Human and Social Dynamics: 'The role of the social sciences in science engagement'

Contents

Acronyms

ARC	Agricultural Research Council
ASSAf	Academy of Science of South Africa
BBC	British Broadcasting Corporation
CeSTII	Centre for Science, Technology and Innovation Indicators (HSRC)
CONICYT	National Council of Science and Technology (Argentina)
CREST	Centre for Research on Evaluation, Science and Technology (University of Stellenbosch)
CSIR	Council for Scientific and Industrial Research (South Africa and India)
DAC	Department of Arts and Culture
DACST	Department of Arts, Culture, Science, Technology
DG	Director-General
DST	Department of Science and Technology
DStv	Digital Satellite Television
DVC	Deputy Vice-Chancellor
ESD	Education and Skills Development Research Programme (Human Sciences Research Council)
GDP	Gross Domestic Product
GM	Genetically Modified
HIV/AIDS	Human Immunodeficiency Virus/ Acquired Immunodeficiency Syndrome
HUMA	Institute for Humanities in Africa (University of Cape Town)
HSRC	Human Sciences Research Council
ICT	Information and Communications Technology
IKS	Indigenous Knowledge System
LSM	Living Standards Measure
M&E	Monitoring and Evaluation
MRC	Medical Research Council
NACI	National Advisory Council on Innovation
NDP	National Development Plan
NGO	Non-Government Organisation
NRF	National Research Foundation
OECD	Organisation for Economic Cooperation and Development
REDES	Centro de Estudios Sobre Ciencia, Desarrollo y Educacion Superior (Argentina)
R&D	Research and Development
RIA	Research Use and Impact Assessment (Human Sciences Research Council)
S&T	Science and Technology
SAASTA	South African Agency for Science and Technology Advancement
SABC	South African Broadcasting Corporation
SABS	South African Bureau of Standards
SANSA	South African National Space Agency
SASAS	South African Social Attitudes Survey
SC	Scientific Culture
SE	Science Engagement
SET	Science, Engineering and Technology
SKA	Square Kilometre Array
TAC	Treatment Action Campaign
TIMSS	Trends in International Mathematics and Science Study
UCT	University of Cape Town
WISER	Wits Institute for Social and Economic Research

Executive Summary

The Department of Science and Technology (DST) and the Human Sciences Research Council (HSRC) hosted a policy workshop entitled Human and Social Dynamics: 'The role of the social sciences in science engagement'. The event took place at the Conference Centre of the Council for Scientific and Industrial research (CSIR), Pretoria on the 10th March 2015 and was attended by 49 delegates from a range of research institutions, universities and government departments.

The emergent DST Science Engagement Strategy

Dr Thomas Auf der Heyde, Deputy Director-General: Research Development and Support, DST

The Department of Science and Technology (DST) has recently produced a 'Science Engagement Strategy' which outlines the challenges, objectives, enablers, and sources of funding for the strategy. The Strategy recognises the need to promote technological advances, a society that values and understands science, and to enhance the attractiveness, accessibility and relevance of science as an essential driver of modernity, empowerment and enlightenment. However, the methodologies required to achieve such objectives are in need of further development. SAASTA plays an informal coordinating role in activities such as encouraging science centres, government departments, international collaboration, and the establishment of science communication chairs. The primary challenges in enhancing the status of science in the public domain are poor levels of scientific literacy and a decreasing interest in physical and natural science at school level. The general public is insufficiently empowered to engage with science and technology, as evidenced by the low level of debate on the unscientific approach to HIV/AIDS that was advocated by the pre-2009 regime. More recently, the DST has achieved some success in highlighting innovations in South African science in the fields of HIV/AIDS, astronomy, and the palaeosciences. However, lack of a formal mandate for science engagement, inadequate resources, poor coordination, lack of effective M&E and meaningful indicators of outcome and impact are ongoing challenges. The emergent strategic objectives of the DST are to popularise science, engineering and technology; to develop a critical public and vibrant science temper that actively engages with the national discourse on science and technology; to promote the communication of science; and to enhance the profile of South African science achievements domestically and internationally. Practical methods of achieving these objectives are the promotion of science and mathematics competitions at school level; provision of science career information by means of role-models and literature; bridging the gap between academia and the public by discarding the deficit model of the past; promoting dialogue on science issues between the public and private sectors; and using the media in all its modern configurations to promote dialogue between science and society. The NRF Act needs to be amended to include science communication explicitly and all DST entities should be required to ring-fence between 3% and 5% of their budgets for science engagement.

Comparative approaches to promoting scientific culture in Ibero-American countries

Dr Carina Cortassa, Researcher, REDES, National Council of Science and Technology (Argentina)

A relatively high proportion of the 22 Ibero-American countries mention the promotion of scientific culture in their policy documents. Concrete practices in this respect are most prevalent in Portugal, Chile, Argentina and Brazil, and least so in El Salvador, Ecuador, Paraguay and Cuba. A matrix of criteria can be utilised to assess a country's effort in promoting scientific culture. These entail the modalities used (awards, competitive funding, events, school activities, national science weeks); government involvement (collaborative, direct, indirect); intentionality (popularisation, pedagogical-educative, promotion of human resources focussed on science communication and culture, research, public hearings and participation); and appropriate targeting of audiences (general, children/ adolescents, college students, science institutions and communities, journalists and content producers, minorities, other diverse groups). Chile has the most comprehensive approach, most active. Only Colombia has a solid document that distinguishes between the polysemy entailed in this sector (communication, appropriation, popularisation). The future agenda for science communication should include a clarification of the goals of the exercise, and the means by which this should be continually achieved. Greater transparency is essential in respect of debates around fracking for oil and the use of genetically-modified agricultural seeds. Recently democratised countries such as South Africa have the space as well as the responsibility to promote these engagements.

The attitudes of South Africans towards science

Dr Vijay Reddy and Andrea Juan, Human Sciences Research Council, Durban

Findings of the South African Social Attitudes Survey (SASAS) indicates a high level of cautiousness and

conservatism amongst South African adults in relation to science. On the one hand, almost 80% perceive science and technology as making their lives healthier, easier and more comfortable; and more than 70% are of the view that S&T will create more opportunities for the next generation. Conversely, 73% think that science makes their way of life "change too fast"; 56% think that there is too much dependence on science and "not enough on faith"; only 49% take the view that the benefits of science are greater than any harmful effects; and 36% feel that it is not important for them to know about science in their daily lives. The most popular media for obtaining science information are TV and radio, with one-quarter or less consulting newspapers, other people, the Internet, books and magazine, or public spaces for this purpose. Public interest is highest in medical science developments but much lower in respect of climate change, the Internet, social sciences, economics, humanities, astronomy or nuclear technology. Science communication should thus factor in the demographic heterogeneity in South Africa, and should stratify and nuance content and messages appropriately. Amongst Grade 9 learners who participated in the TIMSS in 2011, more than 60% strongly agreed that learning science would help them in their daily lives; that it is important to do well in science; that they need to do well in science to get the job they want or to get into the university of their choice; and that they learn many interesting things in science. Conversely, just more than half strongly agree that science is boring; 42% wish they did not have to study science; 34% say science is harder for them than any other subject; only 32% indicate that their teacher tells them they are good at science; and more than a quarter say that science is more difficult for them than it is for many of their classmates. Scores on composite indices were low for levels of confidence in science and/ or mathematics; and somewhat higher for their enjoyment thereof; but relatively high for appreciation of the value of these subjects. The literature highlights the greater success that can be achieved in influencing these non-cognitive traits than the purely cognitive, academic skills required to achieve good results in mathematics and science. Social policy that focusses on attitudes may therefore be more effective in addressing the low learner achievement levels that manifest in only 5% of learners who commence their studies in Grade 1, scoring a Grade 12 pass in excess of 40% in physics. The need for early intervention is highlighted by the strong predictive power of confidence and performance in mathematics at Grade 3 level.

Operational Prospects for Implementation

Dr Beverly Damonse, National Research Foundation, Pretoria

To optimise the efficiency and effectiveness of science communication, the messages disseminated should be enhanced, diversified and balanced, not favouring any particular discipline or sector. Scientists should mobilise a collective effort to improve their communications outputs. SAASTA cannot programmatically address all individual or institutional communications, even within government entities owing to budgetary and capacity limitations. What is done should be subject to systematic M&E in order to inform future interventions. SAASTA's primary activities are funding of research contracts, promotion of mathematics and science education, development of websites, exhibitions and infrastructure. Strategies for science communication need to segment the market appropriately for the consumption of journalists, academics, and other communities. Ultimately it is necessary for the emergence of a social contract between science and society. Science needs to enhance its way of telling stories. For example, everything on one's breakfast plate is a consequence of 100 years of agricultural R&D. Financial return on investment in science is not necessarily the best indicator of impact. Methods of mobilising and incentivising university-based scientists should receive ongoing attention.

Science and the South African Media

Dr Michael Gastrow, Human Sciences Research Council, Cape Town

The media have a tendency to portray engineers as 'wealthier' than scientists, thereby discrediting science as a worthwhile career. The main sources of information about science are TV, radio, newspapers. The Internet is increasingly utilised, especially by younger adults. People with tertiary education and/or in the high LSM category comprise the largest proportion of those who retrieve science information on the Internet as well as by means of books, magazines, newspapers and in public spaces such as museums. Those with lesser levels of education are more likely to glean science information from TV, radio, newspapers and other people in their communities. Information pertaining to South Africa's large scientific endeavour in the form of the Square Kilometre Array (SKA) has primarily been obtained from a range of Internet websites and Twitter postings or re-tweets. These include News24, MyNews24, TimesLIVE, BusinessDayDigi, SKA_Africa (mainly via re-tweets going viral), Fikiswa, and Derek_Hanekom. The messages have tended to portray SKA positively as an African project and as an affirmation of South African and African S&T capacity and capabilities. Science is increasingly penetrating popular culture through movies, TV, radio and novels, often of the dystopian genre, as exemplified

by the recent South African produced movies, District Nine and Chappie. Elon Musk, the high profile South African-born scientific and technological entrepreneur involved with electric cars and solar energy is an emergent media role model for the younger generation. Other methodologies include intellectual biographies (recent movie about Stephen Hawking), blogging, Instagram, trolls, TV soap operas, Internet radio, and mockumentaries such as Animal Planet. The Science Culture Index developed by Martin Bauer incorporates the important role of the popular media in science communication.

