The Department of Science and Technology (DST), the Human Sciences Research Council (HSRC), in collaboration with the Social Protection & Community Development (SPCD) and Human Development (HD) clusters, the Economic Sectors & Employment and the Infrastructure Development Clusters

Promoting an enlightened scientific temper in BRICS: a contribution to a Youth Policy Dialogue

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GOVERNMENT POLICY CLUSTER WORKSHOP

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CONTENTS

ACRONYMS

BRICS	Brazil, Russia, India, China and South Africa
CAST	Chinese Association for Science and Technology
CNY	Chinese Yuan
CSIR (SA)	Council for Scientific and Industrial Research – South Africa
CSIR (India)	Council of Scientific and Industrial Research - India
DST	Department of Science and Technology
EU	European Union
FP7	7th European Union Framework Programme
HSRC	Human Sciences Research Council
ICT	Information and Communications Technology
MASIS	Monitoring policy and research Activities on Science In Society
NGO	Non-governmental Organisation
NRF	National Research Foundation
OECD	Organisation for Economic Cooperation and Development
PUS	Public Understanding of Science
R&D	Research and Development
S&T	Science and Technology
SP	Science Popularisation
UQAM	Université du Québec à Montréal (University of Quebec at Montreal)
ZAR	South African Rand

EXECUTIVE SUMMARY

The Department of Science and Technology (DST) in collaboration with the Social Protection & Community Development, Human Development, the Economic Sectors & Employment and the Infrastructure Development Clusters participated in a workshop on *Promoting an enlightened scientific temper in BRICS: a contribution to a Youth Policy Dialogue*. The workshop took place on 12 September 2012 at the CSIR Convention Centre, Pretoria.

The workshop brought together science communicators and Public Understanding of Science (PUS) researchers from Canada, China, India and South Africa. The discussion explored areas of mutual support in the development of a science communication model to facilitate and ensure more constructive systems of communication in support of the Youth Development Policy, academia and society. By focussing on the notion of a 'scientific temper', the workshop sought to understand science communication options for communities.

The concept of 'Scientific Temper' has a long history but came to prominence in the 1940s in the writings of Pandit Nehru, the first Prime Minister of Independent India. Broadly, Scientific Temper is the essence of scientific attitude that is an active, sensitive questioning, understanding and creative relationship between mankind and the environment, not only the physical and biological environment, but also the behavioural, social and cultural environment. It is a rational approach to the discovery of truth through free and creative thinking, experimentation and objective analysis, a steadfast commitment to scientifically establish truth. At the same time it recognises the tentative and continuously unfolding character of our scientific understanding of phenomena[1].

The workshop highlighted the long history of science communication research in Canada, China and India and provided examples of effective models in these countries. Scientific literacy is not of itself sufficient to ensure that science and society interact optimally and the workshop demonstrated that 'Scientific Temper' requires a combination of 'reason and humanity'. This concept resonates with the 'diplomacy of Ubuntu' described in the White Paper on South African Foreign policy.

Science communication is held in high regard in Canada, China and India and speakers argued that an appropriate Scientific Temper has contributed to the maturation and stability of democracy.

The workshop concluded with a paper that highlighted the remarkable achievements South Africa has made, and continues to make, in science. In order to sustain such successes a more open system of innovation was called for that does not focus on the scientist but is more demand led. This does not exclude individual innovation but will promote better uptake and application of scientific enquiry, ultimately contributing to a new inclusive and accountable social contract between science and society.

[1] Adapted from Udgaonkar, B.M. 1980. Scientific temper and public policy. In: *Society and Science*, 3 (4) November.

INTRODUCTION

The Fifth BRICS Summit will be hosted in South Africa in March 2013. The first Government Policy Cluster Workshop of 2012/13 takes its lead from the Action Plan agreed at the Fourth BRICS Summit, and provides an opportunity for researchers and policy makers to engage in areas of mutual concern and application.

The Delhi Declaration (New Delhi, March 29, 2012) makes reference to:

1. Striving for an enlightened scientific temper (point 4);
2. States a conviction that there is a storehouse of knowledge, know-how, capacities and best practices available in our countries that we can share and on which we can build meaningful cooperation for the benefit of our peoples (point 40);
3. Takes note of the meeting of S&T Senior Officials in Dalian, China in September 2011, and, in particular, the growing capacities for research and development and innovation in our countries. We encourage this process both in priority areas of food, pharma, health and energy as well as basic research in the emerging inter-disciplinary fields of nanotechnology, biotechnology, advanced materials science, etc. We encourage flow of knowledge amongst our research institutions through joint projects, workshops and exchanges of young scientists (point 43).

The Delhi Plan of Action adopted at the Fourth BRICS Summit also specifies the development of a BRICS Youth Policy Dialogue as a future area of cooperation.

BACKGROUND TO THE POLICY CLUSTER WORKSHOPS

The Government Policy Cluster Workshops are designed to better ensure that research feeds into active policy processes, and serve as a vehicle for disseminating policy-relevant results, sharing expertise and experience, facilitating policy dialogue and building the capacity of researchers and policy makers in ways that have a bearing on public policy making. The DST Government Cluster Policy Workshops aim to bring the best social science concepts and evidence into the policy arena and stimulate a discussion of how, in light of these insights, policy can be developed. The goal is to encourage evidence-based policy through an exchange between researchers and policy makers. The workshops are designed to serve the following additional purposes:

- To respond to explicit policy demand and imperatives from the cluster;
- To create space for reflection and the sharing of experience and expertise;
- To facilitate policy review, dialogue and learning.

The aim of this Government Policy Cluster Workshop on 'Promoting an enlightened scientific temper in BRICS: a contribution to a Youth Policy Dialogue' is to take forward the 2007 HSRC Youth Policy Initiative which aimed to move the youth development agenda beyond acknowledging the extent of the challenges, to proposing viable policy and programmatic directions that can be undertaken in an integrated manner.

BACKGROUND TO SCIENCE COMMUNICATION

The importance of the role of science communication and its protégé Public Understanding of Science (PUS) is central to the current science and society paradigm. The two disciplines are globally well established and we are currently witnessing growing evidence of the crucial role played by science communication in South Africa. There is recognition from the side of government of the importance of public participation, which is progressively linked with accountability processes in government. This is well reflected in the South African government's Policy on S&T (green and White papers). The strategic implementation of science communication is to be considered as playing a central role in the success of a democracy. Foremost in this process is the well-informed participation of society in choices such as election processes, appropriate government representation, governance accountability, rule of law legitimacy and last, but not least, our human 'right to life'.

In the last few years the process of public consultation through public engagement with government policy, reviews, reports and strategic plans is experiencing exponential growth in South Africa. In the post-apartheid period a growth in efforts to foster greater international links has seen South Africa entering into agreements with a number of countries. One of those was an agreement of co-operation between the countries of Brazil, Russia, India, China and South Africa; popularly referred to as the BRICS agreement. The latest BRICS report (New Delhi, 2012) refers to frameworks that are now in place and activated in areas such as export regulations, trade in stocks regulations, shares in the banking sectors – including estimations of measures for financial crisis. Questions are currently focussed on appropriate and correct measures to be put in place to address the emergent challenges to the member states comprising of BRICS to grow existing activities. In addition, proposed future collaboration includes areas such as: cooperation in transportation, food security, technical education, research and development, the area of culture and tourism, international issues, energy security and to build effective Institutions.

Underpinning all of these collaboration efforts is the establishment of sound communication infrastructures – both technical and conceptual. Winning the bid to host the Square Kilometre Array with its world class Meerkat-telescope, is positioning South Africa and the eight other African countries that will host remote antenna stations in a crucial position to facilitate and expand on a global science communication process. Therefore, future responsibility, besides the establishment of a technological infrastructure, will be to maintain a science communication system. In similar vein, the sharing of past knowledge (such as knowledge about astronomy) will assist in integrating knowledge systems embedded in people's cultures and histories with new science and technologies to facilitate a better understanding of the world we live in. The promotion of a scientific temper is central to these efforts since it aims to create awareness, underpinned by a responsibility from the side of society, to promote interest in science and scientific method.

With growing interest in the role of science and technology for sustainable development, science communication plays a facilitating role in ensuring that scientific knowledge and advice feeds into political decision making processes and policies. To ensure a sustained impact on the relation between science and society, science communication researchers play a crucial role in ensuring that an integrated approach to developments in science and technology is explored, inclusive of environmental, economic, social and cultural aspects. In the 2012 European Commission (EU) report: *Monitoring policy and research activities on science in society in Europe* (MASIS) a semantic turn was made from Science *and* Society (6th EU Framework programme) to Science *in* Society (7th EU Framework programme) that recognises the awareness that scientific knowledge production is a social activity, there is

complexity and subtleness in the relation between science and society and science is embedded within a broader cultural and political context. Science in society is inclusive of the broad activity that covers political and public debates and initiatives related to the place of science in society, changes in academic institutions, responsibilities of individual scientists, the communication of science in multiple formats among various societal actors and procedures for public involvement in decision making related to science and technology (EU report 2012:25). A number of themes reported upon this matter in the EU report by the 38 countries (27 EU member states and 11 countries associated with the FP7 Science in Society programme) who participated in the FP7 Science in Society programme.

- 'National context which described current and recent debates about the relationship between: science and society in the respective countries, national trajectories with regard to the place of science in society and recent policy developments concerning science in society.

- Priority setting, governance and the use of science in policy making, focusing on the different actors involved in shaping the relationship between science and society, formal and informal procedures for public engagement with science, and national processes and procedures for using science-based knowledge and scientific advice in policy-making processes.

- Science in society related research activities, with the purpose of describing the scale and scope of research efforts in the respective countries, including emerging themes, targeted areas, strategies for embedding science in society issues in mainstream research and funding structures and opportunities for science in society research.

- Activities related to science in society which aims at monitoring the variety of activities particularly concerned with public communication of science and technology, the intensity and complexity of science communication in the respective countries and the actors involved' (EU final synthesis report 2012:22).

These themes indicate the broad framework within which more refined topics were explored. In a national context current debates on the role of science in society focus on: energy and climate change, R&D policy, biotechnologies, academic profession, funding systems and structures, environment, innovation, science communication and education, reforms of Higher Education institutions, health, globalisation and the knowledge based society, scientific ethos, nuclear technologies, ICT, main clusters of debates, technology, innovation and R&D investments and science-industry interplay. To illustrate the role of science in policy-making the EU report (2012:44) aptly states that 'finding the appropriate place and role for science in society is not merely a matter of societal involvement in setting priorities and defining the agenda for research, it also concerns the reciprocal relationship, i.e. the extent to which science-based knowledge and advice is adequately used in policy making processes'.

THE PARTICIPANTS

The participants included representatives from the following government departments: Basic Education; Cooperative Governance; Defence; Energy; Environmental Affairs; Home Affairs; Human Settlements; International Relations & Cooperation; Labour; National Youth Development Agency; Performance Monitoring & Evaluation; the Presidency; Public Service & Administration; Public Works; South African Social Security Agency; South African Revenue Service; Science & Technology; Social Development; and Trade & Industry. Other organisations represented were the China Research Institute for Science Popularization; National Institute of Science Communication and Information Resources, India; Universities of Quebec and Stellenbosch; and the Human Sciences Research Council. The workshop was attended by 51 people.

