equal access to boys and are performing at improved levels in many subjects. In higher education, women are more than 50% of the student body, and while we all want to see more of them in scarce disciplines we are proud of their progress.

Here is an interesting fact. Women don't take advantage of the early success at university. Women graduates don't dominate in the research and laboratory fields. There men continue to reign supreme.

I want to reflect on three statistics about women graduates.

First, four in ten academics are women, but they produce only two in ten publications. We have introduced interventions to encourage women to publish: the provision of equipment grants; special conference funding; workshops in publication and writing skills; postgraduate grants and research fellowships

for women, special concessions for study leave (including lecturing replacements), as well as active institutional communication about research opportunities. Without incentives that support and recognise women in research, significant change is unlikely to take place.

Second, 40% of South Africa's researchers are women. Of the 40,000 researchers in universities, science councils and business that our latest R&D survey records, nearly half are women. That makes South Africa one of the leading countries for female researchers.

Third, and last, men over fifty have turned South African universities into one the worlds most efficient research sectors. According to the National Advisory Council on Innovation, Science and Technology Indicators for 2013, over the last ten years our publication output has risen above the world average. They didn't do it on their own. They worked within a science and innovation eco-system carefully crafted to give them the carrot of financial incentives and the stick of institutional support. And the absence of effective female competition. How much better our record would have been if there were more women with whom to compete and collaborate.

It is well known that better educated women are better for a country's social and economic development.

Are we doing enough to build a new generation of intellectuals?

The answer is no. We must do more. But we are moving forward within the constraints, as finance minister nene outlined, on Wednesday.

In closing, let me say this.

Significant investment is required in both human development and research infrastructure at universities both to improve the productivity of the system and to support the development of research capacity at formerly black universities and universities of technology.