The role of the social sciences in science engagement

Prof Michael Kahn, University of Stellenbosch

The responsibility for communicating science to the multiple South African 'publics' lies with four sectors: Higher Education, Government, Business and Civil Society, with the latter situated at the central overlap of the quadruple helix. Ideologically-driven communications disasters such as the misinformation about HIV/AIDS, which was characterised as separate unrelated phenomena HIV and AIDS during the Mbeki era, should collaboratively be avoided by all four sectors in future, with leadership from the DST. Thereby the disjuncture between political messages and scientific communication can be avoided. The SSH R&D budget is consistent with the size and impact of social science in South Africa, and should be maintained but redirected from basic to applied science. Effort should be placed into promoting "own" science as exemplified by the world's first heart transplant in South Africa in 1967. The science institutions in South Africa, like others, tend to be driven by self-interest in accessing good funding allocations. Hence, the tendency to release dramatic findings that will generate big news headlines without upsetting vested interests. This is borne out by agricultural research foci on genetically modified (GM) soya but not on GM hops or GM potatoes owing to the influence of large commercial interests. The education system should note that language literacy is effectively of greater importance than mathematical literacy in everyday life and that greater emphasis should be placed on the former at school level. This would assist public understanding of science and technology and reduce the extent to which the public communication of science serves as a rhetorical window-dressing device. 'Western' science and Indigenous Knowledge Systems (IKS) would begin to be viewed less as a dichotomy and science communicators would feel less like islands surrounded by sharks.

Introduction

The Department of Science and Technology (DST) and the Human Sciences Research Council (HSRC) hosted a policy workshop entitled Human and Social Dynamics: 'The role of the social sciences in science engagement'. The *event* took place at the Conference Centre of the Council for Scientific and Industrial research (CSIR), Pretoria on the 10th March 2015 and was attended by 49 delegates from a range of research institutions, universities and government departments.

Background and Rationale

'Science engagement' refers to the engagement between institutions of science and the broader public. The institutions of science include universities, research institutes, science facilities, museums, science centres, private laboratories, and public sector actors such as the DST and the National Research Foundation (NRF). The structure and functioning of these institutions has traditionally been a central concern of science policy, which has drawn on innovation systems theory with the aim of improving the performance of national systems of innovation and thus harnessing increased socio-economic benefits from science.

However, globally, there has been growing recognition that the benefits of science, technology, and innovation are premised not only on economic drivers and innovation systems, but also on social drivers – on the manner in which science and technology are embedded in society. Conceptualising, measuring, and analysing these social drivers is increasingly seen as critical to the formulation of socially responsive science policy that includes mechanisms for engagement between the institutions of science and the general public. Examples of such engagement include communication through various media channels, direct public outreach, and public participation in science policy processes.

This extends the scope of science policy beyond the traditional domain of innovation studies, and into the broader domain of the social sciences. Social scientists and philosophers of science have sought to re-conceptualise the nature of science as a social phenomenon, moving beyond narrow instrumentalist interpretations and objectives, and embracing the complexities of social landscapes and ambiguous normative models. Simplistic notions which position science as a hegemonic world view and an unchallenged social good are not sufficient, as they do not take account of social and cultural formations and responses outside the scientific world view. At the same time, the power and potential of science needs to be recognised, and its unique characteristics need to be harnessed for the benefit of society. Examples of this tension include public ambivalence over controversial technologies such as genetically modified organisms and nuclear energy, as well as uneasy relationships between mainstream science and indigenous knowledge systems, between innovation-driven growth and inclusive sustainable development, between rapid socio-economic change and personal wellbeing, and between science and contrasting religious world views.

Research into social aspects of science has begun to shed light on this complex relationship between science and the public. Research efforts have sought to understand public attitudes towards science, public knowledge about science, and public sources of information about science. For example, Reddy *et al*. (2013) found that most South Africans felt that we depend too much on science and not enough on faith, and that science makes our way of life change too fast. At the same time, the majority also felt that science is making our lives healthier, easier, and more comfortable. These contrasts and complexities highlight the importance of undertaking evidence-based assessments of how citizens form attitudes and how public opinion is shaped and composed, in order to inform public policy.

Science engagement policy falls within the ambit and mandate of the DST. Since the advent of democracy in South Africa, the Department has been developing policies and mechanisms supporting science engagement, but largely in a fragmented manner. In order to create a more coordinated environment to enable stakeholders to play more effective roles, the Department has, after extensive consultation, generated a Science Engagement Framework. The Framework acknowledges that an awareness and understanding of why science and research are critical to our lives is essential for developing an innovation culture: 'To fully realise the social, economic and environmental benefits of the significant investment in science, research and innovation, as a country, we must communicate and engage the wider community more fully in science and an

understanding of the knowledge economy to which we aspire'. As such, the Framework aims to define a coherent strategic direction for science engagement by the DST and its partner organisations.

The Framework aims to draw together and streamline a variety of initiatives supported by DST strategies and policies. The DST's mandate, in terms of the 1996 *White Paper on Science and Technology*, includes the delivery of science awareness campaigns that contribute to the creation of a society that values science and technology as socioeconomic tools. Other policy documents that include aspects related to science engagement include the *National Research and Development Strategy* (2002), the *Youth into Science Strategy* (2006), the *Ten Year Innovation Plan* (2008) and the *Framework for the Promotion of Excellence in a National Network of Science Centres* (2012). The operational context for these strategies and policies includes the South African Agency for Science and Technology Advancement (SAASTA), a business unit of the National Research Foundation (NRF), which has become the primary implementing agency for DST science engagement efforts. The DST also supports a network of 31 science centres, seven science festivals, the National Science Olympiad, and the National Science Week. Other mechanisms include outreach programmes at national science councils and research facilities.

Science engagement in South Africa faces a number of challenges, including low levels of maths and science literacy, and high inequality in educational attainment, which, according to Reddy *et al*. (2013), is the strongest demographic variable to impact on attitudes towards science in South Africa. Operationally, science engagement is currently constrained by limited public funding, limited co-ordination across actors, a lack of long-term strategic orientation across the system, and a lack of clarity regarding long term impact and monitoring and evaluation mechanisms. The South African media also face significant challenges in science reporting due a lack of dedicated structures for science journalism and a limited pool of qualified science journalists.

In response to this context, the Framework has an overarching vision for 'A stimulated and engaged South African society that is inspired by and values scientific endeavour, critically engages with key science and technology issues, and participates in a fully representative science and technology workforce' and a mission 'To support and promote communication of and engagement with science to diverse constituents at all levels of society, using the most appropriate technologies, whilst respecting social and cultural contexts'. This informs the four main strategic aims of the Framework:

- To popularise science, engineering, technology and innovation as attractive, relevant and accessible in order to enhance scientific literacy and awaken interest in relevant careers.
- To develop a critical public that actively engages and participates in the national discourse of science and technology to the benefit of society.
- To promote science communication that will enhance science engagement in South Africa
- To profile South African science and science achievements domestically and internationally, demonstrating their contribution to national development and global science, thereby enhancing its public standing.

The seminar aimed to reflect on science engagement in South Africa, against the background of the DST's new Science Engagement Framework. This included reflection on the broader role of science in society, and on the role of the social sciences in science engagement, including the conceptual and empirical challenges that face researchers and policy-makers. Participants reflect on the Science Engagement Framework from the national, international, and developing country perspectives. On this basis, the seminar examined prospects for the implementation of the strategy. Using the Square Kilometre Array (SKA) telescope as a case study, the different dimensions of the science engagement debate and ways in which actors can work together to successfully implement a science engagement strategy were addressed.

The Workshop

A transcript of the workshop follows. In order to preserve confidentiality, the names of participants other than the main speakers are replaced with pseudonyms such as Mr X1 or Ms X3.

Opening

The workshop was opened by Professor Michael Kahn.

PROF KAHN: Okay, good morning, everybody, welcome to this meeting to discuss the role of the Social Sciences in Science Engagement. I am the Chair for the day my name is Michael Kahn. I am someone who has been somewhat involved in many of the issues that will be discussed today since coming back home in 1990. So, I am here to chair and also to learn from all of you where the state-of-the-art is progressing. One order, of course, brains on, mobiles on silent and we can then proceed. The issue of the Social Sciences in Science Engagement, there's one little aspect, it's almost an apologetic element which is far from correct. The reality in South Africa, in the university sector, to take a case in point, the quantum of research in the Social Sciences and Humanities is fully one third, 35% of total research expenditure calculated bottom-up in the proper manner. And when I say this to audiences of social scientists, their jaws generally drop because they assume it's around 10%. 35% is a lot and it's amongst the highest in the world, that's the first. The second is in terms of scientific production from the Social Sciences and Humanities, our method of gauging scientific production is to look at the bibliometric databases and usually people look at the world of science, ISI, and if you do that then the social sciences production in South Africa is way down. But if you go to Scopus guess where it is? What rank are the Social Sciences and Humanities on Scopus? In the top 10? Here's the surprise for you, it's second. It's second in terms of publication council and that's incredibly high. Among the BRICS, we're the outlier. So the social sciences are far from, in a sense, underfunded and far from invisible. Today we have got a very full programme, and I won't say anything further. As I learn I might butt in with a few observations but as I said, my job is to keep things moving and maybe occasionally to be a little provocative. So, my first provocation is to introduce my long-standing colleague, Dr Thomas Auf der Heyde, who has a long career both in higher education as well as in the department of Science and Technology. He is one of these people who has held two very senior positions, first as Deputy Director General for International Relations, where his team did a really excellent job working with the European Union and the framework programmes, and now he is back, perhaps in something that's closer to his heart which is human capital development, so Thomas, the floor is yours. Thank you.

The DST Science Engagement Strategy: facilitating the science: society interface

Dr Thomas Auf der Heyde, Deputy Director-General: Research Development and Support, DST

DR AUF DER HEYDE: Thank you very much, Michael. Good morning, colleagues. It's good to see you all here. I am not sure, is that Cape Town or Durban that I see on the screen there, or Pretoria? Cape Town? Is there somewhere else as well? Hello, Cape Town. Is there somewhere else as well? Okay, no, that's good. Can you all hear me, I hope? Thank you for the introduction, Michael. Let me start off, colleagues, with a couple of apologies. First of all, I must admit that up until quite late last night I was a little confused about today's event and tomorrow's event. I was concerned it might have to do with my office or me getting older. But this morning, I met some friends here of whom neither can be said and they said they had the same experience, so it wasn't just me. In reflecting now on the two days *foci,* I think it's a fantastic package of presentations and a fantastic programme that's been established for these two days. But as I said until quite late last night, I wasn't completely clear and so the presentation that I will be making was informed a little by that. The second observation I'd like to make is that I thought that this was going to be more an in-house discussion with our colleagues in the Human Sciences Research Council (HSRC). I did not realise that there were going to be guests quite extensively outside of that circle. Had I known that, I think I would have amended this presentation slightly to talk more directly to this topic here of the role of Social Sciences in Science Engagement. But nonetheless, let me present to you an overview of the conceptual work that has been done within the department to organise our activities in the area of Science Engagement. Now let me just see if I can [silence 0:06:40-0:07:23] its engagement framework, but it's also being referred to as a strategy. Now to be frank, I am not exactly sure if there is a unique definition that distinguishes a strategy from a framework. So, it's sometimes referred to as a strategy, this

document is sometimes referred to as a framework. And the intention of that document really is to facilitate the science society interface.