THE WORKSHOP

INTRODUCTION DR TEMBA MASILELA, DCEO RESEARCH, HSRC

Dr Masilela welcomed the Deputy Director Generals and Chief Directors from the various government departments and other delegates. He explained that the HSRC runs these seminars on behalf of DST. Their purpose is to help promote the use of evidence for policy making and create a safe space for policy makers and selected researchers to engage. 'Chatham House Rules' are applied (no attribution, outside the room, of ideas discussed inside it) when appropriate. This approach is designed to encourage full discussion of potentially controversial topics so that people can express their own views without fear of official sanction or concern for their own reputation. The DST identifies workshop topics at the beginning of the year and then the HSRC develops a programme with international and local expertise. The aim is to encourage robust debate between policy makers and researchers.

WELCOME MR. WISEMAN MAGASELA, DDG: SOCIAL POLICY

Mr Wiseman Magasela, explained that the theme of the workshop was to promote an enlightened scientific temper in South Africa and contribute to the Youth Dialogue. Speaking as a senior government official, Magasela recognised the challenges faced by the members of BRICS. One of these is the multifaceted social and economic issues facing the youth in our countries. The question being to what extent can science and the public understanding of science assist us make outcomes for youth that are different from the current ones? To appreciate the role of science in development we need to consider the human, social and economic development aspects. We need to determine how governments can tap into scientific knowledge to advance evidence-based or informed policy. Experts from Canada, China, India and South Africa will help us appreciate how science and Public Understanding of Science can be used as vehicle to drive the desired growth and development in society.

THE DEVELOPMENT OF SCIENCE COMMUNICATION IN CANADA.

PROFESSOR BERNARD SCHIELE, Researcher at the Interuniversity Research Centre on Science and Technology at UQAM, Professor of Communication at the Faculty of Communication and Professor for the Joint Doctoral Program (PhD) in Communications at UQAM, the University of Montreal and Concordia University.

Prof Schiele began his talk by pointing out some of the unique characteristics of Canada. It is a huge country, larger than China in area but sparsely populated with only 37 million people. It has been active in Science Communication for a long time and has made hundreds of contributions – more than either France or Germany. Its political structure is also distinct. Canada is a Confederation of Provinces meaning that each Province is more or less independent. Each province has its own government and laws, rather like the countries within the European Union. Each province controls its own schools, museums, art museums etc. and has its own research and development programme. Each province has responded to its needs differently. This is not to say that government has no say in science communication and development but its role is indirect. It can launch programmes so long as they do not interfere with provinces' right to do so. The federal government promotes Science Communication but all towns and villages are also very active. Most policies have been developed in reaction to the need expressed by communities – such as the museum

community, astronomers, birders, mushroom collectors – all policies react to these communities. Federal and Provincial government have their say but this has no effect unless coordinated with the will of the communities. Canada is therefore different and maintains this dual relationship between Province and Federal government.

Schiele has worked in Québec and Ontario which are the oldest, most populated and most industrialised provinces. In these two provinces local government has policies to enhance science communication. Development of Canada has taken place in three phases: up to the 1980s there were no science communication policies and all the work was done at grass roots level. Communities expressed a need for help with science communication from government. In the 1980s OECD made recommendations saying that science and society development are so closely related that to be competitive every society must support science development, either at school or through non-formal training. It was the role of government to support this process. During the 1980s Ministries of Science and Technology began to take shape in other countries and governments began to listen to communities' expressed need for support. Each province began its own science communication programme and science communication policies became part of each government's programme. From the 1980s to 2000 there was continuous support to grant policies, followed by 10 year lull, but recently there is renewal of support. Coordinated support is evident in all developed countries and all these initiatives are organised around increasing the intellectual capacity and output of the country. They also have a focus on the youth from the very young to adolescents.

In a competitive global economy, countries need to develop all the capacity they can to compete and these initiatives support science development capacity of the countries. And within this process gender equality has become a focus since girls find it more difficult to enter science programmes in most countries.

The second objective is science awareness, i.e. making people more aware and bringing science to the people. The expectation is that people who are exposed to science will support government policies and development initiatives. The snag is that while people may be aware of the wellbeing that science has brought about they are not necessarily convinced that progress will benefit all people all the time. In the UK and France people are ambivalent about science; being aware of good things like health improvements but at the same worried about climate change. This ambivalence will remain when we engage in public understanding of science. In Canada, every programme that strives to advance science is also critical of science – thus promoting critical thinking about science.

Discussion

Question (Q): The first question asked whether there was any specific legislation on the goals identified and what promotes investment?

Answer (A): Incentives take the form of support from a government programme. Either government proposes a specific programme or open grants are offered which allow the different scientific communities to propose their own programmes. Most of the policies were developed in a three or four step consultative process. Building consensus is the way to maintain a unified country made up of many peoples.

Q: Canada's use of science to underpin government policies is impressive. In South Africa it is not clear whether science and technology play an active role in influencing policies. How has

Canada institutionalised science in policy making and service delivery and are there good practices that we can learn from Canada?

A: You have to keep in mind both formal and non-formal training in science communication. Formal science education goes from primary school to universities and government has developed science teaching at all levels through a consultative process. Everyone is aware of the role of science. In non-formal communication the policy tries to relate formal and non-formal science programmes addressing the needs of the population. Federal programmes facilitate those kinds of relations. At universities there is a team devoted to non-formal science education supported by the federal government. The Science and Technology Awareness Network (STAN) is a famous programme across Canada which brings bright young people to universities to make them aware of the life of a researcher. Another component is compensation for private sector scientists to spend a day or two at university. There are many different formulas leading to hundreds of programmes but the common objective is to bring people together to understand the life of a scientist.

Q: Between the federal and provincial government, who funds science projects?

A: Both do this but the final say is with the provinces. Federal government tries to coordinate programmes nationally and provinces might work with other programmes. An example is when the federal government sets about freeing Professors from teaching to promote science. This interacted with the independence of the province but all provinces saw the advantage of the programme and supported it.

Q: In the South Korean example – can anyone tell us how the South Koreans do it?

A: In Korea they have an organisation that overseas science communication much like CAST in China. Nothing goes through without support from these foundations which are closely related to government. It is not like this in Canada where the science associations are non-profit organisations or private and *not* government owned. Private initiatives are relatively few and most concentrate on science museums and are always orientated towards the young. In Canada every association tries to put up new ideas – there are hundreds of them. Therefore it is very different from the centralised approach in Korea, China, and Japan. In Canada communication always relies on local initiatives.

Comment (C): The way that a country promotes science is very context specific. In a decentralised state like Canada they have managed the dialogue and tensions; in Korea, China and Japan it is very centralised and managed differently. The institutional structures and policies determine how you deal with science communication. Cultural issues are important too and relate to prevailing attitudes of citizens to science and technology.

POLICY PERSPECTIVE ON SCIENCE POPULARIZATION IN CHINA

PROFESSOR SHI SHUNKE, China Research Institute for Science Popularization (CRISP) and the China Association for Science and Technology, Beijing, China.

Please refer to Appendix 5 for copies of the slides used in this presentation.

Science popularisation has been a national engagement in China since 1949 and the China Research Institute for Science Popularization team reviewed a sample of 100 policies from over 1000 policy documents produced over the past 60 years. Various terms have gained

popularity and in China three remain in fashion – science popularisation (SP), science communication and science education. There is good support of the concept in China and it is not controversial.

The materials falling under SP include laws, regulations, guidelines, plans, outlines, programmes, reports, decisions, instructions, notifications, and state leaders' speeches. From 1949 there have been thousands of documents issued with some relationship to SP. Those involved in producing SP policy include the Ministries of Science & Technology, Agriculture, Education, Culture, Health, Finance and others; government agencies in charge of environmental protection, seismology, meteorology, radio and TV broadcasting, the press and publications; the Chinese Academy of Sciences; Trade Unions; the Women's Federation; the Youth League and the Chinese Association for Science and Technology (CAST).

The documents reviewed were classified according to their producers, coverage and categories. Policy making is a government-guided process and SP has been taken over by government. All policies aim to help make economic production better and to help make society develop harmoniously and stably. The process of seeking better quality of life or 'civil and mental civilization' equates to 'science temper'.

Of the many policies reviewed, three are the most important and influential, namely:

1. The *Instructions on Strengthening Engagement in Science and Technology Popularization (1994)*
2. The *Law of the People's Republic of China on Popularization of Science and Technology (*2002*)*
3. The *Outline of the National Scheme for Scientific Literacy (2006–2010–2020) (2006)*

According to the first of these, SP ran into difficulty around 1990 with SP losing priority with local governments and a superstitious craze that gained strength since 1980s. There were many false claims being made in the name of science. Some of this was due to the legacy of the Cultural Revolution which meant that people had no knowledge of science with which to refute spurious claims.

The *Instructions* began to address the situation as follows:

- Governments at each level were to place SP on their working agendas and play a part in its delivery. SP engagement was to be included in the state's five-year plan and in local social, economic, and science and technology programmes.
- Governments were to secure public input into SP and make sure that more money would be invested in it. The construction of basic SP infrastructure, such as science museums, science centres and public spaces for SP activities was to be supported.
- The mass media would be used to popularize science, and science-based institutions and scientists would be encouraged to contribute to the effort.
- Activities were to be targeted at youth, farmers and cadres in public posts.
- Sensationalist media reporting on superstitions and pseudoscience was to be opposed.

The Instructions were followed by a National Law and this was replicated in the provinces. Some provinces introduced legislation prior to the national legislation.

SP law guaranteed the legitimacy of the SP activities but there was a lack of capacity to effect this legislation. Some argued for detailed guidelines to enforce the effect of the law and guidelines were developed with scientific literacy as the key concept. The *Outline* was

issued by the State Council on Feb. 6, 2006 and in 2012, the *Outline* was renewed and an *Action Guideline* produced.

Four main projects arose from the *Outline*: Training, Resource Development, Capacity Building for Mass Media and Infrastructure. Funding for SP soared and according to statistics from the Ministry of Science and Technology, the total investment in SP was about 2.4 billion Chinese Yuan (CNY) in 2004, CNY 4.6 billion in 2006, CNY 6.5 billion in 2008, CNY 8.7 billion in 2009, and CNY 9.9 billion in 2010 (CNY 1 = ZAR 1.296).

Today, the Outline is a dominant policy for running SP across the country. As the document states, the principal strategy in carrying out the Outline is 'Government boost, mass participation, raising scientific literacy, and promoting harmony'. Government support is going to be stronger, more resources will be explored, more social sectors will be involved, capacity will be widely improved and more actions will be taken.

Some sayings recur in the policy documents and become government catch-phrases, reflecting an attitude of science advocacy in SP. The most frequently used terms are: 'to learn science', 'to love science', 'to communicate science', 'to use science', 'to trust in science', 'to respect science', 'to rely on science' and 'to admire science'. These sloganistic jingles encourage people to stay away from superstition and behave scientifically.