Now let me, the topics I'd like to talk to very quickly are the science engagement landscape in South Africa, challenges around science engagement, I would like to show you what are the strategic objectives of the framework or strategy and some of the responses that we will be pursuing, then I will talk about a few cross-cutting enablers for successful implementation of the strategy, a little bit on the way forward with this document and funding. And to start off though, I would like to say that, for me personally, this work is informed by the view which I think is held across our department, although the document doesn't say this in these words, that science is an essential element of modernity, that science is a driver of modernisation, a driver of economy, a driver of social development and is essential to empowerment and enlightenment as well. These are my personal views, they are not expressed like this in the science engagement framework. But for me really, that is the underlying rationale for ensuring broader understanding of the role of science in society. I hope to clarify that as we go ahead.

Just to quickly talk about the policy context for the department's work in science engagement. The national development plan, which I assume all of you are, at least know that there is this national development plan even if you haven't managed to read the entire document, the national development plan emphasises the role of science and technology at a very high level, and very consistently throughout that document you will find science and technology being listed as a key driver of social development. There are direct references to a whole lot of important outputs and indicators such as the number of PhD students produced per year, the number of publications, the whole range of indicators that are seen internationally as proxies for science development and these are highlighted in the national development plan and specific benchmarks set with regard to those indicators, to be reached by 2030.

When it comes, however, to dealing with the conundrum of how do you get to being a highly scientific, as it were, society from where we are now and what are the deeper cultural changes that you have to undergo as a nation and as a society to get from here to there? The document is fairly silent. In fact, this reference here, is pretty much the only one that I believe I could find, but there might have been a second one, but really on these more complex and subtle things which is the subject of your discussions and deliberations today and tomorrow, the document is fairly silent, but there is this specific reference in it.

Prior to that, of course, in the mid '90s, the White Paper on Science and Technology emphasised the importance of an understanding of science and technology in society, although as we will discuss later on, it was still within a particular context of an understanding of the role of science knowledge in society, and then in 2002 the national research and development strategy expressed the DST's intention to extensively invest in science promotion towards making science attractive, accessible and relevant. So, this brings me to the first point. There is a plethora of terms and words used to describe the science society interface. Public understanding of science, public understanding of science and engineering and technology, public understanding of science, engineering, technology and mathematics, public engagement on science or with science or around science. Then there's concepts of science communication, public communication of science. There is a whole plethora of these terms. This document that I am referring to, the science engagement framework, mentions them, but does not try to formulate a definitive formulation of its exact understanding of these different terms. Instead what it tries to describe is that in the document, the concept of science engagement is used as an overarching framework that encompasses all of these others, all of these other terms as well as the concept of corporate communications of science, and now I will get to that again shortly as well.

Now, what is the current operational context for science engagement activities in South Africa? SAASTA, the South African Association for Science and Technology Advancement, which is a branch, as it were, of the National Research Foundation, informally plays a coordinating role that largely manages projects on behalf of the department. There isn't an overarching

framework for science engagement or there hasn't been one until now. A reliable network exists of cross-sector institutions that collaborate with the department and SAASTA in promoting science engagement activities including science centres. The department supports more than 30 science centres around the country and various other government departments that participate in science promotion, public understanding of science, etc., activities.

The DST entities, those are the entities that sit within the department's portfolio, are involved in science engagement through their outreach or corporate communications divisions. All of them have activities in this area that are to a greater or lesser extent coordinated with the activities in SAASTA and with the department's own activities.

South Africa is involved in cross-border and international science engagement activities. We have run workshops, capacity development programmes and a range of other interventions in the SADEC region and I think there might have been some on the African continent, and South African researchers in this area and practitioners of science engagement have also been sent abroad for a range of different exposures. Lastly, two science communication chairs have been established under the South African Research Chairs Initiative and the Scientometric Centre of Excellence in Stellenbosch has a science engagement and science communication function.

What are the challenges? Well, first of all scientific literacy in South Africa is low. I must acknowledge I am not in a position to present to you comparative indicators of this, so this is to a large extent anecdotal and perhaps a somewhat subjective assessment, but I believe it is low, certainly by comparison to where we would need to be in terms of the expectations of the national development plan.

There is a decreasing interest among the young. I think this is evidenced in the number of statistics from schools about the extent to which enrolment, in the physical and natural sciences at least, are going down. Challenges in school science teaching, again there have been many reports along these lines. The ones that are most troubling are that mathematics teachers, who are formally mathematics teachers, but they feel, they feel threatened at the thought of having to teach advanced mathematics programmes, so that when school kids in grades eight, nine and ten are faced with having to make a choice between mathematics literacy and the normal mathematics programmes, there are many examples were the teachers discourage them from enrolling in full mathematics programmes because they feel unable to teach full mathematics programmes competently to the kids in those schools.

Then I formulated here something called social levels of scientific ignorance. I think there are examples at all levels of society of scientific ignorance. The most critical one, of course, and the most damaging one, was in the late, in the last few years of the previous administration under President Mbeki, when a completely a scientific approach was taken to how the nation dealt with HIV and AIDS. That's perhaps the most gross example that I can give in this regard, but there are many others I'm sure that, especially South Africans, will be able to think of.

Popularisation of science engineering technology in South Africa is happening on a small scale leading to a decrease, as I mentioned in the percentage of learners following mathematics and physical science at school. Empowerment of the general public is to engage critically with science and technology, is limited yet it has a corollary in the need to empower science as a social phenomenon to engage publicly. What this is beginning to talk to is the fact that, yes, we might have had public understanding of science, engineering and technology programmes, but they really are more about popularising science engineering technology, rather than problematising it in its social context, and this is something that needs to be addressed.

While the DST and its entities have been fairly successful in profiling specific successes in South African science, such as very recently, HIV/AIDS, astronomy and paleo sciences, there is general agreement that more can be achieved. Almost every time we go out into the general public, to parliament, to all sectors of society and talk about what the department and the national science system has achieved, people are astonished at the achievements of our national system

of innovation. And so, there is no doubt that much more needs to be done in communicating that. Coordination of science engineering, science engagement programmes, has so far been pursued on an ad hoc basis. I think I have made that clear. There has been a lot of projects but they have never been systematically organised and conceptually organised around a common framework, with clear articulation of roles and responsibilities for different actors within such a framework.

There is no systematic approach to coordination of engagement activities across all of our DST entities and there has been a lack of effective monitoring and evaluation instruments, as well as meaningful indicators to measure outcomes and impacts. This is not a trivial problem. How do you measure the impact of science engagement activities? So, the purpose of the framework that we formulated was firstly to systematise science engagement, public understanding of science engineering and technology activities – all these activities that we undertake in this area of endeavour, to systematise those. Secondly, we needed to ramp up our DST science communications activities including corporate science communications activities. We needed to raise the status of science and technology in public and political perception and lastly to transcend the deficit model philosophy.

The notion that somehow all progress in science is positive and that it is inappropriate to critique the role of science and technology in society, such a notion is surely out of step with the ethics and desires of contemporary South Africa where we are seeking to empower South Africans to participate meaningfully in debates and discourses that shape their lives. And surely science and technology shapes people's lives and will do so more as we go into the future. So, it is important to develop a critique also and a critical capacity around science and technology.

So, the strategic objectives, there are four specific strategic objectives that have then been formulated in this framework. The first is indeed to popularise science engineering technology and innovation, as attractive, relevant and accessible in order to enhance scientific literacy and awaken interest in relevant careers. There is no doubt we do need to promote science in a positive light in South Africa as well, notwithstanding my previous comments. Secondly, to develop a critical public that engages actively and participates in the national discourse of science and technology to the benefit of society. This goes to the notion of scientific temper which Gauhar Raza is going to be talking about tomorrow. And for those of you who don't know about it, I strongly urge you to read a little bit about this notion of scientific temper, which is a very powerful organising concept in India. To promote science communication that will enhance science engagement in South Africa and lastly to profile South African science and science achievements domestically and internationally, demonstrating the contribution to national development and global science, thereby enhancing its public understanding. So, it does have a, it does have the objective of ensuring more effective communication of science, both nationally and internationally. The document then goes on to list under each of these strategic responses, or strategic, rather the strategic objectives, examples of initiatives that either we are already supporting in the Department of Science and Technology through our partnership with SAASTA or other agencies, as well some new initiatives. I won't go through the full list. I have given you, there is a sheet going around which has the, all of these slides except for the first two on it, so these examples that I have listed here are on that sheet. I don't think in the interests of time or today's discussion that it will be useful to go through them in a great amount of detail, just to make the point that we list then a whole range of initiatives underneath each of these strategic objectives.

The document also then goes on to list role players, I just want to make sure that, yes, to list role players and their envisaged roles and indicators of success and it identifies the so-called enablers. These are cross-cutting interventions. The first is, we need to have an effective coordination function, coordinating function, given that the strategic goals are realisable through multi-stakeholder collaboration. So, the need to explicitly state how this is all going to be coordinated is taken care of and the document formally indicates that SAASTA will be the department's agency for promoting science engagement, promoting and coordinating science engagement activities in South Africa. Institutional and legislative platforms, it's necessary for

the establishment and location of the coordinating function to undertake certain institution and legislative rearrangements and the role that we envisage for SAASTA has to be formally given to the National Research Foundation through an amendment of that Act, because at the moment the NRF Act does not make science engagement or science promotion or public understanding of science, an explicit role or function of the National Research Foundation. So, we need to undertake an amendment of that Act in order to make this function an explicit responsibility of the National Research Foundation.

There is a need to look at how we are going to fund a more ambitious and coordinated science engagement programme on a sustainable basis and a proposal that we make in there is that all DST entities will need to ring fence a proportion of the annual operating budget and allocate it specifically for science engagement activities. Now, currently they are all spending probably between 3% and 5% of their total budget on science engagement in the broad sense in which it is described in the framework so, including cooperate science communication activities, and we want to ensure that they do this on a consistent basis, and we will negotiate with them a coordinated way to ensuring that the DST's collective investment in science engagement is invested in such a way that it supports our strategic aims around science engagement.

And then lastly we need to develop, or develop further, an information management system around science engagement activities. Different entities manage this or measure their science engagement activities in a number of different ways, fairly random, not necessarily imprecise, but fairly random, and we need to coordinate this and systematise it better. Funding the strategy, as I have mentioned already, in part we will continue making bids to Treasury for this. We will top slice funding from our entities and discuss with them the best way in which to coordinate the investment of those funds, and that's already covered there.

The way forward, an implementation plan is being developed that would include short, medium and long term targets, available resources and what they will deliver, necessary resources that we hope to obtain in the near future and details on monitoring and evaluation of the strategy. Thank you very much.

PROF KAHN: Thank you very much, Dr Auf Der Heyde. A well-earned applause for a very concise and clear presentation. We do have five minutes for Q and A. As you will notice we adjusted the programme to ensure that there is more time for the substantive issues rather than the procedural and formal introduction of this person and that person, so we are running almost on time, five minutes for Q and A and then we will move to the next presentation. If there is anyone in the house who would like to open up, it would be great. And for the latecomers, there are some copies still of Dr Auf Der Hyde's presentation, the notes. Any offers in the house? I see two. Yourself.

MS X1: Before I go … I can comment, to say that I, my comment is that I really appreciated your introductory comments which essentially set the tone that we in the social sciences and the humanities should not always be working from a model of, or a deficit model. Even though there are challenges and Thomas Auf Der Heyde, I really appreciate your input. It's the kind of engagement that universities should be engaging more with the departments and the science councils.

PROF KAHN: Thank you, Ms X1. If I could just add a little rejoinder to that. Let's remember that South Africa, in terms of composition of GDP, is services-led. 60% of GDP is in the services sector and the services sector is strongly driven by the social sciences and humanities. It's huge. So the social sciences are far from invisible and when you go to the public service or government, the social sciences dominate. So it is a critically important sector, academic sector, research sector for our society.

MS X2: I am very glad that we're having this meeting today and it's been prompted by the DST's science engagement strategy and the fact that this important area has found its space, has found a space within DST, is commendable. I think, Michael, just correct me on the dates, the

1996 Green Paper for the, what was it called then? For DST for department of, for DACST at that time, Department of Arts, Culture, Science and Technology. I remember this one section that talked about public understanding of science and then somehow from the Green Paper to the White Paper it disappeared and it seemed to have disappeared for a long time, so I am really glad that it's back on the agenda and that we could engage about this. Now, of course we're engaging about the strategy but I suppose the old adage of you've got to put your money where your mouth is, and I want to know where the money is and then because the mouth is here and that's great. But you've talked about the money coming from the top slices of, is it the science councils or universities? Whose budgets are going to be top slice? And how do you think this will happen and how do you think the institutions will react to that?

MR X1: It seems this document and many other documents which are policy documents issued by various governments across the world, in one way they use science, technology and engineering. And in my opinion, the engagement of science, an engagement of technology, an engagement of engineering, takes place at very different levels. They cannot be swept by one brush. And therefore there is a need now after 25 years of research that has gone on in public understanding of science, or 30 years of research, there is a need to distinguish between the engagement of science. Very different kind of forces come into play when we are talking about science and a very different set of people and forces within a society come into play when we are talking about engagement with technology or engineering, is you feel that there is a need to distinguish between these three when you are developing a national White Paper.

MR X2: Just a question on the timelines. What do you see is like emails from like … and things like that. What are the … and the second one for me is whatever … have there been in the social sciences in developing this framework?

DR AUF DE HYDE: Thank you, Michael. Thank you, colleagues, for the questions and comments and observations. We are grateful for the support of the community around this. First of all, Vijay, on the top slicing, the department has influence over its entities, not over entities sitting in other line departments, especially around budget issues. So, the word top slicing can be interpreted in a number of different ways. The crudest way is that the department simply reduces the entities' budgets by a certain percentage, retains them and then dispenses them according to another formula. A complete, and at the other end of the scale, top slicing could be to say you need to earmark a percentage of your budget to support this framework and then you leave it up to them to support and you don't even monitor it. These are the two extreme ways, neither of them is probably very realistic. So, we will need to engage with our entities on what is the most effective way of ensuring that all DST entities support the science engagement framework of the department as a strategic framework and a strategic ambition of the department. I can certainly confirm that the Minister has come back into our department with a very strong mandate on science communication. And so she is intent on ensuring that all our entities play their role in supporting the department's ambitions around science engagement. So, this will be subject to consultation with the entities over the next year so that by the time the next financial year starts we have a common approach on how to do this.

I would certainly throw the ball back into the court of the social scientists and specialists in science engagement and public understanding of science to deliberate more on this question. I think that in the context of the document that we have formulated, this is not a sufficiently important tactical distinction to make in the context of that document. I think that this is probably going to be more important in the context of specific plans that we make to roll out public communication and public engagement activities, whether you're doing this around science in the generic sense or engineering in the generic sense or indeed innovation, because people often talk about public understanding innovation. And so there, I think at the point of developing specific plans and programmes we would need to distinguish between different types of stakeholders and different types of engagement and different ideologies and systems of value. So, when you get to see the document I think you will see the point that I am making.

The Minister signed off on the content of that document. We now need to just have it professionally laid out so that it's presentable as a brochure or something like that but essentially the content of the document had been signed off by the Minister, so we should be able to publish this in its final version very soon on our website and very soon thereafter in hard copy, it will be available. So, let me put Isaac and his team on the spot here, let's say two months, in two months we want this job done. You can live with that? Okay, so in two months this document will be at least available on our website in its final laid out form. Secondly, your question about the, and then another part of the timeline is the revision of the NRF Act is something that we have already initiated. Just a week ago we had a long and very helpful engagement with the NRF board around the first draft of the NRF Amendment Act that we have, that we had sent to them late last year. We have revised that, we are awaiting a second round of comments from the NRF board on this. We have also sent it to the chief state law advisor, so we are hoping that by the end of the coming financial year this exercise will have reached its conclusion so that we can start the next financial year, the 16/17 financial year with a new NRF Act.

And then lastly on the level of engagement, the document has been extensively discussed with, shall we say a more, an in-house constituency. So we have used SAASTA, we have used colleagues from the HRSC, we have used colleagues from the National Science Technology Forum and we have used colleagues from the Academy of Sciences of South Africa. Have I left anybody out? Oh, and NACI, the National Advisory Council on Innovation and then the Science Centres Community of Practice? And government departments. So, there hasn't been a call for public input on this document, but it has been extensively discussed with all the stakeholders that we have had any engagements with over the last few years.

Promoting a Scientific Culture: A Review of Public Policies in Ibero-American Countries

Dr Carina Cortassa, Researcher, REDES (Argentina), an associated institution to the CONICYT (National Council of Science and Technology)

PROF KAHN: Thank you very much. I think that needs to be the last of this session so that we can move to the next presentation, so thank you again to Thomas Auf der Heyde. I would now like to call to the microphone Dr Carina Cortassa from Argentina, who is associated with Centro REDES, which is an interdisciplinary centre for studies on science and higher education development, that is if my broken Spanish translator in this little head and Google has worked effectively, but I see a smile so I think it has. And we will be hearing about ways and means of promoting a scientific culture in Ibero-American countries and your starting point is to explain what Ibero-American is to those who don't know. Thank you.

DR CORTASSA: Thank you. It's okay. Well, good morning. My name is Carina. I come from Argentina. I work at REDES Centre for Studies in Science, Technology and Higher Education, and I am going to talk about promoting scientific culture review of public policies in the community of Ibero-American countries. The 22 countries from Latin America, Spain, Portuguese and the Republic of Equatorial Guinea, they can form the community. Well, I'm so glad to be here this morning. It was a long journey and very, very long. And you know English is not my native language, so I wanted to apologise and advise that I am going to read the main parts of my presentations because I don't want to miss the point and I have many things to say in a short time. Okay? Thank you. Well, I'm going to speak about some of the problems you are going to address with the science engagement framework. I am glad to see that we share those problems and I will present an overview of a recent study aimed at describing how the efforts to improve the public scientific culture - we prefer the term scientific culture instead of public engagement with science and technology as the more comprehensive one – have gained ground in the broader frame of public policies for science, technology and innovation in the main Ibero-American countries. The purpose, our purpose was to assess to what extent the discourse of the official agencies reflected the concern over the matter and in which way beneath the level of

[unclear 0:43:01] the level of, beneath the level of the plans, the documents. The usual claims in this sense turn out or not into operative strategies, actions and tools. So, we are used to hear that expand in the scientific, the citizens' scientific culture is a challenge, you use the term challenge. One of the main reasons is that the chances of success or failure of scientific and technological development strongly depends on the conditions of a society able to fully … in the … interwoven of its cultural practises. From this point of view we must not only act to improve our scientific capacities but also our scientific culture. The existence of a bad reactional relationship between both phases, science and technology advancement and citizens' culture advancement, is thus one of my main premises.

So our question was, what are governments in the region effectively doing to improve the public scientific culture? And do the concrete facts correspond with the rhetorics, and in other words do they act according to what they say? Well, here you have the, our 22 countries. The study covered all the countries that are members of the Ibero-American community, Argentina, Bolivia, Brazil, Colombia, Costa Rica, Cuba, Chile, Dominican Republic, Ecuador, El Salvador, Spain, Guatemala, Republic of Equatorial Guinea, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Portugal, Uruguay and Venezuela. In the first stage, the governing bodies in charge of STI policies in each country were identified using additional collateral of STI policies. Once these were located an exhaustive track of their websites and other relative elements was applied oriented to detect plans, programmes, budgets and promoted actions, financed and/or managed by those entities, comprised under expressions such as the plethora that our colleague mentioned, science communication, popularisation, scientific culture, social appropriation of knowledge and alike. As the evidence show there is a wide variety on that, both in terms of concepts and other kind of practises include under those denominations. That led us directly to the question of the pertinence or not of this conceptual grouping. However, our methodology strategy was to reflect the actions and tools with that naturalistic approach. I will talk further about this. Describing all those things that the respective agencies or programmes consider to be part of their strategies in the area, that is avoiding to assume on a pre-normative stance about what does or does not belong to the field of scientific culture from the point of view of the correct academic debates. Due to the dispersion and low level of systemisation of the data provided by some programmes, a second stage appealed to the help of local informants linked to the field with their collaboration, the data work entrusted to improve its consistency and complement it to another non-accessible information through the risk analysis procedure.

So, let's see some of our outcomes. At a different scale most of the countries explicitly encompass the topic of scientific culture and the need to improve public engagement with science in the respective sectorial plans. In the context analysed that implies a very positive shift in visibility from a certain status of note in the margin, have a discount of interests and practises for several years, besides the launch of specific governmental areas responsible for sketching the general strategies and carrying forward concrete practises also pulled some intentions to strengthen this progress. But the three variables are not always mentioned by name. Explicit mentions in policy documents, audit systems of a particular area doesn't necessarily imply concrete actions. Nor the opposite, its absence, implies lack of activities. For instance, in some national science, technology and innovation plans, popularisation and social appropriation of science are extensively alluded, however it was not possible to detect any activity in this sense. On the contrary, Chile has one of the most dynamic programmes in scientific culture of the region the programme explorer, although the topic as such is not one of the most relevant in its current policy documents. In other countries, like for instance Costa Rica, Peru, Paraguay and Cuba develop activities where diversity is of great intensity without any specific agency devoted to each. Well, the policy, the policy in the publicised documents references to the topics in publicised documents show a varied range of terms in this white semantic field, concepts that are indistinctively used to refer both to the ends and the means of the collective flowing of scientific knowledge. So, you made a great effort to distinguish all the concepts that are used in the field nowadays. But there is only one country, in your [unclear 49:37], in the region, that is Columbia, that has a solid, a strong document like yours that makes this conceptual clarifications. Well, they opt for a concept that we used a lot in Latin America, that is social appropriation of science, but you do the efforts, others don't. An additional problem regards the

broad diversity of practises levelled in each context under the text of popularisation, social appropriation, scientific culture, public engagement. This iteration idea represents not only a difficulty to achieve a reliable picture of the region policies for the area, but at the same time hinders sometimes the possibility of assessment and comparisons. So, conceptual agreements are needed to achieve a set of common indicators, as we were speaking before, to be able to measure the impacts of this kind of actions.