The most heavily advocated practice in approaching science nowadays concerns personal achievements in four aspects: scientific knowledge, methods, thoughts and ethos (spirit), as stated in the Outline. Together with two abilities (to resolve practical problems and to participate in public affairs), the four aspects are used as a yardstick to assess whether a Chinese citizen is scientifically literate or not. From the late 1990s onwards, these themes have been repeated again and again in SP policy documents, and are now the highest goals in the pursuit of SP in China.

In the 1990s, Chinese researchers in the field and students in the universities turned towards the Western public science communication arena and began to import many fresh concepts, such as 'science communication', 'public understanding of science', 'science and society', 'scientific literacy', 'the deficit model', 'science consensus', 'dialogue', 'bottom-up approach', 'hands-on activity', 'inquiry learning' and the like.

Chinese policies issued in recent years place more emphasis on the perception of science–society relations, public scientific literacy, and the engagement of the public. The policies now positively encourage interactive dialogue, inquiry learning and hands-on practice. They reflect a strong effort in an organized pattern. The main underlying theme is to encourage people to love science and to use science, and the major effort is to bring science to the people on the streets following a top-down pattern.

The mainstream in China is SP supported by government. CAST is a national organisation with 33 branches at province level. The system goes down to county level and then to family level.

Government has had special programmes for support of farmers (since 2008). For example, CNY 3-400 million is made available to reward agricultural associations that do well in promoting practical techniques for improving production.

In closing, Prof Shi Shunke said that each country has to make its own case. Although China has imported notions from the UK, US and elsewhere, finally China needs to follow its own way.

RESPONDENT: DR THOMAS AUF DER HEYDE, Deputy Director-General: Human Capital and Knowledge Systems, Development and Innovation, Department of Science and Technology

Prof Shi referred to the many terms used to describe the popularisation of science but few embrace the critical spirit. In South Africa we want to give effect to a popularisation of science but we want to empower people to engage the issue and provide tools to reflect critically

There are various tools for producing policy documents and in South Africa the national parliament fulfils this role as do public consultations.

Prof Shi referred to a wide range of policies – over 1,000 with some aspect of SP which is a staggering number of policies! There must surely be a risk of policy fatigue. It has been said that it is sometimes easier to develop new policies than to deal with the problems they seek to address. The rapid increase in policy papers in the last decade in China may not be helpful, especially if the policies tend to reiterate or reinforce previous ideologies.

Apparently regions were not focusing on SP although the State relies on decentralisation to the provinces. National level polices should help guide regional/provincial polices. The superstitious rage promoted the need for a rational framework and the scale of the response is huge: 505 science museums and 55 million visitors to those museums.

An important point made by Prof Shi is that lessons learnt elsewhere may not fit the local context. In South Africa we find that top down policy formulation does not work.

Dr Auf der Heyde disagreed with the notion that Science and Technology as a concept is more embedded in Western culture. Many technological advances arose in Asia although they may have been refined in the West.

The way that we take Science Policy and its communication forward will be informed by our philosophical and ideological view of science. Much depends on whether we have a 'positivist view', i.e. that science can do no wrong, or a more reflective view of science which is more critical.

Dr Auf der Heyde hoped that there would be ways to take this debate forward within the Department of Science and Technology and with those who can help provide space for such discussions. DST can do little on its own. For example, DST only reaches 7,500 children with its programmes yet there are 12.5 million scholars in 25,000 schools. Thus the Department of Education has most scope for science popularisation with children. There is scope for more research on the institutional platforms that can change the way South Africans think about science.

FROM HISTORICAL REALITY TO THE ABSTRACT: 25 YEARS OF PUBLIC UNDERSTANDING OF SCIENCE (PUS) RESEARCH IN INDIA.

PROF GAUHAR RAZA, Head: Science Communication through multi-media (SCM), National Institute of Science Communication and Information Resources (NISCAIR), CSIR, New Delhi, India

In 1976 India was the first country to amend its constitution to include a duty for citizens to spread scientific temper and encourage scientific enquiry. This did not happen in a day and has its origins in the Freedom Movement in India.

India is a country with a huge population; 1 in 5 human beings is Indian. There are many provinces and great diversity of languages – more than 3,000 languages and dialects are spoken. Currently there are 15 official languages. There is also diversity of caste, which is unique to India, and diversity of religion. This creates fault lines in the mass of humanity.

In 1857, India was not an entity like most other countries and none of the identities at that time would bind everybody. British Imperialism influenced leadership and they realised that the only identity that could exist was based on Western secular and scientific values. Equality of human beings, gender and education for all were foreign concepts. Some castes did certain things and others were forbidden from doing them. In time, the new identity came together to fight British Imperialism; Gandhi and Nehru being the main architects of this identity.

Pandit Jawaharlal Nehru, the first Prime Minitster of Independent India, referred to Scientific Temper in his book written in prison (Discovery of India: 1945). The term first appeared in British literature in the 1890s but there was a sudden peak in the 1940s related to Nehru's writings. Nehru was referred to as 'a great mind' because the leadership was aware that the movement should not turn racist and had no slogan against the whites but rather against Imperialism. Nehru distinguished between two products of England which came to India, namely, brutal suppression of leadership on the one hand vs. science and technological progress.

In the debate that was going on about scientific temper the words that occurred most frequently were 'way of life, a spirit of inquiry, conclusion based on evidence, investigation of external nature, and modern social scientific consciousness'.

Scientific leadership rose to the occasion and pointed out how science should be built in the country and Congress had no problem with Scientific Temper because it wanted to build the infrastructure of the country. Mobilising the youth to communicate science temper began in 1957, some 10 years after independence. In the 1970s science temper was discussed more widely and by 1981 Science Temper was being used by historians, poets, and others. In 1987 the state and NGOs joined forces for an experiment in which a group of scientists moved around the country to address the myths around the solar eclipse that had persisted for 4,000 years. Indians for the first time came out and rejected the myth around the eclipse and saw and celebrated it.

However, since then the media have reinforced superstitions such as astrology. Prof Raza argued that high technology does not necessarily result in high science temper. People

generally have no problem embracing technology but they often have a serious problem with science. Thus it is important to distinguish between science and technology.

Two major experiments involving science temper are being carried out in India and China. India is surrounded by fragile democracies yet India is a stable democracy. One of the reasons for this is that Indian society has engaged with science and not only technology. Even though India is a society that is riddled with illiteracy and poverty it has done much better than its neighbours. Others have not engaged with scientific temper sufficiently and their democracy 'comes and goes'.

Discussion
Q: The notion that science temper is the basis for *democracy* as opposed to *development* is novel. Perhaps we need more scientifically minded political leaders. Most developed countries have the scientific training whereas the underdeveloped and less democratic are less scientifically educated. Is this true or not?

A: Other identities were not wiped out by the national Indian identity. Science temper is not static, it is a continuous struggle. Some of the myths are wrapped in religion and the clash continues whereas other indigenous knowledge systems (IKS) can be measured on a scientific basis. We need to sift the IKS and avoid over romanticising it just because technology has had its problems. The Science Temper Statement of 1981 is currently being revisited in light of the developments that have taken place around the world. A new statement to the nation is likely to be rededicated in about six months' time.

Q: Both China and India have a wealth of traditional knowledge in common, e.g. Ayurvedic medicine and Chinese traditional medicine. How have these been dealt with in science temper and popularisation of science?

A: The traditional Chinese medicine debate is going on in many parts of the world. Traditional medicine was rejected by many as not safe from a scientific perspective and is known by some as 'alternative science'. Many refuse to take it seriously and label it false. In China there is huge debate between the two. The Chinese government declared that Chinese medicines should be protected for 30 years with attempts to combine traditional and western approaches. In traditional hospitals almost all the doctors have western training as well and the public still have strong trust in traditional medicines. Traditional medicine gets prime time TV coverage, although there are some very ridiculous claims. People blindly believe this and buy the recommended food. However, Chinese traditional medicine is still legal and protected and trusted by the people. In many cases the Chinese do not find it difficult to combine traditional and modern knowledge. Thus astronomy and evolution are well received but in other areas people are very misguided.

Q: Women's empowerment is an area which is less promoted in science. What measures exist in India and China for getting more women scientists involved when popularising science?

A: In China, since 1949 women and men have equal rights and their rights are entrenched in legislation. There is a major programme for rural women to learn science skills in agriculture, child care and other aspects of science. Women are not always treated the same as men but this is not common and women's rights are protected. Another opportunity is provided through the Ministry of Civil Services which organises training for new employees coming to the cities from rural areas.

A: In Canada, women's rights are embedded in the Charter of Rights. As for participation in science, the trend is that there are more women in medicine and biological science than men although there is still a lack of women in physics, maths and chemistry.

Q: In South Africa we have high unemployment, particularly for the youth and technology seems to be a contributing factor in terms of negatively affecting the labour market, because companies substitute labour with technology. So what are the lessons from your country and how do we strike a balance between technology and the labour market?

A: Countries which have high levels of technology that have not engaged with the science always have problems. However, labour will protest against technology if it does not improve their livelihoods.

Q: In South Africa we are investing in education but there seems to be little impact for science. When India and China started science popularisation they faced similar problems to South Africa, i.e. few people were science literate. What should we do here?

A: The strongest channel for communication is education and inculcates science in the citizens. But other means have to be used as well because cultivating a science temper is a lifetime process.

Q: When you popularise something you de-popularise something else. Do you let both systems flourish? In a rural area there will be a traditional midwife, so my question is, is science always there? My other concern is the risk of rubbishing one knowledge system and promoting others. I really would like to hear your comments around allowing different knowledge systems to flourish rather than promoting one against the other.

A: It is difficult to accept all traditional medicines. Policy makers may romanticize the traditional medicine but you will notice that they don't take their own families there. If we cannot provide modern health care to all right now we have to let traditional systems continue. Other systems must be allowed to flourish but don't romanticize them from the national state.

A: I think we are struggling with a false dichotomy here. There is a notion that science is white, European and male and indigenous is black and African – this is a false dichotomy. Most science has been shaped by humankind as a whole. Different parts of humanity have contributed to all aspects of science. For example, India and China have a centuries-old written knowledge system which has been adopted by the West.

C: Science Temper is a useful notion but I don't interpret the word 'science' or 'scientific' in its purest sense. Science training is a necessary but not sufficient condition for Scientific Temper. What we are looking for 'reason and humanity' - there must be both. And regarding the context here, if you approach this notion of scientific temper in this sense, the question is 'does reason and humanity prevails in society?' Well, then it becomes very clear to see whether science is making a contribution, a positive contribution or not, because if humanity and reason are prevailing, it must be at least in part, because science is there as well. So it is a socio-political challenge that you've put on the table, not fundamentally a scientific one.

A COMPARATIVE PERSPECTIVE FOR A FUNCTIONAL APPLICATION OF SCIENTIFIC TEMPER IN SOUTHERN AFRICA.

DR HESTER DU PLESSIS, Head: Science Communication, Research use and Impact Assessment (RIA) unit, Human Sciences Research Council (HSRC) South Africa.

Dr du Plessis circulated a paper that she developed for this presentation. She pointed out that there is a policy in South Africa regarding the development of science communication and public understanding of science. The Department of Science and Technology has produced both a Green and a White paper that stipulates the importance of public understanding of science and its relation to the national system of innovation. However, going into all the more recent reports, including the latest ministerial report, there is very little mentioned about the role and function of science communication in the restructuring of our system for science and technology in the country.