Well, at the level of the concrete practises, table one summarises the data of the 18 countries among which is, was identified an approximate total of 154 actions, development by governmental agencies in our countries. However, the order reflected in the table must be interpreted with some caution. First, as I mentioned, because of the variety of alternatives and actions included in the different context under the same levels of communication popularisation and so on, for instance in Costa Rica, their strategy of social appropriation of knowledge is very linked with the expansion of ICT. And so their programmes, Costa Rica wireless to warrant the access to people to ICT, is included in their strategy for social appropriation and popularisation of science. And in the second place I think that 9th comparisons may be avoided, must be avoided because due to the lack of data, the information refers to the number of activities and not the financial resources that each country dedicate to the topic, that's it. It would be wrong to infer that the governmental interest in scientific culture in Argentina practically doubles their Spanish one, or that Mexico, Columbia and Costa Rica are on the same foot regarding the issue, because it's likely that attending the resources allocation in, and if this case is the relation, would be greatly modified. Further information would be necessary to allow a more legitimate comparison between the different countries. Still with those caveats, it's possible to contrast the level of interest in the scientific culture expressed in the publicised documents described previously and a mode in which this concern turns into concrete actions. This chart allow us to visualise that association. In the vertical axis is qualitative represented, the attention dedicated to the matter in the rhetoric level aspect, while in the horizontal axis is reflected the gradient of activities identified for every case. So we have here the two extremes of the comparison between our countries. So as it was said, the action survey was developed without adopting a pre-normative stance. On the contrary we tried to reconstruct the landscape or practises from the point of view of the agents. On the basis of what their own criteria and not those of academic discussions considered relative with the fostering of scientific culture. The heterogeneous corpus of practises obtained was classified afterwards on the basis of an inductive analysis of the information. As a result we obtained a matrix of criteria and categories that classifies the action taken by governments according to four significant aspects. The modality that these actions adopt, what are they effectively completely? The degree of the involvement of the official agency in its concretion, if it was direct actions, collaborative actions or indirect actions just founded but not having any more to do with this. The explicit or inferable intention that I think is the most interest of our categories and the main target audiences.

So with all the actions we have identified, we classified them, taking into account this criteria and categories. You can see in table 2 they have taken together awards and contests, awards to scientific journalism and contests of science tales, science photography, science videos, science documentary etc. Awards and contests and a number of diverse events concentrate half of the actions and tools that the government agencies dedicate to the expansion of scientific culture. One of the most important events is the National Science Week. I was talking with Vijay that you have your National Science Week here also. It's probably the most consolidated and extended event of its kind in the region, permanently settling in 11 counties and in some decades with, in some cases with decades of experience with an outstanding format. I think it's the same everywhere. Popularisation and pedagogical activities for your transversal topics, proposal institutions, proposed by institutions, organisations and research centres and take place in this and other contexts, maybe in museums, gardens, libraries, the streets, etcetera. As Thomas said before, the expansion of scientific culture is not only a duty for public policies, but for a broader set of social relations. The institutions of the national education systems, scientific communities or organisations of the civil society must meet their cultural and productive entities. So the visibility to assemble the efforts from different sectors, it's valuable for different reasons. But from a practical point of view, because it allows optimising the human resources and available

materials, avoiding overlaps or interferences in the planning and also allows to take advantage of the scales of different expertise of the involved agents. Their technical competences abilities for campaigning and mobilising specific groups. In more than half of the identified actions, the official agencies work corporately with educative and all scientific institutions or in 28 cases with other government agencies, with international institutions, with other national institutions – all forming part of collaborative networks that gather several organs. Direct actions include all those promoted, founded and executed by the official department and on the contrary the indirect ones comprises the cases in which its participation is reduced to economically support proposals designed and executed by other actors.

The intentionality, well I think it's the most interesting of the criteria because detecting the intentions permit to somehow infer what is in each case the implicit idea of scientific culture and its relation with the different mechanisms through which the flowing of knowledge is promoted. Mechanisms of popularisation of formal education, of transference, etcetera. So what's the main goal of the actions and tools developed by governments to promote their citizens' scientific culture? The question is relevant because from this point of view the strategies adopted should be closely related with those intentions. So what's able to make meaning to promote scientific culture? That's the question. The spread of knowledge to promote scientific vocations, regenerate public positive attitudes of support and value for the science and technology development, or to favour a reasonable and wholesome dialogue between science and society, or to achieve a fully citizenship with committed subjects who are critical participative aware of their rights or responsibilities. All these goals, some of them and other ones. Table 4 shows that most parts of the initiatives is oriented with a popularisation purpose and/or pedagogical educative. This trends is practically reproduced in all the countries. The first set of actions, the popularisation of knowledge actions, reflects the dominant orientation anchored in the traditional idea that achieving scientific culture has to deal directly with the spread of knowledge and emphasising popularisation clearly derived from the deficit model of the public. A second call of action segregate those guided by objectives of a pedagogic educative nature linked to the science didactics and the goal of creating scientific vocations among children and young people. For instance the support for the creation and the development of science clubs, scientific Olympiads, maths Olympiads, camps and other similar activities, jointly undertaken with schools and other institutions of formal education. A negligible percentage of actions tend to promote engagement and citizen participation in the discussion of topics about science technology and citizen culture. I think this point is of particular interest because it clearly shows the gap between the latest concerns of the academic perspectives emerged during the last decades and an environment of policy making. We are moving hard from the deficit models approach. We are trying to move to a more interactive and to a more interactive mobile base on dialogue discussion, on debate, etcetera, but there are just two activities, one in Colombia and the other in Venezuela that allow citizens to participate in the discussion of science and technology plans.

And to finish, the distribution of the target audience is coherent with the distribution of actions according to the goals described in the previous section. Among the first ones we found both those of popularisation which are oriented to the general public as the ones that show a pedagogic educative intentionality and appeal to children and teenagers. A key aspect, another key aspect to take into account is that from all the registered actions it's been possible to detect only one which targets a group with disabilities. It's a national science project of sign language, an intentional initiative in which participate science, technology and innovation agencies of Venezuela along with other organisations of the social society and the community of people with hearing impairment. It's the only action registered that is oriented to specific groups with any form of disability, what reflects an important deficit, I think, from the public bodies on this matter. So yes, opening remarks, I think we have identified the reincarnation of science, the growing visibility and institutionality of the scientific culture among the official science, technology and innovation (STI) agencies in the Ibero-American region. In some countries activities are numerous and varied and show a certain degree of continuity. What we have detected also – strong heterogeneity in the terms and applied concepts that are not always comparable and in the practises growth under those levels that leads us to the normative point

of view. So what is and what is not part of scientific culture or public engagement with science and society activities.

And a future agenda. I think we need a debate about the goals of improving scientific culture. What is it? What are our main goals? The empowerment of citizens or the achievement for their support? Do we need people cheering science, technology and innovation? Or we need both and how to make both levels compared. We also need a discussion about occurrence between goals, means, ends, strategies and promotional content for scientific culture, maybe the discussion you had while elaborating your framework. And conceptual clarifications and agreements regarding the concepts of scientific culture appropriation, popularisation, communication and practises. In order to be able to operationalise them in a set of indicators that will allow us to assess the impact of this kind of activities and to facilitate the comparisons of the initiatives in the regions and other practises. That's what we were talking about before. So thank you very much for your attention and well, I hope you have questions.

PROF KAHN: Thank you. Thank you very much, Dr Cortassa, for a very interesting discourse of what's happening in our neighbours to the west. We have an increasing interaction with Latin America and this is part and parcel of teaching us more. The floor is open, comments or questions, identify yourself. We are slightly ahead of time and therefore we can take many interventions. One, and another one, two three, ……. Thank you, we have a, you have a microphone? Okay.

MS X3: Good morning. I need to say from the outset I am not an expert in science communication. A few colleagues and I have embarked in a very interesting journey through a course presented at the University of Stellenbosch in science communication. My comments and question has to do with a country which is not included in the group that you mentioned but which is a neighbouring country to the Dominican Republic, which is Haiti. Last year I was involved in a delegation of the Council for Geoscience that went to Haiti. We were, and to an extent still are involved in establishing a minerals innovatory of the country and we were also involved in training transfer in remote sensing, which is applicable to several domains. And I was astonished to see, we had an introductory meeting with representatives from mining companies, government departments and agricultural institutions, where the project, which was a collaborative project between the Haitian government and the Council for Geoscience, was presented to these delegates and after the purpose of the project was explained, I was astonished to see that the overwhelming reaction was one of suspicion. The perception, look again I am talking about something I don't know a lot about and I don't know Haiti that well. But the perception that I certainly had was that there was, the impression was that there was a collusion between the Council for Geoscience, which obviously to them was an unknown institution and the Haitian government to somehow use the knowledge that was being created in this project, not to the benefit of the country, but as some kind of conspiracy. Now I don't know if this has to do with what you were talking about with the deficit model, that there was perhaps a lack of understanding what it was about or something else I don't know.

MS X4: Thank you very much, Dr Cortassa. I felt you were describing, just by gut, our particular situation. I don't have the research to support your numbers, especially in the modalities and the number of activities, but when I looked at the distribution between events and popularisation and then public hearings and participation, we have a feeling that that's about what it is for our situation as well. The kind of events that you mentioned are things that we recognise, that ring a bell for us. But I was particularly interested in your concluding or introduction slide and the point that you make about the tension between empowerment of citizens or the achievement of support for STI development that that, where does it lie? And I wonder what you feel, what your thoughts would be when you think about the location of a body that would need to do this kind of coordination for science development or promotion of scientific culture or science engagement, one of the questions we get asked is how close or how far away are you to government? And that, to the government, to the central body in terms of then being questioned whether your intention is genuinely empowerment of citizens or are you there for rolling out, drumming up achievement support of STI in support of government? That

is, for us it's that tension in terms of thinking through this. We know its arms'-length but that is definitely something that speaks to that point that you have made in our thinking through where we are going.

MR X3: I'm very interested in this diagram in relation to practical versus discourse, and I was wondering whether it's purely a wealth/poverty thing that's dictating what's happening there, or are there other factors? I mean, for example, what's the difference between Chile and Brazil? They're in very different squares there. What are the dynamic between the different countries? Maybe just give a couple of examples? Thank you.

PROF KAHN: Thank you very much for the three questions. I am going to abuse my power as the chair because this slide is now up, and I also had a question about it, or it's an observation. The observation is that the top right quadrant contains, certainly in the case of Spain, Brazil, Mexico, Argentina and Portugal, countries which are regarded as having functioning national systems of innovation. And you have the papers by Albert Curcio where he talks about emerging or immature systems of innovation, and all of the others are disarticulated. So there is a link, a clear link between the level of development of your innovation system and the discourse. The outlier is Chile. It doesn't make sense to me. I would have expected Chile to be up in the top right as well, more since it has the highest per capita income in Latin, of this group, except maybe an outlier that is a [unclear 1:13:19] state or an oil-producing state, but it is much higher and Chile is the sole member of the OECD, other than the core countries, Spain and Mexico and Portugal which have been there for much longer. So it is a lot to talk about in this diagram. Let me give it back to Dr Cortassa and we will then take another round. Thank you.

DR CORTASSA: Okay. Thank you. Okay, well I will start with the last question. It's clear that in that quarter, up on the right we have the countries that, which national systems of science, technology and innovation are well articulated and that they produce science and technology on frontiers in some way. The problem with Chile is not about their science, technology and innovation system, it's strong, it's hard and it's consolidated. The problem is that in the vertical axis, I represented the explicit interest in public communication of science, in public engagement with science or in scientific culture, in the documents of policies. In the current documents of policies, the topic is not mentioned. That doesn't mean that they have lack of activities. As I said they have one of the more comprehensive strong and relevant programmes of public engagement with science and technology probably in Ibero-America, the problem, the programme explorer. But they are there because we couldn't find any references to the topic in the policy documents.

The first question was why we did not talk Haiti in the study because, just because Haiti has not signed the pact of the Ibero-American organisation of countries, so that's why it's not in our sample. And I think, I'm sorry your name? Beverly, I think we share a set of common problems and a set of similar situations, but you have moved forward and I think, and I hope that your framework, your science engagement framework will contribute to surpass some of these difficulties. Your first question was about the tension between what are we looking for if empower, the empowerment of citizens or the empowerment of the science and technology and the innovation systems, that's to say. Sometimes when we think about the classical models of scientific literacy, we think about modelling which the most important was to get people supportive for science and to be able to approve the efforts of governments in science and technology development. That's why I said that on the one part sometimes governments, I think, are looking for support for their science, technology and innovation policies through the meanings of popularisation, for instance. But I think that we should, may converge those extremes. We have, we need supportive citizens, literate citizens, fully engaged with science and technology, but we also need critical citizens, reflective citizens that could participate and could judge the efforts of the science and technology and innovation systems, and sometimes can't, but sometimes cannot be as supportive as our governments need it on some initiatives. For instance, in matters of, in controversial matters, you mentioned them in the document. Well, sometimes empowering citizens is seen as a risk for governmental policies. For instance, nowadays in Argentina we are going through a discussion about fracking and, well, I don't know

if you have the same problem here but fracking or transgenic seeds. We are, our economy is strongly based in transgenic soya and, well, we need citizens able to say what they want and to make their voice be listened. That's why I emphasise the tension of what we need and how can we do it to make those disposed converge. Anything else?

MR X4: What I'd like to know, have you come across specific policies or activities that engage with religious organisations or leaders on the public understanding of science?

DR CORTOSSA: No an activity. No.

PROF KAHN: Okay, we'll probably take one. You might want to respond in more detail. Let's talk the other two inputs.

MR AUF DER HEYDE: Thank you very much for a really interesting talk, and the presentation of your empirical framework for analysing these different science engagement, science popularisation programmes. I think that the general elements of your framework are very applicable to our situation and I hope that my colleagues will look at our programmes in the context of your framework to understand a bit better perhaps conceptually how our activities fit into that framework so that we can understand our activities better against our scientific, our science engagement strategy. So I think that was a very helpful contribution I hope we can get your written paper as well. While you were talking I don't really have a question but an observation to make. I was struck by, what strikes me as a paradox, which is that in order to really overcome the deficit model, you in fact have to deal with a deficit model of a different kind. You were talking about your interest, and it is ours too, of establishing a dialectical relationship between Science and society. In order to do that you need not only the citizens to begin to understand the nature of that dialectical relationship but the scientists too. So in a sense there is a deficit in respect of establishing a dialectical relationship, there is a deficit on both sides that prevents this relationship from being established, and I thought that that's an interesting conundrum for us to deal with. And so one of the things that we have, for example, identified is, we need to encourage and facilitate that the scientists who receive support from the Department of Science and Technology and the National Research Foundation, that they actually become involved in beginning to establish this dialectical relationship. That they begin to understand what it's about. So we will have to work with them and the National Research Foundation to put in place a system of support and a system of incentives to build this relationship using the platforms that we are already funding. So, for example, our South African Research Chairs Initiative which is similar to the Canadian Research Chairs Initiative, so we have very prominent chairs that have been established in the universities with funding from the Department of Science and Technology, they present really and ideal platform to begin to promote a more active and dialectical relationship between those who practise the science in those chairs and the communities around them. Some of them have already done that for some of the South Africans here, for example, there are already communities of practise emerging in specific areas of chairs. For example there is a community of practise on poverty relief. We have six or seven chairs that are working in the area of poverty relief that have gotten together already and are beginning to look at this aspect of their practise of science. They are looking at that as well as at policy interventions. So there are a number of opportunities that governments who are funding research have in fact, and in a sense one could say that the funding research obliges them to think about these things, particularly in countries like many South American countries and South Africa that are recently politically liberated. Where we really have got not only the space but the responsibility to think about these things deeply. Thank you.

MS X5: Thank you very much for the lovely presentation. I am very much interested in the graph that we have on the screen in relation to, you mentioned a number of areas. I am interested in the involvement of government where you were stating the various areas or levels of involvement of government. I am interested in the first quadrant, which means, we call it what? Top right, yes, the first quadrant, yes. The countries which are there, to what extent is government involved in their activities, the practical activities for, you call it scientific culture, in

advancing the scientific culture? Is there any pattern which is emerging in that regard? And also is there any pattern emerging with respect to their intentionality?

DR CORTASSA: Regarding the first comment about the deficit model of the public and the distance with scientists, I think that both parts have some kind of deficit. I prefer not to talk about deficit because of its pejorative connotations sometimes, but I prefer to talk about asymmetry. They are in asymmetric positions regarding knowledge and that's objective, but I think that in 1985 the Bodnar's report was the first document in acknowledging that it's not only necessary to bring the public to science, but we have to move scientists to society. So I think that we need to stress the work with scientists. I am trying to, I was working during the last year with an initiative that we took for different universities to train scientists, not in skills or abilities to communicate, but to be more sensitive to the topic. We worked with them in some seminars, in intensive seminars. And at the end of the seminars they have to present a project on how would they communicate their project to the broader society. And in one of the universities it was particularly interesting because the Department of Science and Technology of the university launched a call for projects for scientific culture funded with their own resources. That was interesting. I am teaching the same course in a long life platform we have in REDES, and there is more and more scientists interested. I think we have to work with novel researchers. It's difficult to change the mind of a senior, sometimes. But I am sorry, that's politically incorrect but sometimes, huh? Yes. We have to make strong work with novel scientists, with students with doctorate students because they have to realise from the beginning that they have a duty, that they have the duty to communicate, they have the duty to participate in those events. Last night, we were talking [about] problems we have sometimes to find one or two researchers to go to the Science National Week activities, they are always the same people, they are people that they are already interested and year by year they are always the same. So once again, every member this is the National Science Week so we need your help, yes, of course we'll go. So we need to enhance that amount of people interested in communicating with society.

And the second question ….. Portugal, that is one of the most advanced where practises, yes, they have 17 actions. They are strongly collaborative actions and the intentionality, well, I'm sorry I don't remember, but I can give you this we can see in these tables that we have the data for country. So this is the modalities, for instance the intentionality of the actions by countries. You can see popular in, the ones that were in that quarter, popularisation in Argentina and second on, and in Portugal the trend is almost the same. Popularisation pedagogically [unclear 1:33:13] for instance Spain let's see that it was another one, the trend is similar and the other you wanted to know was there involvement? The involvement of the governmental agencies…. They are most engaged in collaborative activities with our institutions, you have Portugal, Argentina, Brazil and, well, Venezuela is among between collaborative and direct but I can give you this data if you want to compare. I hope you will help me to get better at this, to improve this criteria and classification, so any comments, any suggestions, they would be very welcome.

PROF KAHN: I wonder if you could elucidate a little bit what you mean by the term social appropriation? I have a feeling it may be more of a French or Spanish or Latin term than English. So I would like to understand that and I may have a follow up.

MR X5: There are two questions, really. The first one is, which comes from a discussion I had with a visiting astrophysicist named Gustafson, when he said one of the problems is, quite frankly, that science teaching is boring. And one of the reasons for this he suggested was that the education system is too, is prematurely specialised and in Sweden a recent survey of the higher education system has said that that is the case and proposed an idea of a liberal arts model in which scientists will be exposed to humanities and social sciences thinking and vice versa. So in other words it's more of a broader, a need for a broader education for everybody. And that comes into the second question or second part of the question also about the famous upper right hand quadrant. And the question is this of your diagram previously, is there any difference between those countries in that quadrant and the other countries in terms of the

successes of the primary, secondary and tertiary education system as a whole? Or is it something that is specifically restricted to scientific education?

MR X6: I have a methodological question when you were looking at what you called the actions and you had to decide which modality they fit into, did you do this on your own or did you have a team of people working with you and you work-shopped the criteria, the two of you? And then if you reached consensus it went into the category and if you didn't reach consensus, it didn't?

DR CORTASSA: Thank you for all your questions. The concept, regarding the concept of appropriation, I used to think that the problems were not terms but what we do with terms because I didn't realise that sometimes, some concepts have cultural appealings and almost themological connotations. Why don't we use for instance popularisation? We in Latin America, we don't use the term popularisation because it has a kind of, that is so common in English, we don't use it. Because it has to do with connotation of the term in Spanish, *popularisara*. To populist. The same term of vulgarisation in French, we don't use vulgarisation because it means to make of lower quality, knowledge of lower quality, for scientific knowledge for lower quality for people. So we use the term of scientific culture. Because of our influence scientific culture is particularly used for instance in Spain. So many of us we obtain our PhD and our Master of Sciences in Spain and we are very influenced for the use of the term and social appropriation of science and technology is one of the ideas that has been gaining ground during the last years. Appropriation in terms of checking for oneself what is of own authority. I think? Is it right? Taking something for oneself by its own authority, that's the definition of the Spanish Real Academy of Languages. The colleagues in Columbia have written a document just like yours to DST and they call the strategy for social appropriation of science and technology, and they discuss all the uses in the literature of social appropriation and reform, a definition of social appropriation of sciences that has, it's been expanding all over our countries. So, many of us are replacing their usual terms, popularisation, dissemination and things like that, for the concept of social appropriation. Science teaching is boring everywhere I think, that's why Vijay is working hard on the dialectics and pedagogics of science and of mathematics. I don't know what the concrete differences are, in science teaching among those countries, but I think they are not substantially different, that there are other things that make the positions to be so different in them and I agree also with the fragmentation of the two cultures. The humanistic and social sciences cultures, scientists' cultures. That was said almost 50 years ago by CP Snow and I think we are on the same in the conference, in the really conference. So I think our professionals in natural sciences and engineers, for instance, at least in Argentina, they never see a subject on social sciences all along their careers. And that happens, the same thing happens with my students of journalism. They don't know anything about maths, nor physics. And the fifth year of their career with me they have to learn about, for instance, the laws of gravitation. Because during their school years they learnt something and then they memorised something like that but during five years of a social sciences career they have forgotten everything. So I think that this kind of fragmentation must be solved or surpassed in some way. And I think?