There has been no national public understanding of science survey done in South Africa apart from small demarcated surveys such as those on the public understanding of biotechnology and climate change attitudes. There are a few household surveys (mostly those that were conducted in the early 90s) but there has never been a national study on the public understanding of science. So we have little understanding of what is going on in the country regarding people's attitude and understanding of science, which is a crucial issue to flag here, because if you want to start to innovate and add value to people's thinking and understanding of science, you need to first establish what do they know and think at this time.

The HSRC conducted a study on science communication perceptions (about 2009) which noted that perceptions are still dominated by race perceptions. The public's perception exists in theory only because there are no national surveys. The public is still perceived in deficit terms with scientists following the contested deficit model of science communication. The HSRC is currently engaging in a new international project with 6 different countries (Epistemological review of a science communication model). The aim is to revisit the popularly applied deficit model. This project will probably bring to life a new science communication model that could actually lead the way forward to a global application of a more appropriate science communication model.

There is a fairly recent report which focuses on developing a bidirectional relationship between the public and science, with related issues such as the communication of messages about science and technology, the dynamics of attitude of belief formation regarding science and technology and, most importantly, access to information about science and technology.

This presentation seeks to address exactly what Thomas Auf der Heyde has mentioned regarding the philosophical issues related to the right to reason and rationality. There are a number of studies that look at the effect of colonialism on Africa and a lot of African philosophers have also been writing about that. So instead of taking for granted that we all have the right to reason (and rationality), we are able to prove that, within developing countries' context, and specifically within the African context, there is not an overt acceptance of a right to reason. That right to reason has been taken away through the colonial system. So part of the whole process of facilitating science communication will be a process of actually reclaiming the right to reason and rationality within Africa, hence our efforts to inculcate the scientific temper.

To illustrate this point, the African philosopher (Mogobe Ramose)[2] looked at a number of differentiated lines drawn up within this notion of reason and unreason. He spoke about:

- The notion of the fidels and the infidels (a line with special impact on religion);
- Cultural civilization and barbarism;
- The establishment of principles governing the humanization of war (just and unjust wars);
- The Geographical rayas and amity lines – driving the unfair (illegal) appropriation of land; and
- The meridian line defining truth and justice; based on the notion that the conqueror has sole and exclusive power.

In working with the National Institute of Science Communication and Information Resources (NISCAIR), CSIR in New Delhi, India, we have discovered interesting issues of potential importance for South Africa. It is on this point of reference that the words of Nehru is of importance. What Nehru said in his five point plan was to be implemented in the first few years after the 1947 independence of India:

- People should develop along lines of their own genius and we should avoid imposing anything on them;
- Tribal rights in land and forest should be protected;
- We should try to train and build up a team of their own people to do the work of administration and development;
- We should not over-administer these areas or overwhelm them with a multiplicity of schemes; and
- We should judge results not by statistics or the amount of money spent but by the quality of human life that is involved.

Then briefly, what exactly is scientific temper? Udgaonkar (1980)[3], defined it as:

'…the essence of scientific attitude that is an active, sensitive questioning, understanding and creative relationship between man and his environment, not only his physical and biological environment, but also his behavioural, social and cultural environment. It is a rational approach to the discovery of truth through free and creative thinking, experimentation and objective analysis, a steadfast commitment with humility, not arrogance, to scientifically establish truth. At the same time it recognises the tentative and continuously unfolding character of our scientific understanding of phenomena.'

There is more to the definition but this quotation sufficiently explains what it entails.

[2] Ramose, M. 2002. I conquer, therefore I am the sovereign: reflections upon sovereignty, constitutionalism, and democracy in Zimbabwe and South Africa. In: Coetzee,P.H. & Roux, A.P.J. 2002. *Philosophy from Africa*. Cape Town: Oxford University Press.

[3] Udgaonkar, B.M. 1980. Scientific temper and public policy. In: *Society and Science*, 3 (4) November.

Finally, there are four points that should inform the discussion going forwards in our discovery of the possibilities of applying a scientific temper:

- First is the development of the linguistic sciences and the increased interest in social customs and in specific kinds of discourses issuing from different social worlds, including the world of science;
- Secondly, the rise of sociology and anthropology of scientific activity, which is the social and political dimensions of research;
- Thirdly, the theorising of popularisation as a means to generate reflectivity and challenging the irreducible heterogeneity of the production of knowledge;
- Fourthly, the critique of the political role played by science in social life looking at the links between so-called legitimate forms of knowledge production and ideological frameworks supported by literature and the media.

RESPONDENT: Mr Mahdi Basadien, BRICS SECRETARIAT, DIRCO

Dr Du Plessis' paper explored the notion of scientific temper as a driver for democracy and as an aid towards youth development. She also argues that scientific temper could be used to facilitate dialogue between developed and developing countries. The paper also explores how scientific temper became institutionalised as the philosophical driver for socio-political transformation in India during its first post-colonial era.

South Africa joined BRICS with three objectives in mind; to partner with key players of the South on issues related to global governance and reform; to promote our regional integration programme and related continental infrastructure programmes; and thirdly to advance our national interest as outlined in the President's State of the Nation Address.

Like South Africa, our fellow BRICS nations are striving to enhance inclusive economic growth that will lead to an increase in the creation of decent and sustainable jobs, advance the fight against poverty and facilitate the economic transformation of our countries. We are also working to realise a more equitable global, political and economic system.

South Africa's invitation to join BRICS takes cognisance of our country's contribution to shaping the socioeconomic regeneration of Africa as well as our active involvement in peace, security and reconstruction efforts on the continent. Mr Jim O'Neil, chairperson of Goldman Sachs Asset Management, recently published an article entitled 'South Africa's BRICS score, not all doom and gloom.' He concluded by saying South Africa could more than justify its presence in BRICS if it helps Africa to fulfil its remarkable potential. By exploring cross-border expansion in trade and infrastructure as well as improvements in domestic productivity, South Africa will have more than justified its role as a member of BRICS.

BRICS leaders have expressed support for the infrastructure development in Africa and its industrialisation within the framework of NEPAD, the new partnership for Africa's development, first at the Sanya Summit in 2011. At the New Delhi Summit (2012) the leaders reiterated the highest importance attached to economic growth that supports development and stability in Africa as many of these countries have not yet realised their full economic potential.

The BRICS leaders undertook to support Africa's efforts, to accelerate the diversification and modernisation of its economies through infrastructure development, knowledge exchange

and support for increased access to technology, enhanced capacity building and investment in human capital, including within the framework of BRICS. The New Development Bank will be one mechanism to achieve these objectives.

President Zuma's State of the Nation Address stated that the triple challenge of poverty, unemployment and inequality required our single-minded attention. Central to this new growth path is inclusive growth and creating jobs. We have identified six job drivers to help us achieve the much-needed growth leading to jobs. These are infrastructure development, agriculture, mining and beneficiation, manufacturing, the green economy and tourism. Some of you might have heard of the terminology called 'diplomacy of Ubuntu'.

In your paper you also emphasise the role of indigenous knowledge as a valid and important tool for knowledge production. You also focussed on the destructive impact of historical knowledge structures that still permeate our societies today and privileges Western concepts of reason over indigenous African knowledge structures. The white paper on South Africa's foreign policy entitled 'Building a better world, the diplomacy of Ubuntu' therefore reflects the importance of indigenous knowledge to South Africa's foreign policy.

According to the white paper, Ubuntu South Africa is a multi-faceted, multi-cultural and multiracial country that embraces the concept of Ubuntu as a way of defining who we are and how we relate to others. The philosophy of Ubuntu means humanity and is reflected in the idea that we affirm our humanity when we affirm the humanity of others. It has played a major role in the forging of the South African national consciousness and in the process of its democratic transformation and nation building. The white paper concludes with the statement:

> 'South Africa's greatest asset lies in the power of its example. In an uncertain world characterised by competition of values, South Africa's diplomacy of Ubuntu focussing on our common humanity provides an inclusive and constructive world view to shape the evolving global order.'

In your paper you highlight the importance of creating research and educational institutions, enforcing the development of scientific temper and wider socioeconomic development. The BRICS Academic Forum has recognised the need to consolidate sectoral areas of co-operation, especially in critical areas of pure learning, knowledge sharing and research.

Co-operation between these five countries is also being strengthened in a range of sectoral mechanisms that include trade, agriculture, science and technology, health, finance, social development and statistics and communication. The BRICS Academic Forum in particular is a dynamic forum where academics from the BRICS countries can freely exchange ideas and research. New areas for our co-operation that have been proposed, include co-operation on youth development, energy co-operation and population management.

You also argue in your paper that scientific temper and youth development is dependent on partnership between education, industry and society. In an effort to institutionalise knowledge production in South Africa, cabinet has given a directive for the creation of a dedicated BRICS think tank or centre of excellence. The rationale for such a think tank is that South Africa's engagement with BRICS should contribute to the domestic objectives that government has identified, namely poverty, inequality and unemployment, particularly among the youth of South Africa. Research on BRICS could therefore help to identify the key

areas for co-operation where South Africa can find concrete benefits from its membership of BRICS.

Minister Nkoana Mashabane has therefore launched an outreach program to provinces to educate and inform youth and the wider South African population. As you may be aware, South Africa will host the fifth BRICS summit in March 2013 and as part of the preparations there will be an educational drive to all provinces in South Africa informing them of BRICS and its objectives.

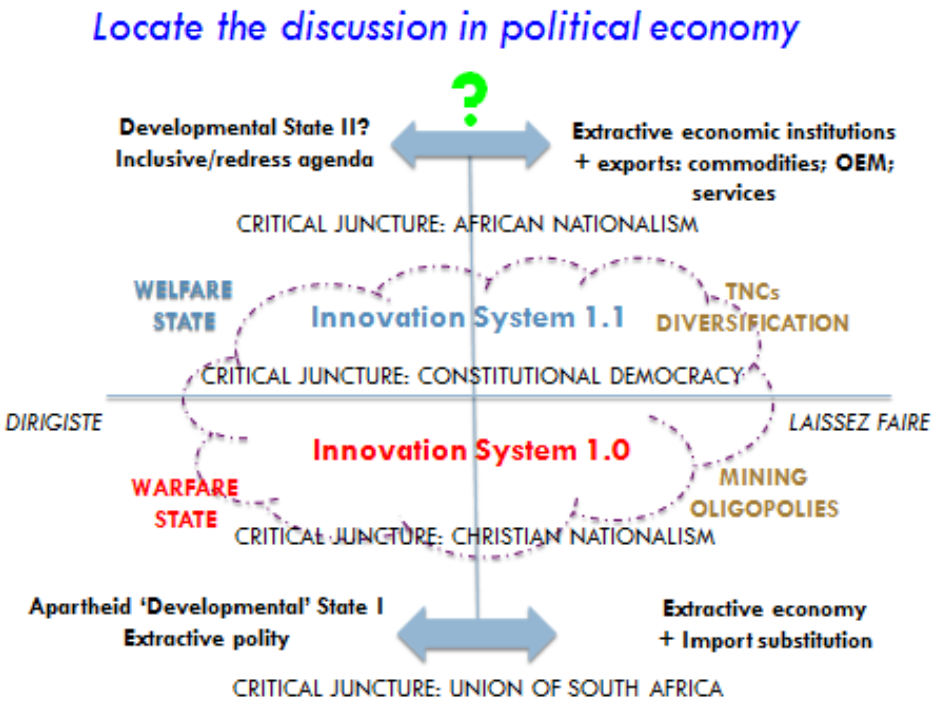
The Department of International Relations is committed to youth development and will seek to use its membership of BRICS to benefit the youth of South Africa.

PROMOTING AN ENLIGHTENED SCIENTIFIC TEMPER IN THE BRICS: TOWARD A NEW SOCIAL CONTRACT BETWEEN SCIENCE AND SOCIETY.

PROFESSOR MICHAEL KAHN, Professor Extraordinaire, Stellenbosch University

Please refer to Appendix 5 for copies of the slides used in this presentation.

Prof Kahn began by locating the discussion using a summary of the political economy of South Africa highlighting four 'critical junctures', namely, the foundation of the Union of South Africa in 1910, Christian Nationalism in 1948, constitutional democracy in 1994 and, since then, the growth of African Nationalism (see below). On the one side there is the growth of the private sector, e.g. the mining oligopolies, on the other, what can be characterised as a 'warfare state'. And this is the all-conquering apartheid developmental state. It is based on extractive politics and extractive economics. We are seeking to change this to inclusion, both political and economic. So now the warfare state is changing into a welfare state and the mining oligopolies have diversified. What was import substitution has given way to competition with countries like China.



Before 1994, the majority was excluded by design, technology was for the apartheid state, there were strong links between the state research organisations and industry, and everything was being driven by the linear model of innovation.

On the other side and up to the present, there is freedom to do basic research and this is supported by mechanisms such as the journal subsidy and the rating scheme of individual scientists. Interestingly, both of these work against the notion of collaboration and reward the individual.

In about 1960, the state established the Foundation for Education, Science and Technology which was intended to promote science awareness, but that was essentially part of the white structure. For the black majority, non-governmental organisations filled the space and they were very active in science and maths education, including developing some science centres, some of which still exist today. Science was for the few, with very high barriers to entry, yet it produced four Nobel laureates in the sciences. In this sense we are very similar to Argentina, and it can be characterised as an 'extractive system of innovation'.

Forming the democratic state between 1990 and 1999 very quickly laid the basis for an inclusive polity, and a large scale attempt was made to do something to right the wrongs and the deficits in school science and maths education. Students and youth were encouraged to enter science, technology, engineering and maths. The programme ran for five years and then was dropped. In parallel, a totally new school curriculum was developed (Outcomes-based education) which very importantly included and still includes technology as a core subject of the curriculum.

The white paper on science and technology has already been mentioned and how it said just a little bit about public awareness of science and technology. Other processes of the time included foresighting, the establishment of the Academy of Science and some surveys of public attitudes to science and technology. Based on the American NSF instrument South Africa was the most pro-creation thinking nation of those surveyed, after the United States.

Consolidation took place in the last decade with the founding of the Department of Science and Technology and, very importantly, during the 2002-strategy, a declaration of the intention to establish the Institute for the Promotion of Science. The earlier Foundation for Education, Science and Technology was to be enhanced but this did not happen for various reasons. Instead, the foundation was merged into what is today the National Research Foundation, the South African Agency for Science and Technology Advancement (SAASTA).

Another important initiative, which is still in place, is the 500 science and maths focus schools which are potentially a very important resource. They are like science academies in any other country, and the establishment of these marked a very important shift in thinking in the National Department which initially was very opposed to any idea of differentiation.

Outputs and achievements during this period are varied. The innovation system has not grown significantly, but it has managed to hold its own. The South African share of world publications is steady despite the huge rise in publications from China, India, Korea and others. South Africa's impact rating is about the world average.

In terms of participation in international networks, we have done extremely well, with notable successes in the European Union networks.

On the economic side, we are an open economy by any measure. There has been a slight rise in our patenting and we still retain strength in particular fields like catalysis. What is generally unknown is our prowess as an important country for registering plant cultivars. Significant efforts have been made to elevate the status of indigenous knowledge systems and legislation exists to protect it as well as to ensure benefit sharing. Also, contrary to what some people think, there has been an increase of engineering and natural science graduates (44% and 67% respectively). So, although we started from a very, very weak base, we are beginning to see some progress. Our higher education system is open. It is an asset for the whole of Africa.

South Africa plays a leadership role in science and technology policy on the continent within NEPAD and the African Union and there has been recognition in the form of two Nobel prizes in Literature, the Templeton prize, the Planck prize and the L'Oreal prize. We also have demonstrated the ability to develop and manage large science projects. There is a network of science centres, but no national flagship centre, which is a great pity.

Science events and activities capture public attention. One of the most important events was the impact of the Shoemaker-Levy comet on Jupiter in 1994, which we saw happening live on TV. This was because we could get a feed of the signal to the radio telescope. Then we had the Year of Science and then we had Africa's first space tourist, Mark Shuttleworth. On the negative side were the debates about the aetiology of HIV/AIDS. Science week was institutionalised; the Cradle of Humankind became a world heritage site and more recently there has been excitement about malaria work done at the University of Cape Town. Technology projects like the Square Kilometre Array have received attention and we are now the joint award recipients.

But the science-based innovation that has been the most significant for the South African public is Mxit, an instant messaging application for use on any phone. It has been engineered to run on 3 000 mobile handsets so far and is popular because it is a huge cost saver.

So where are we going next? The World Economic Forum ranks countries according to the Global Competitiveness Index. The first index of note for South Africa is 'financial market development' where the country is ranked 9th in the world. This is not adjusted for country size and reflects the financial and banking sector (e.g. Santam, Sanlam, First Rand). Then there is the other side where we are ranked 129th for primary education and healthcare. These figures show up the two economies – a first world financial sector and a third world health sector.

So, where to after this? I would like to look at the nature of a new social contract. The previous social contract is very individually oriented. The war machine has been replaced by big science; our telescopes are coming, but they don't feed the masses. It is a great achievement that we could win the award. But we need to have a more open system of innovation, one that does not just focus on the scientist and one that is not strongly supply side driven.

That brings me to the ministerial review of the science, technology and innovation landscape. The committee was asked to look at the landscape and make recommendations on structure and governance, roles and responsibilities of the Department of Science and Technology, Human Resources, Infrastructure and Funding. Essentially the key

recommendation is to try and shift away from supply side to demand led thinking and to do that, to have a representative body at the top where the demand can be specified. Secondly, for that to happen, one needs support structures that will enable policy learning, and policy learning includes understanding your system, having the data, having the surveys done, doing the analysis, carrying out the measurement and evaluation and taking it seriously. Without that it will remain very difficult to affect coordination.

The committee also introduced an idea borrowed from Brazil, which is to urge the establishment of what we call sectoral funds, using some of the mineral royalties for research and innovation, in other words investing in the future. Critically, we call for mandatory evaluation of projects that are bigger than R50 million and to do everything possible to promote an environment for research and development investment to flourish.

POLICY IMPLICATIONS OF THE PRESENTATIONS AND DISCUSSION

- There is a long history to the term 'scientific temper' but it was brought to prominence by Pandit Nehru in the 1940s. It can be argued that inculcating a Scientific Temper has been instrumental in the maturation and stability of India's democracy.

- Science communication has a long history in Canada and policy is developed through a consultative process with the many different science communities. Local needs are addressed by developing policy independently in each province and although the federal government develops policies as well it is only allowed to do this if these policies do not interfere with the local (provincial) agenda.

- Science communication is not without controversy; in Canada, every programme that strives to advance science is also critical of science – thus promoting critical thinking about science.

- In South Africa we want to give effect to popularisation of science but we need to empower people to engage the issues and provide tools to reflect critically.

- Government support of science communication in Canada has led to hundreds of programmes designed to bring people together to understand the life of a scientist, with a particular focus on young people.

- In China, science popularisation is seen as a necessary ingredient for economic development and social progress.

- While the state can develop policies, successful implementation depends on these being carried out at provincial, local and household level.

- The Policy on Popularisation of Science in China was followed by an 'Outline' which set specific milestones for improvement. Subsequent revisions of the Outline included an 'Action Guideline' which led to rapid uptake and expansion of the policy.

- In South Africa, from a numbers point of view, the Department of Education has more scope for popularisation of science through children than does the Department of Science and Technology.

- Scientific literacy is not sufficient in itself to promote the social and political emancipation that the concept of scientific temper is trying to project. What we need is a combination of 'reason and humanity', which is a concept that resonates with the 'diplomacy of Ubuntu' described in the White Paper on South African Foreign Policy (2011).

- South Africa has had some notable achievements in science – several Nobel laureates and, recently, awards such as the Square Kilometre Array. Various models for promoting science have been tried but we need a more open system of innovation; one that does not just focus on the scientist but is demand-led and not strongly supply side driven as at present.

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49	Ms	Barbara	Watson	Chief Director-Diversity Management	Dept: Public Service and Administration	0828032510	barbaraw@dpsa.gov.za
50	Mr	Oliver	Zambuko	Deputy Director	Dept: Social Development	078 140 8577	oliverz@dsd.gov.za
51	Ms	Nokuthula	Zuma		Dept: Performance Monitoring & Evaluation		nokuthulaz@po.gov.za

APPENDIX 2: WORKSHOP PROGRAMME

'PROMOTING AN ENLIGHTENED SCIENTIFIC TEMPER IN BRICS: A CONTRIBUTION TO A YOUTH POLICY DIALOGUE'

Rapporteur: Prof John R Seager, Freelance Consultant

Chair: Mr. Wiseman Magasela, DDG: Social Policy

08:00 - 08:30	Registration,Tea & Coffee

08:30 09:00	**Session 1: Context and Background**

08:30 - 08:45 **Introduction**
Dr Temba Masilela, DCEO Research, HSRC

08:45 - 09:00 Welcome
Mr. Wiseman Magasela, DDG: Social Policy

09:00 – 10:00	**Session 2**

09:00 - 09:25 **The development of science communication in Canada.**
Professor Bernard Schiele, Researcher at the Interuniversity Research Centre on Science and Technology at UQAM, Professor of Communication at the Faculty of Communication and Professor for the Joint Doctoral Program (PhD) in Communications at UQAM, the University of Montreal and Concordia University.

09:25 - 10:00 Discussion

10:00 - 10:20	TEA

10:20 – 11:20	Session 3

10:20 - 11:00 **Policy perspective on science popularization in China.**
Professor Shi Shunke, China Research Institute for Science Popularization (CRISP) and the China Association for Science and Technology, Beijing, China.

11:00 -11:10 – **Respondent***: Dr Thomas Auf der Heyde, Deputy Director-General: Human Capital and Knowledge Systems, Development and Innovation, Department of Science and Technology*

11:10 -11:20 Discussion

11:20 – 12:30	Session 4

11:20 - 11:50 **From historical reality to the abstract: 25 years of PUS research in India.**

Gauhar Raza, Head: Science Communication through multi-media (SCM), National Institute of Science Communication and Information Resources (NISCAIR), CSIR, New Delhi, India

11:50 -12:30 Discussion

12:30 – 13:30	Session 5

12:30 – 12:45 **A comparative perspective for a functional application of scientific temper in southern Africa.**
Dr Hester du Plessis, Head: Science Communication, Research use and Impact Assessment (RIA) unit, Human Sciences Research Council (HSRC) South Africa.