PROF KAHN: Thank you very much for that, and thank you for the participation from the house, you've certainly earned your coffee break. Just my last comment on this great diagram, the way it played out. Educationally if you leave out Spain and Portugal, the metropolitan countries, the education schooling I think is strongest in Chile. It is by far the leader, so it's a little odd that Chile comes out down there, and I think there's is a lot more to think about. One would really have expected to be up in the top right as the leader. So, I leave it for further discussion. We'll have a tea break. Could we please return, I think the programme says 11:05, let's make it 11:10, we add on five minutes. And thank you once more to our presenter.

[break]

Attitudes to science: part of the puzzle to improve educational achievement?

Dr Vijay Reddy, Executive Director, ESD, HSRC and Andrea Juan, *ESD, HSRC*

PROF KAHN: I will make way for you. Yes, just sit over there for a start. Yes. Yes, I will watch the time for you. Oh, I've seen – oh, it will be nice. Should we make a start and allow the latecomers to straggle in? We are somewhat a little bit over time, we should be starting at 11:05 and it is a pleasure to introduce to you my colleague of many years standing, Dr Vijay Reddy. We first met at the beginning of time in 1991 in an NGO where we were both were working at the time and we have stayed involved and in touch in many spheres since then. Vijay is an executive director in the HSRC and has been heavily involved in understanding education measurement and strongly in the maths and science field is the editor of a book called *Matric Matters*, that was you? Well, but it is still there on the shelves. So Vijay is going to speak about attitudes to science, part of the puzzle to improve education achievement. The floor is yours and enjoy.

DR REDDY: Thank you very much. Sorry, Michael, I should have said that I have changed the title of the presentation. Sorry about that. Before I start the presentation, I think with many people here I have relationships of about 20 years because of the maths and science field, and working in the maths and science education and research and it's great to continue that relationship. I also, I didn't make a point, Carina, I think so, yes, didn't make a point, any comments at your presentation and I really appreciate the presentation, I thought it was excellent. And my question was going to be as you did the various activities and science communication engagements and activities, was one of the categories about how you communicate science over dinner? And I must say it was one of, we had dinner last night, and it was a wonderful occasion in that two hours or so and you have kindred spirits and sharing the ideas and so it was a, yes, and I hope, Thomas, we can change something on the National Treasury Guidelines about dinner. That goes there. And I must say to my friend, where is Isaac? Again somebody of working over 20 years with him that I have promoted the National Science Week very well, because he had taught Isaac with this. Okay?

Now, a couple of things changed since I sent the abstract and this morning when I thought about what to say in the half an hour, I thought I want to just take a broader view than the abstract if you'll allow, but part of the abstract is included, to look at attitudes to science and the views from public and a slice, and I will tell you what I mean by the slice in a minute. It's there. In this presentation, Michael, I think in earlier versions of your programme, I think you had something about that I would do something about evidence-based something and research, and I remembered that in my mind, and if I can declare myself upfront about why I wanted to do this presentation, and why, yes, and the line that I am going to push, and the line that I want to push is, I'm going to reflect on some of the research we have undertaken in the HSRC in this area. But more than reflecting on the findings from the research I want to strengthen the argument for funding for research in this area and that as we move in science engagements, it's important that we would do it from an evidence base. So I want to, that's my storyline on this one. And in terms of, as I said we want to reflect on studies, and again, does it need government to sort of direct one or do you, no, not does it need government, do you wait for some sort of science engagement strategy and then you say we start with this work? I think many of us have had interest in science engagements for a long time *mos* and again the terminology, public understanding of science, the surveys, the attitudes, whatever you want to call it, and Beverley and I have had discussions and trips to India on this and a couple of years ago SAASTA had commissioned a piece to say reveal what the work of science, public, I don't know what the right term we used there at that time, but science communication, a public understanding of science in South Africa and Michael Gastrow, Andre Swan and I looked at what was done. And it's not a blank slate as far as the research was concerned. There were surveys undertaken by the then FESTA organisation and Purus and papers by William Blankley and the HSRC used to have these surveys now called the SASAS, the social attitudes surveys. South African social attitude surveys and the precursors to that was the omnibus and the e-pop surveys. So there has been bits of items throughout and we tried to pull all of that and what we then did, was to say we should just, let's go ahead on the, from our own beliefs that this is a very important area, and put in 20 items a year around public understanding of science into the SASAS instrument and Isaac again supported the last, the 2013 one. And I think we have been building up a body of research around these areas. It's not consolidated, it's not coherent but, and I think things start off that way and it's okay. And so I want to share some of the

findings from the public attitudes of science survey and that will be public and we will give you the overall bits.

The other study that we undertake at the HSRC and I lead, is the trends in the international maths and science study and that's about student achievement in maths and science at the Grade 9 level. For the advertorials we've just produced the report on this and you will find the electronic version is at the HSRC, it tells the analysis of the TIMSS data. Now, of course TIMSS is traditionally known for about learner achievement. Now a part of the, in the instruments that they have and part of the background information, was to find out about learner attitudes to school science and maths. And so we, I want to reflect on that but then I see there were a few questions around school science. We have some publications that are directly related to that and again for the DST we're just about finishing a, the analysis of the 2013 SASAS instruments, which was science awareness attitudes, and we had a module on astronomy there. We've had a paper, Michael, Andre and myself, in the South African Journal of Science on public attitudes to science in South Africa and that reflected on the 2011 SASAS, I think. And then recently we have a paper on attitudes to science and part of the puzzle to improve education and achievement in, oh, I forgot to put the, it's the Africa Growth Institute, no, it's Africa Growth Agenda is the Journal. Yes, sorry, I forgot to put that in there. So we're building up a body of knowledge to consolidate our understandings in this area. And as we are building up this, part of the debates that we are having and that reflects our positions on this debate, is and we use the word science in society, and of course the word that comes first is the dominant word. Or is it society in science? And I am just going to raise that and I see Carina has also used the word and Michael, I think, first also, we've used the word bidirection, or this relationship or the dialogical relationship. It is dialogical but it still depends which word comes first. Scientists would say science comes first and is it science to influence society or does society also influence the science that is undertaken? So I think that in itself is a debate.

We also when we did the review for SAASTA and said really, we can't talk about a public understanding. We actually have publics, because there isn't a homogeneity in the country and so we need to have this notion of publics and equally as we develop different strategies of framework, a one-size-fits-all might not be the appropriate one, and one needs to have an understanding of why you want to do something and which are the groups that would be involved.

So the kind of nuance and stratified sense of the different publics is important and so if I'm choosing two, I'm choosing the general public or rather not I'm choosing it, that's the data we have here, but the general public through the SASAS instrument and the Grade 9 students who took the TIMSS test as one of the publics in the country, but it gives you a reflection of something.

So the first thing I want to do is reflect on some of the findings from our public attitudes to science through the 2013 or through the SASAS module. And I'm not going to go into details with this, but Thomas I did remember to have two slides on methodology, that's even before [there is] a question about methodology. Because it's important for you to anyway, so SASAS is a public survey, it's a household survey and that's undertaken every year and it is administered to 16 years old and above. And they have various modules in there and in 2013, 2 739 adults participated in the survey. And the data was stratified, it's a stratified sample, it is weighted on the census data and in addition to the items above, public understanding of science, there are background variables of social cultural demographical data.

So we had, this is the 2013, we had 30 or 40 items, 30 items that were there on various aspects but there is one item which is called the promise reservation index that appears, it's a, it's used internationally so one can also have some comparability with this. But it was, it is a measure that we had a few other times. So I want to reflect on the public's views on a couple of items about the promise, that's the benefits of science and their reservations and the risks of sciences here.

In this, this is the sort of seven items that constitutes the promise reservation index on the left hand side by the statements and R is, it is a reservation that they have and P is a promise. We had these, it was quite serendipitous that we found the data, it had been administered in 1999. So we had a sense of how, so the top, the top most bar is the '99, the second bar is 2010, we had done that and again in 2013. Now it's interesting to see how the public views science and what kinds of changes have occurred through time and then the next question, of course, we need to ask is do we want these attitudes to change?

What do we want? And I will come back to this point of what does one do after measuring attitudes. This is one aspect of the measurement, but what do you do thereafter? From the first item it is about two thirds of them think it's important for them to know about science in their daily lives. So whatever they might define science as, I don't know, but it is still important and there's still, and I think we need to see this as a positive. So it's not a rejection of it.

In the second item you would see that a concern is being expressed that science makes the way of our lives change too fast. And there's a big change from '99 to the 2011 and it stabilises on 2013. So, of course, we all experience this in terms of the information technologies and how fast one needs to go. We depend too much on science and not enough on faith. And again the interesting part is the trend and the changes. So in 1999, 42% said we depend too much on science and not enough on faith, but the concern increases in 2013 in that 56% are saying, and if there is a, of course we need to do further studies to see why this is so, but something has changed in society and the role of religion and faith, etcetera, might be playing a part in that. Again the benefits of science, number six, the benefits of science are greater than the harmful effects, 60% of the population thought the benefits were there higher but it drops in 2013 to half the population. So this is part of the attitudes to science and if my plug-in is going to be around this, and we come back to this again, is that somewhere within this science engagement strategy and one thinks about research, we also, as we have various interventions to improve the relationship between science and the public or the public and science, we have to measure the views of the public about science and we need to design a national instrument. We'll have to decide what's going to be there, and we have to administer this periodically and again some decisions need to be made, but the empirical basis for decision-making is very important and this is one modality to do this.

We also asked the population, which of the following science and technology developments are you most interested in? Not unexpectedly, they were interested in medicine, because it's something that half the population is interested in, in medicine, because they experience that. And the lowest interest is in nuclear technology, astronomy. Humanities, I know this is a big concern, they might not, maybe it's, are trying to understand what it means. But, for example the astronomy, at first when I looked at that, I thought wow, there should be a greater interest in astronomy, given either the public relations around the SKA has not been good enough, but if we look at European countries as well, we found that the levels of interest on the specialised areas are similar, so it's not way out on this. But again, if say nuclear power, I thought that might be more, and as we look to nuclear power, and so how do we then ensure a greater interest in, or not an interest, awareness, knowledge, so that there is an active citizenry involved in the decision-making about this.

Another question that we ask is that if we are looking at science engagements and communication, I will go very quickly over this, because Michael is going to pick up this on this slide as well, because you need to know how do people access information because if you're trying to communicate, you need to work out the channels of communication and of course television and radio are the greatest in the public spaces, it's very low at 14%. I mean, public spaces for science engagements are very much urban area linked, so we need to think about if we're investing in the public spaces, how to ensure maximum leverage on it.