12:45 - 12:55 **Respondent**: *Mr Mahdi Basadien, BRICS Secretariat, DIRCO*

12:55 – 13:10 **The new social contract between science and society.**
Professor Michael Kahn, Professor Extraordinaire, Stellenbosch University

13:10 -13:30 Discussion: Inputs on the scientific temper for the BRICS Youth Policy Dialogue.

13:30 - 14:30	Lunch and departure

The presenters are all chapter authors/editors of the following book publications:

Bucchi, M. & Trench, B. 2008. *Handbook of public communication of science and technology*. London: Routledge.

Raza, G & Fujun, R. & Khan, H. & Wei, H. (eds) 2011. *Constructing culture of science: communication of science in India and China.* New Delhi: NISCAIR.

Schiele, B. & Claessens, M & Shunke, S. (eds). 2012. *Science communication in the world: practices, theories and trends*. London: Springer.

APPENDIX 3: ABSTRACTS

Professor Bernard Schiele, Researcher at the Interuniversity Research Centre on Science and Technology at UQAM, Professor of Communication at the Faculty of Communication and Professor for the Joint Doctoral Program (Ph. D.) in Communications at UQAM, the University of Montreal and Concordia University.

The Development of Science Communication Studies in Canada
(Bernard Schiele and Anik Landry)

This presentation is in three parts. The first discusses the level of achievement in structuring the science communications research field in Canada and elsewhere. The second examines the historical development of the research. We recall the role of the state, underscoring the influence of the OECD in formulating national policies. In the third part, we describe the major orientations of the research by distinguishing two phases: an initial one, in which the work devolved mostly from government concerns or was conducted directly at the behest of various ministries; and a maturation characterized by the development of university research. The presentation concludes with the observation that research still remains underdeveloped in Canada, although it has diversified and grown significantly in recent years.

Professor Shi Shunke, China Research Institute for Science Popularization (CRISP) and the China Association for Science and Technology, Beijing, China.

Policy Perspective on Science Popularization in China
(Shunke Shi and Huiliang Zhang)

Science popularization is important in China. It is the Chinese term for the concepts of public understanding of science or public communication of science and technology now prevailing around the world. Science popularization in China has developed in an idiosyncratic way, as part of an organized and mobilized effort. This presentation explores science popularization from a policy perspective. From about 1,000 policy documents on science popularization, the authors selected 100 of the most relevant. In this presentation, the 100 policies are classified into four groups according to their operational effects. Three of the most important ones, which have in the past 15 years played decisive roles gaining funding and stimulating the advancement of the enterprise, are highlighted. The driving forces behind science popularization in China are many, but underlying ideology and imported advocacies have been especially significant. Because science popularization, by whatever name, has begun to appear on the agendas of the governments of many countries, policies reflecting government decisions in this area are becoming ever more influential, and need to be fully understood.

Mr Gauhar Raza, Head: Science Communication through multi-media (SCM), National Institute of Science Communication and Information Resources (NISCAIR), CSIR, New Delhi, India.

Public Understanding of Science: Glimpses of the Past and Roads Ahead
(Gauhar Raza, Surjit Singh, and P. V.S. Kumar)

This presentation gives a historical account of turning points that mark the ever-changing relationship between modem science and the public at large. Scholars recognize the importance of that, but assert that there is a growing gap between the scientist's way of configuring nature and the people's world view. This led to an intense debate about the science-technology-society relationship. The presentation examines the development of science communication in India and similar countries, the science-technology-society relationship that followed a trajectory that was not rooted in the Enlightenment and the Industrial Revolution. Modem science was alien and had to be learned and mastered by natives. The realization that science and technology are essential to improve conditions for Indians marked the first phase of science popularization. In the second phase, propagating science among the general public and building scientific institutions were seen as essential parts of the national struggle for freedom. In the third phase, science and technology and their acceptance among the masses were considered necessary for building a modem and self-reliant nation.

Dr Hester du Plessis, Head: Science Communication, Research use and Impact Assessment (RIA) unit, Human Sciences Research Council (HSRC) South Africa.

A comparative perspective for a functional application of scientific temper in southern Africa.

In a country like South Africa, with its historical links with India and the emotional as well as political links through the ideas of great statesmen such as Mahatma Gandhi, one finds similarities as well as differences in its historical development that caused a difference in post-liberation governance practices. With both countries subjugated to British rule under a colonial system of governance, diverse post-colonial choices in governance and policy are reflected after their respective independent periods. These choices were often made as result of visionary leaders or under global political pressure. At the same time, these choices were infused with each country's respective cultural worldviews and histories. One similarity of post-colonial action between the two countries is the idealised protection of people's indigenous knowledge systems. A striking difference, however, is the striving for the protection of people's scientific temper in India and the culturally embedded perception of the apparent acknowledgement of people's inability of being 'rational' in Africa. This presentation will briefly explore this socio-political divide created through the subconscious 'acceptance' of people's apparent inability of being 'rational' in Africa against the endorsement of a nation's ability of 'being rational' through a constitutional obligation towards maintaining a scientific temper in India.

Professor Michael Kahn, Professor Extraordinaire, Stellenbosch University, Stellenbosch.

The new social contract between science and society

The Apartheid government in 1960 created the Foundation for Education, Science and Technology as a statutory body for public communication of S&T. This was the era of science for the warfare state, coupled with science for its own sake. FEST endured until 2003 when it was de-proclaimed and transferred to the NRF, becoming a division named SAASTA.

Two policy instruments of the democratic government noted the importance of public communication of S&T – the 1996 White Paper and 2002 R&D Strategy, but annual Science Week notwithstanding, there now seems to be a lower key approach to PCST.

An indicator of this is the absence of a flagship national science centre. This absence stands in contrast to government desire to promote 'big science' as in the Pebble bed Reactor, SA Large telescope, KAT/MeerKAT and of course the SKA.

These disjunctures did not receive attention in the recent Ministerial Review of the STI Landscape, and it may therefore be an appropriate time to explore the issue of PCST within the larger context of the social contract between science and society. This social contract has yet to grapple with the transition from the warfare state to the welfare state.

APPENDIX 4: BIOGRAPHIES

Dr Thomas Auf der Heyde
Currently Deputy Director-General (Human Capital & Knowledge Systems at the South African National Department of Science & Technology (DST). Prior to joining the DST Dr Auf der Heyde held the post of Professor and Executive Director for Research and Innovation at the University of Johannesburg. In 2009 he was appointed as an Extraordinary Professor in the Centre for Research on Science and Technology at the University of Stellenbosch.

Mr Mahdi Basadien
Mr Basadien served and travelled the Middle East, Asia and New York from 1995-2010 (Abu Dhabi, Bahrain, Saudi Arabia, Oman, Qatar, Palestine, Kuwait, Jordan, Cairo, Azerbaijan, Israel, Iran, India and China). He is currently forms part of the BRICS Secretariat at the Department of International Relations and has attended the Third (China) and Fourth (India) BRICS Summit.

Dr Hester du Plessis
Dr Hester du Plessis (DLitt et Phil in Philosophy), is a senior research specialist and head of Science Communication in the Research Use and Impact Assessment (RIA) unit at the HSRC.

She has a background in Art and Design and was a lecturer at the Arts Faculty at Tshwane University of Technology, a senior researcher at the Faculty of Art, Design and Architecture and associate senior researcher at the Sustainable energy Technology and Research (SeTAR) Centre, Faculty of Science at the University of Johannesburg. She was a Research Chair in Design Education and Innovation at the National Institute of Design (NID) in Ahmedabed, Gujarat, India during 2008/9.

Her research in Public Understanding of Science (PUS) is done in collaboration with the Science Communication through Multi-media (SCM) unit at the National Institute for Science Communication and Information resources (NISCAIR), CSIR, New Delhi, India. She works on a number of science communication research projects such as the Philosophers of Science in Africa and India project that forms a part of the HSRC Africa Knowledge Producers Series and an international science communication project: Epistemological review of a science communication model with the focus on the development of pro-poor policy. She is a Fellow at the Mapungubwe Institute for Strategic Reflection (MISTRA), and a team member of the project: The concept and application of transdisciplinarity in intellectual discourse and research.

Professor Michael Kahn
Professor Michael Kahn is a policy analyst working in the fields of research and innovation policy, and develops instruments for strategy, planning, measurement, monitoring and evaluation in these fields. His career spans being a Ministerial special advisor, head of Corporate Informatics in the Gauteng Provincial Government, education professor in Botswana and South Africa, analyst in the Centre for Education Policy Development, and an Executive Director of the Human Sciences Research Council. He is Professor Extraordinaire in the Centre for Research on Evaluation, Science and Technology of the University of Stellenbosch.

His work for Government includes contributing to the ANC Policy for Education and Training, developing the SYSTEM second chance initiative, the Dinaledi Schools project, the ICT in

Education strategy, co-writing the Green and White Papers on Science and Technology and writing the White Paper on Arts and Culture. He co-developed the National Research and Technology Foresight study, and designed the Performance Measurement System for the Science Councils. He consults to many governments and the multilateral organizatons. Prof Kahn publishes widely, serves as a board member of the Agriculture Research Council, and is a member of the Ministerial Committee appointed to Review South Africa's innovation policy.'

Mr Wiseman Magasela
Wiseman Magasela is Deputy Director General: Social Policy at the National Department of Social Development. He heads the Social Policy Programme which has the responsibility to promote and institutionalise evidence-informed policy making in the social development sector. The Programme fosters the key role of research in providing evidence in policy making and policy choices, and the promotion of social policy as a way of thinking in an integrated manner in addressing human and social development challenges. The Social Policy Programme works with Directorates in the Department in the development and review of policies on children, youth, the elderly, people living with disabilities, community development, and other policy areas which are the mandate of the Department of Social Development.

Prior to joining the Department of Social Development, Wiseman Magasela held the position of Research Manager at the Centre for the Analysis of South African Social Policy, University of Oxford, England. He worked as a Chief Researcher at the National Research Foundation in the Research Capacity Development Directorate which promoted and supported research at South African universities. Wiseman Magasela lectured Sociology at the University of Natal and the University of Fort Hare.

Wiseman Magasela has researched and written in the areas of poverty and human and social development. He holds a Bachelor of Social Science and a Bachelor of Science (Honours) in Sociology from the University of Natal (Durban), a Master of Arts in Sociology from the University of Witwatersrand and a Master of Science in Comparative Social Policy from the University of Oxford, England. Wiseman Magasela is an Associate Research Fellow in the Department of Social Policy, University of Oxford and is currently reading for a Doctor of Philosophy Degree at the University of Oxford.

Dr Temba, Masilela
Temba Sipho B. Masilela, is currently the Deputy CEO of Research at the Human Science Research Council (HSRC), South Africa. His wide-ranging research interests include social policy, public management reform, social innovation, research communication, the research-policy nexus, and stakeholder engagement. He was the founding director of the Policy Analysis Unit at the HSRC and was previously the executive director of the Policy Analysis & Capacity Enhancement cross-cutting programme at the HSRC. Before joining the HSRC in July 2006, he worked for a number of years as a special adviser to the minister of social development in the government of South Africa. He has also worked in the areas of corporate citizenship and reputation management, in both commercial (Telkom SA Ltd) and academic settings (Centre for Corporate Citizenship, University of South Africa). Dr Masilela holds a PhD and MA degree in development support communication from the University of Iowa, and a BA degree in economics and politics from the University of Nairobi. He started his working life as a journalist in Kenya and taught research methods, media policy, health communication, and editing for a number of years at the School of Journalism at Rhodes University.

Prof Shi Shunke
Prof Shi Shunke, born in 1954, is Head of Division of Theoretical Studies on Science Popularization of the China Research Institute for Science Popularization, with which he has been working since 1988. His main research interest concerns the history of science popularization and the theoretical study of S & T communication development around the world.

He has published articles on science popularization, edited *The English-Chinese Lexical Dictionary*, collated *A Chinese-English Dictionary of Classic and Current Expressions*, published *Brief Introduction to Science Popularization in USA,* and collaborated in publishing the books *At the Human Scale* as co-author, *Communicating Science in Social Contexts* and *Science Communication in the World* as co-editor.

He helped organize the Beijing PCST Working Symposium in 2005 and the International Forum on PCST Studies in Beijing in 2010 and 2011.

APPENDIX 5: PRESENTATIONS

Policy Perspective on Science Popularization in China

Shi Shunke
China Research Institute for Science Popularization

September 12, 2012

2012.9 China Research Institute for Science Popularization

1. Science popularization, a catch phrase in China

SP in China has a name as *kepu*. *Kepu* is an acronym similar to English SP, with *KE* standing for *kexue* (science) and *PU* for *puji* (popularization). Its connotation could also include technology. In its full address, we say *kexue puji* or *kexue jishu puji* (*jishu* means technology). Tricky as it is, the term also literally refers to popular science. Thus the Chinese phrase *kepu* could be understood as either referring to a social phenomenon that reveals the interaction or communication between science and the public in a broad sense, or simply a science book, a lecture or a show in a narrow sense.

Presently, different expressions are in fashion:
Science popularization; Science communication;
Science education

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Storyline

1. **Science popularization, a catch phrase in China**
2. **Policies in concern**
3. **A number of important policies**
4. **Ideas and notions supporting the policies**
5. **Policies make things go**

2012.9 China Research Institute for Science Popularization

2. Policies in concern

What we count as SP policy

laws, regulations, guidelines,
plans, outlines, programmes,
reports, decisions, instructions, notifications, and
state leaders' speeches.

Thousands of documents issued after 1949 has more or less relation with SP.

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Background

The discussion is based on a research program of policies of science popularization (SP) in China. The results of the research has been published in the book of *Science Communication in the World*.

As science popularization is a national engagement under government support since 1949, there could be seen a great amount of policies in this regard issued in the past 60 years. The research team (of CRISP) collected more than 1,000 policy documents on science popularization and selected 100 of the most relevant.

Policies do not appear only in paper forms, they also make things change. Through reading these documents, one could have a much clearer understanding of the situation of science popularization in China.

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Producers involved:

Ministry of Science and Technology,
Ministry of Agriculture,
Ministry of Education,
Ministry of Culture,
Ministry of Health,
Ministry of Finance; etc.

Government agencies in charge of environmental protection, seismology, meteorology, radio and TV broadcasting, the press and publications; the Chinese Academy of Sciences; and

National organizations such as the Trade Union, the Women's Federation, the Youth League and CAST...

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1. Science popularization, a catch phrase in China

Communication terms:	Different notions
Diffusion	popular science, science popularization, popularization of science, popularized science
Dissemination	Science communication, (s & t communication)
Improvement	Science culture, culture scientifique
Advancement	Public understanding of science (& technology)
Popularization	Science and (in) society
Vulgarization	Public awareness of science
Translation	Public engagement of science
Interpretation	Science temper
	Scientific literacy

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Basic classification

Producers of the documents
Central government (state)
Departmental (independent or joint)
Local governments
Organizations (CAST, societies and associations)

Coverage of the documents
National
Regional
Professional

Category of the documents
Basic
General
Special

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2. Policies in concern

Basic policies

Such as the *Common Programe*, 1949

The *Law of the People's Republic of China on Popularization of Science and Technology*, 2002;

General policies

the *Outline of the National Scheme for Scientific Literacy (2006–2010–2020)*

Special polices

Plan for the Development of SP Infrastructure (2008–2010–2015);

Standards for the Construction of Science and Technology Museums

Most of the documents contain SP as part of the whole, such as five-year plans, reports to national congresses, etc.

3. A number of important policies

The most important and influential three:

The *Instructions on Strengthening Engagement in Science and Technology Popularization (1994)*

The *Law of the People's Republic of China on Popularization of Science and Technology* (2002)

The *Outline of the National Scheme for Scientific Literacy (2006–2010–2020) (2006)*

2. Policies in concern

100 most valuable policy documents are picked out from 1000 original ones. They are classified in 4 groups.

	National laws	Leaders speeches	State policies	Departmental policies
number	10	5	26	59

3. A number of important policies

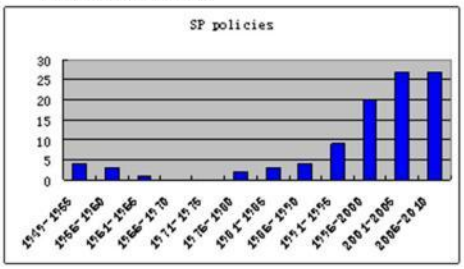
Instructions on Strengthening Engagement in Science and Technology Popularization

According to the *Instructions*, SP had run into difficulty in two aspects around 1990:

- SP work had been losing priority among some local governments, resulting in a loss of SP strength and momentum since 1978.
- A superstitious craze had gathered strength since the 1980s, involving fortune-telling, 'extrasensory perception', 'magic' medical therapies and other false claims in the name of science.

2. Policies in concern

The distribution of the 100 documents in the span of 60 years



3. A number of important policies

Key points of the *Instructions* as follows:

- Governments at each level were to place SP on their working agendas and play a part in its delivery. SP engagement was to be included in the state's forthcoming ninth five-year plan and in local social, economic, and science and technology programmes.
- Governments were to secure public input into SP and make sure that more money would be invested in it. The construction of basic SP infrastructure, such as science museums, science centres and public spaces for SP activities was to be supported.
- The mass media would be used to popularize science, and science-based institutions and scientists would be encouraged to contribute to the effort.
- Activities were to be targeted at youth, farmers and cadres in public posts.
- Sensationalist media reporting on superstitions and pseudoscience was to be opposed.

2. Policies in concern

Characteristics of the policies discussed in China

High frequency and large numbers

Continuity of systematic consistency (the main tune)

Government-guided, paying attention to all aspects and sectors of the business (as an integrated enterprise)

Laying stress on practices and promotion of social and economic development

Advocate both civil and mental civilizations (science temper)

3. A number of important policies

To help create a sound environment, the *Instructions* also put forward the following suggestions:

- Draw up special state laws or by-laws to govern SP practice.
- Set up a joint meeting system to integrate resources from different government sectors to run SP in a well-designed way.
- Formulate regulations or policies to encourage social or private organizations to do.

3. A number of important policies

The *Instructions* gave rise to a series of nationwide activities in the following years, including the following programmes and guidelines:

- Teacher's Action in Science and Technology Education (1995)
- Knowledge Project (1997)
- Bringing Science, Culture and Health to the Farmers (1997)
- *Guidelines for the Popularization of Science and Technology among Chinese Teenagers (2001–2005)*
- *Notification on Strengthening SP Propaganda Work* (1996), jointly issued by the Propaganda Department of the Central Committee of the CPC, the Ministry of Science and Technology, and CAST to guard against the reporting of superstitious beliefs and supernatural claims.

3. A number of important policies

The Outline of the National Scheme for Scientific Literacy (2006–2010–2020)

The *Outline* was promulgated by the State Council on 6 February 2006. It is the most ambitious SP scheme ever to be enacted in China, and greatly advances Chinese SP.

As the title shows, scientific literacy is the key concept. One of the arguments for the drafting of the policy was that Chinese citizens had been shown to have very low levels of scientific literacy. The intervals 2006–2010–2020 mark the stages where milestones are set for improvement.

3. A number of important policies

Law of the People's Republic of China on Popularization of Science and Technology

The advent of the *SP Law* was an immediate outcome of the *Instructions*. It is structured in six chapters with a total of 34 articles. The chapters cover general provisions; organization and administration; responsibility of the society; safeguards; legal responsibility; and supplementary provisions.

Now there 27 provinces promulgated corresponding regulations following the style of the SP law, some even had their regulations before the law enacted.

3. A number of important policies

Issued by the State Council on Feb. 6, 2006

In 2012, the Outline was renewed, An action guideline was produced.

3. A number of important policies

Law of the People's Republic of China on Popularization of Science and Technology

Passed at the 28th Meeting of the Ninth National People's Congress of PRC on June 29, 2002

3. A number of important policies

The major objective tasks of the *Outline* consist of four actions and four projects.

The four actions are:
- Minors' Scientific Literacy Action
- Farmers' Scientific Literacy Action
- Urban Workforce Scientific Literacy Action
- Leading Cadres' and Public Servants' Scientific Literacy Action.

The four projects are:
- Science Education and Training Project
- SP Resources Development and Sharing Project
- SP Capacity Building Promotion Project for Mass Media
- SP Infrastructure Project (State Council 2006).

3. A number of important policies

The SP Law guaranteed the legitimacy of the SP activities in the country and set as the ground for various official documents.

Anyhow, the Law was produced in a period when actors in the field had limited knowledge in confining the practices concerned. To make the Law more practical, there are voices arguing for detailed guidelines to enforce the effect of the mother law.

3. A number of important policies

Immediately after the *Outline* was put into effect, a state leading group of 23 government departments and national organizations was formed. Tasks were divided among the 23 actors, and guidelines for each action and project were developed in detail.

Local governments soon took up the *Outline* as a state guideline and developed a similar working pattern and a corresponding package of programmes in each province.

3. A number of important policies

Funding for SP soared. According to statistics from the Ministry of Science and Technology, the total investment in SP was about 2.4 billion *yuan* in 2004, 4.6 billion in 2006, 6.5 billion in 2008, 8.7 billion in 2009, and 9.9 billion in 2010.

Year	S&T museums		Science books (titles)	TV programmes (hours)	Science websites	Lectures	Exhibitions
	Number	Visitors (m)					
2004	185	-	2,523	74,959	995	381,345	70,583
2006	239	17	3,162	113,758	1,465	723,337	103,090
2008	380	23	3,888	219,168	1,899	955,142	115,339
2009	309	26	6,787	234,094	1,978	849,483	130,198
2010	505	54	7,043	263,926	2,126	813,421	127,345

3. A number of important policies

Recently, New polices are produced focusing on the building up of an army of qualified SP practitioners.

Some other practical issues are investigated in policy supported programs, such as the market operation of SP products, scientists meeting with media, emergency respond ability in dealing with science-related disasters, unexpected incidents, and so on.

SP is gaining more and more of notice from the government and the state leaders. The state President Hu Jintao made remarks recently: S&T innovation together with SP, both are of equal importance to the development of the country.

The goal of raising the nation's civic scientific literacy to 5% is put squarely on the agenda of the government.

3. A number of important policies

In 2012, the *Outline* was revised in line with the national development strategy of the 12th five-year plan.

One additional action was added in: community residents Scientific Literacy Action.

Together comes one more project: SP human resource construction project.

Civic scientific literacy is set to level up to 5% by the end of 2015.

4. Ideas and notions supporting the policies

- SP engagement is consistently targeted at serving the economic development of the country. Many activities are organized with that aim in mind. For instance, each year a great number of workers and farmers are trained through SP channels to help raise their skills.
- Management and governance of the business are repeatedly emphasized in the *SP Law*, the state plans, and suggestions in the documents urging local governments to include SP in their working agendas. It is also noticeable that very large investments have been made in human resources, infrastructure (museums, centres, bases, galleries, caravans etc.) and information resources.

3. A number of important policies

Today, the *Outline* is a dominant policy for running SP across the country. As the document states, the principal strategy in carrying out the *Outline* is 'Government boost, mass participation, raising scientific literacy, and promoting harmony'.

Government support is going to be stronger
More resources will be explored
More social sectors will be involved
Capacity will be widely improved as a whole
More actions will be taken

(SP Benefiting Farmers, SP benefiting urban community residents)

4. Ideas and notions supporting the policies

SP, as a useful tool in communicating science and technology, is considered beneficial in assisting people to learn things in a scientific way. In many of the SP policies, it is made clear that SP is important because it concerns people's views of the world. For pragmatic purposes, it is used to fight against superstition and pseudoscience, which is a persistent challenge for scientists and SP practitioners in China.

3. A number of important policies

Some other policies on state level also have significant influence in the field:

The *Long and Mid Term National Program for the Development of Science and Technology* (1992),
The *Law of the People's Republic of China on Science and Technology Progress (1993),*
Notification on reinforcement of Science Popularization Propaganda (1996),
The Outline of the Popularization of Science and Technology (1999)
Opinions on the Construction of the Nation's Capacity in Science and Technology Popularization (2007),
The Plan for the Development of SP Infrastructure(2008),
Special Program for National Popularization of Science and Technology in the 12th Five-year Plan (2012).
Action Guidelines of the Outline of the National Scheme for Scientific Literacy (2012)

4. Ideas and notions supporting the policies

Some sayings recur in the policy documents and become government catch-phrases, reflecting an attitude of science advocacy in SP. The most frequently used terms are 'to learn science', 'to love science', 'to communicate science', 'to use science', 'to trust in science', 'to respect science', 'to rely on science' and 'to admire science'. These sloganistic jingles encourage people to stay far away from superstition and behave scientifically.

In China SP stresses on giving positive support to science and technology.

4. Ideas and notions supporting the policies

The most heavily advocated practice in approaching science nowadays concerns personal achievements in four aspects: **scientific knowledge, methods, thoughts and ethos (spirit)**, as stated in the *Outline*. Together with two abilities (**to resolve practical problems and to participate in public affairs**), the four aspects are used as a yardstick to assess whether a Chinese citizen is scientifically literate or not. From the late 1990s onwards, these themes have been repeated again and again in SP policy documents, and are now the highest goals in the pursuit of SP in China.

The four aspects translated in the *Outline* as knowing some necessary knowledge of science and technology, mastering basic methods of science, building up science thoughts, and advocating science ethos (State Council 2006).

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4. Ideas and notions supporting the policies

About in the 1990s, Chinese researchers in the field and students in the universities turned towards the Western public science communication arena and began to import many fresh concepts, such as 'science communication', 'public understanding of science', 'science and society', 'scientific literacy', 'the deficit model', 'science consensus', 'dialogue', 'bottom-up approach', 'hands-on activity', 'inquiry learning' and the like.

Chinese policies issued in recent years place more emphasis on the perception of science–society relations, public scientific literacy, and the engagement of the public. The policies now positively encourage interactive dialogue, inquiry learning and hands-on practice. They reflect a strong effort in an organized pattern. The main underlying theme is to encourage people to love science and to use science, and the major effort is to bring science to the people on the streets following a top-down pattern.

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5. Policies make things go

Chinese government has been taking SP as its accountability ever since 1949. Though China underwent a tremendous change during the last 60 years, SP has always been developing under the concern of the government: it is public supported, with a nation-wide network of huge rank of practitioners, armed with a strong notion that is favorable to science, and following the long-lasted pattern of popularizing, top-down but not one-way.

Now SP is expanding its borders, more people, more trades and more social sectors joining in. Comparing with efforts input 10 years before, there are more museums, books, TV programs, activities, all kinds of resources, and the input in the field is still growing fast.

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5. Policies make things go

Problems:

Scientists are not effectively involved,
Less studies to support the practices,
Depending too much on the government,
Practitioners shortage as well as poor capability,
Less flexible in dealing with emergency situation
...
...
The more it is developed, the more challenges it is going to face. The conflict between the two keeps updating the situation. SP policy helps solve problems and make things change.

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PROMOTING AN ENLIGHTENED SCIENTIFIC TEMPER IN THE BRICS
- TOWARD A NEW SOCIAL CONTRACT-

DST-HSRC-SPCD Policy Cluster Conference
CSIR, 12 September 2012

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Locate the discussion in political economy

Pre-1994 social contract between science and society

- **Exclusion of the majority**; Technology for the apartheid war machine; State Security Council link with industry
- Linear model: 'Research cannot be dictated and organized from above; it must grow from within the organization'
- Freedom to do basic research – an 'own affair'
  - Journal subsidy
  - FRD rating scheme
- Foundation for Education, Science and Technology (1960?)
- Large range of NGO activity including science centres
- Science for the few: high barriers of entry; four Nobelists
- An extractive system of innovation

Forming the democratic state 1990-1999

- IDRC Review 1993; S&T Initiative
- **Inclusive polity**; ANC Policy on Education and Training
  - Students and Youth into Science Technology, Engineering and Mathematics 1994-1999
- Outcomes–based education: Curriculum 2005 including Technology in core curriculum to Grade 9
- White Paper on S&T 1996
  - "Government will institute the delivery of S&T public awareness programmes in collaboration with consortia of institutions"
- Research and Technology Foresight 1995-1999
- NSTF 1994; Academy of Science 1996
- Public attitudes to S&T Survey 1996/7

Consolidation

- DST established; R&D Strategy (2002)
  - Foundation for Technological Innovation (today's TIA)
  - … there is a need to massify a number of public understanding and engagement activities using the ***Institute for the Promotion of Science*** and similar structures … (including) out-of-school maths and science programmes to increase the number of matriculants achieving university entrance in Mathematics and Science … enhanced use of the media to promote mathematics, science and computing subject choices among learners.
  - SAASTA 2003
- Dinaledi focus schools 2001 -
- SA Research Chairs Initiative; Centres of Competence;
- OECD Review 2007
- Ten Year Innovation Plan 2008

Outputs and achievement: different and varied

- Steady % of world publications; impact at world level
- 3rd non-ERA participation in FP7; #1 if normed
- Open economy; rise in USPTO; #4 in catalysis patenting
- World leader in registration of plant varieties # 12
- Elevation of indigenous knowledge; benefit sharing
- Engineering (44%), Nat Science (67%) graduate increase
- Higher Education open; hub for sub-Saharan Africa
- Leadership role in S&T within NEPAD and African Union
- Prizes: 2 Nobel (literature), Templeton, Planck, L'Oreal
- Ability to develop and manage large science projects
- Network of science centres. No national flagship.

Science events/activities capturing public attention

- Shoemaker-Levy comet impact on Jupiter (1994)
- Year of Science 1997?
- Africa's space tourist (2002)
- Arguments about the aetiology of HIV/AIDS
- Science Week institutionalized
- Cradle of Humankind/ hominid discoveries
- Prof Chibale's malaria work at UCT
- Pebble Bed Modular Reactor
- Square Kilometre Array

So where to?

Global Competitiveness Index

	Rank (out of 139)	Score (1–7)
GCI 2010–2011	54	4.3
GCI 2009–2010 (out of 133)	45	4.3
GCI 2008–2009 (out of 134)	45	4.4
Basic requirements	79	4.4
1st pillar: Institutions	47	4.4
2nd pillar: Infrastructure	63	4.0
3rd pillar: Macroeconomic environment	43	5.0
4th pillar: Health and primary education	129	4.1
Efficiency enhancers	42	4.4
5th pillar: Higher education and training	75	4.0
6th pillar: Goods market efficiency	40	4.5
7th pillar: Labor market efficiency	97	4.1
8th pillar: Financial market development	9	5.3
9th pillar: Technological readiness	76	3.5
10th pillar: Market size	25	4.8
Innovation and sophistication factors	43	3.9
11th pillar: Business sophistication	38	4.4
12th pillar: Innovation	44	3.5

Toward a well-functioning innovation system

- A National Council on Science and Innovation (NCRI) for **DEMAND SIDE** prioritization and agenda setting, focused resource allocation, and that the institutional landscape is fit for purpose. Membership: government, captains of industry, HE, civil society. Cover technological, social, and public sector innovation; promote accountability, transparency and responsiveness.
- Office of Research and Innovation Policy to replace NACI and and support NCRI with tools for **POLICY LEARNING**
- **COORDINATION** through cross-government budget through the Research and Innovation Vote
- **FINANCING** through Sectoral Funds based on resource rents
- Building and rewarding **RESEARCH GROUPS**

A "new" social contract between science and society?

- Le plus ca change, la meme chose: fragmented; uncoordinated;
- Big science replaces war machine; science push
- Freedom to do basic research – 'own affair' continues
- More open system of innovation still focused on the individual scientist;
  - Journal subsidy
  - NRF rating scheme
  - Research chairs
  - Supply side policy

- **NEXUS COORDINATION** economic; higher education; social
- **HUMAN CAPACITY DEVELOPMENT.** HE reform; immigration law.
- Review of mandates and scope of TIA, Science Councils and all PROs. Stronger oversight of reviews of public organs in NSI
- **MANDATORY EVALUATION** of large publicly funded STI projects
- Re-think and improve **STI DATA COLLECTION,** especially TBOP
- **PROMOTION OF R&D INVESTMENT CLIMATE**
- Re-establish **FORESIGHT**

Build a new inclusive and accountable social contract between science and society

Remit of the Ministerial Review on the STI landscape

- … comprehensive assessment of STI system … to determine whether the country is making optimal use of its existing strengths and whether it is well positioned to respond rapidly to a changing global context and thus to meet the needs of the country in the coming ten to thirty years … measures required to ensure that the country has a sustainable and robust STI system in both the public and private sectors.
- Recommend as to:
  - Structure and governance of the System, including the roles and responsibilities of the different actors in the Science, Technology and Innovation system;
  - Roles and responsibilities of the DST, including its relationship with other government departments;
  - Human resource and infrastructural capacities;
  - Recapitalization and funding requirements.