We thought it would be very interesting to ask the question as well, for this public what did they think about science in schools? And remember it's a population that goes from 16 upwards to everything. The science I learnt in school has been useful in my daily life, so one third, and the science that I have used in my job is one third, jobs in science are very interesting. So while they might not have 60%, so there's still a certain aura about science and scientific engagements. Studying science will get you a good job, about half of them and we thought we had to put in this question, science as a career suitable for women and I think the South African population did well in their responses. We just wanted to test that out.

So that's the one area about the attitudes to science and our measurement. The other study that I want to reflect on, is Grade 9 learner attitudes to science and who participated as I said, in the TIMSS study and it's undertaken every four years. In 2011 we administered the maths and science instrument and nationally represented 285 schools and close to 12 000 learners in public and independent schools. I am not going to report on the achievement. You all know we did very poorly and we have come to the bottom of the pile. I'm going to reflect on the set of items that they asked about attitudes to science and

there were 21 items, and these 21 items could be clustered into three main areas about enjoyment, and the set of items on enjoyment refers to the intrinsic motivation, I like it, I enjoy it.

Then there was valuing science and seeing the utility value of science. Will it get me a good job and what have you? And the self-confidence, how do you feel about learning science? And we wrote this paper where we tried to look at what were the views about the attitudes to science, but we also wanted to link it to achievement, given the poor state of science and maths education at the schooling level, and you've mentioned it, and you've mentioned it and everybody else mentions the schooling system is the basis for which you can talk about anything else and we have to get that school a basic education right. And so we were looking at the relationship. Is there any relationship between attitudes, that's the non-cognitive and the cognitive aspects. And I want to reflect on that.

But just as a reality check, just looking at the schooling system pipeline, what we did was if we take 2014 as the matric results last year and there we have about half a million of kids write the Grade 12, and if you're just sort of trying to work back all things being equal, these people should have started Grade 1 in 2003. And if we look at that pipeline, if in 2003 the system had 1.25 million kids at Grade 1, they would have been in Grade, if they progress smoothly they would have been in Grade 9 in 2011, and at that point, this is a crude, crude measures, 1.05 million and then somewhere between Grade 9 and Grade 12, there is, something happens, 532 000, just over half a million and of those 500 000 or so, and because we're interested in kids that will progress to post-school education and training, and you want to look at those that perform well. 150 000 achieved bachelor passes. And if you start off with your 1.25 million, 150 000 of 1.25 million, you work out the maths, this is your maths test as well to see how well people's maths literacy is, what percentage are those that have these bachelors passes to go further?

And also if you look at those bachelor passes there's a wide variety, it's about 80 000 that pass with over 40% in mathematics and 60 000 with over 40% in physics. Now I know that the requirements at universities for the science, maths, technology is way above the 40%, but if we do that it just, you won't sleep tonight with the numbers, so that gives you a sense of the schooling system pipeline. So the interest in terms of improving that pipeline, improving at this Grade 12 level, both participation as well as quality of passes, is what interests us and in terms of looking at that, we've looked so much in terms of the cognitive areas.

There's lots of work about teachers, how terrible they are, the textbooks, the curriculum, everything else, and if we look at the emerging literature, it reflects and it refers both to what are the cognitive aspects about learning, and there's lots been written there, but there is a non-cognitive dimension as well. The issues of motivation, attitudes, values, interests, etcetera, in order to produce this desired educational outcome, and we are sort of pushing the line of we need to concentrate both on the cognitive and the non-cognitive, as traditionally we only concentrated on the cognitive.

And again if we look at the literature, we don't know the causal link between the cognitive and the non-cognitive and at this point it is a bidirection. Is it that people perform well and therefore have good attitudes? Or is it that they have good attitudes and then try to perform? So that debate is still out in the open and there isn't any conclusive evidence around it, but I think that it is important to pursue it. But what we do know is that the evidence is that these involve both the cognitive and the non-cognitive. But you could work out a kid's trajectory by 6, their performance say at Grade 3 level will tell you what their performance in the schooling system will be throughout. You can, the predictive power of maths performance at Grade 3 level is very strong to predict what they will do in matric, what they … want in matric, what's their post-school education opportunities, what's their life opportunities. And it's very difficult to play catch-up, unfortunately. I know we try lots of things, we have to keep trying these things.

But somehow the non-cognitive is more amenable to change. So we know that from the literature as well. And so social policies, if we can sort of get to know more, we can improve the social policies that focuses on attitudes and could contribute to improving the achievement. These are, I'm not going to read this, but the 20 items which we had in the instrument to ask their views about science and do you like science, in general you'll see the enjoyment sector on the top, pretty high, they valued science highly. I'm glad that this result is low, but their confidence in it is quite low. Because I do think kids need to have some modesty about what they like and they don't like. It's interesting if you look at the international

literature, how kids, all the kids that performed the poorest, love maths and science the most, value it the most and the Japanese and the Singaporeans and the Chinese who perform the best, hate it, so I don't know which is better, but I mean kids commit suicide. Quickly to say to you we trusted the items to say what's their enjoyment value and confidence in maths and science, so enjoyment was at about 41%, their valuing of both maths and science is quite high, although mathematics three-quarters of the kids saw the high value and the utility value of mathematics, and lower for science and their confidence levels in terms of learning it was much lower. Again as Michael says I've got five minutes, it's important to also look at it in terms of other countries, and I am not going to do that. And then we looked at what's the relationship between the enjoyment value and self-concept by achievement scores? And those that had a high enjoyment, it appeared, had scored the highest. And valuing, there's not such a strong relationship between valuing and achievement. Confidence, those that had high confidence performed better. So that seems to be a better indicator.

What we then did was to undertake some regression analysis controlling … schools, etcetera, to say so what is the effect of enjoying science more on achievement? And found that if we could improve the enjoyment of science by one scale point, we could increase the achievement, in TIMSS points the total is about, is 1 000. You can increase your achievement points by 24. Similarly if we could increase self-confidence, as I said it is bidirectional, so, which comes first? If we increase it by one scale point we can increase the achievement by ten. In terms of the valuing there wasn't a relationship impact, it was a negative relationship. So in terms of looking at both the studies, what are the main points to make here? I think that South Africa is ready and ripe, but the time to, like we have the various instruments to measure R&D surveys or achievement, we need some sort of survey that periodically, three years, four years, five years, I don't know, but to have some sort of measure of attitudes to science and it's finding the appropriate instrument for us. But I think we also need to move beyond the measures and my particular interest at this point is, how do you change the attitudes? And what does it need to change attitudes? I'm looking for social psychologists to work in this area, Cheryl, so I haven't a clue and I'm going to talk to you about this, but the only theory I know is Argent and Feinstein and it comes to, it is quite dated I know, and some people are saying look at identity, but we need to understand better, what does it take to bring about attitudinal change?

We have, I mean if there is a National Science Week, if there is all these other places, we need to strengthen those spaces to encourage enjoyment and that might be not only those physical spaces, I'm always looking in terms of TV and what can I, I mean, the media as a kind of instrument to improve the enjoyment of science and, yes, for the schooling system again, because our performance is so low and we have an absolute obligation to ensure that that schooling system is strengthened, not only from a moral or ethical perspective, but just from the sustainability of the whole systems, but we need to focus on how to, in a stronger way, to encourage the enjoyment of science and build students' self-confidence. So I think, Thomas, as you go to the National Treasury to say we need to make sure kids enjoy the science more and they are going to ask you so what, enjoyment is not part of National Treasury's thing, but I'm giving you the evidence now to say that it does improve achievement. If there is anything that can move National Treasury to look at their budgets, is does it have an impact on achievement? Alright? Thank you very much.

PROF KAHN: Well, thank you. That certainly gives one plenty of food for thought. TIMSS is a very powerful instrument. It's been deployed in our country over 20 years. Vijay?

DR REDDY: Yes, 1995

PROF KAHN: Yes, so it's a 20 year period. There've been points where government has declined to participate. I think we're back in and we want to learn more about what's going on. There is also the, what do you call the thing? The annual assessments?

DR REDDY: The national assessments.

PROF KAHN: ANA, the national assessments and you get very interesting stuff coming out of this which has a bearing on all forms of literacy. Not just scientific literacy. Maths literacy. We have a subject for the foreign guests called mathematics literacy whose existence goes some way to explain why there is such a

small group coming through with the matriculation exemption pass. And we have whole issues around language literacy. And we do offer instruction, so there is plenty to think about and plenty of questions for Vijay. Over to you. I see one, I see two, I see three, beg your pardon? And thank you for that. One in Cape Town. Brilliant, let's start with Cape Town just to show that we are not prejudiced against my home. Thank you, go ahead. Introduction? Microphone.

MR X7: At some point in … or science public interface, we should flag the … of nine historically disadvantaged languages. I read that the nine language bureaus have indicated to translate nuclear physics terminology into all the historically disadvantaged languages, but we surely [unclear 0:32:41] to the rest of science and in particular there are no science textbooks in school from any grade up to Grade 12 that are translated into the disadvantaged languages.

MS X6: I have no formal science background, so this at times is sort of over my head. Having said that, thank you so much, Doctor, for your presentation. It's really insightful to just be reminded of which science and technology developments kids are most interested in and also to remind us of how the public view or accesses this information. I'd like to reflect on the Grade 9 student attitudes study that you did and I think it would be interesting to find out or to note whether these students have been exposed to any science outreach or science advancement initiatives and then just to find if there's a link between the work done by outreach teams and the uptake of science and technology students? Thank you.

MR X8: Just a comment on the composition of attitudes towards science. There is often a search for reductionist answers from these types of data. For example, are attitudes positive or negative or are they going up or down, but the more you look the more complex the data is, because it is describing a complex phenomenon. So attitudes towards science ends up like attitudes towards fire. It's something that can hurt you. It's something that can help you. It depends on your level of fire management technology, it depends on your experience. So in the data at no point do we find something that's simple or simplistic or really follows a well-defined pattern. We're talking about a fragmented set of attitudes that change in different directions and every country in our international comparison has what we call a different fingerprint that represents the specific local attitude that vary along a range of dimensions. So I just wanted to emphasise the complexity of the data and that should be taken into account when it's used.

DR AUF DER HEYDE: I have got two small methodological questions and then just one observation. There was one, the questions about the area of interest, climate change and medicine and further down astronomy. I was wondering whether you ask this as an open-ended question or whether there's a checklist, okay, open-ended question. Second one, checklist, okay. Second question was the fact that 66% of respondents felt science was a career, viable career for women. How did that disaggregate according to gender? If you happen to know. If you don't right now, it's fine. And then just the last point, I did a back-of-the-envelope calculation once where I calculated the amount of learner hours to which our, to which all the youth into science and science engagement activities that our Department of Science and Technology sponsors, calculated the total number of learner hours for which students or scholars, pupils, are exposed to and I calculated that as a fraction of the total annual hours spent by kids in school. It's not even 1%. So, and this is the point I've been at pains in making in the department, that no matter how effective our interventions are, they are not at scale. They are not going to change the dynamics of the system. Now this is not an observation that's meant to discourage anybody. On the contrary. What I would want you together with the other researchers to start thinking of, is seeing these really as laboratories. The range of interventions that, Isaac, where has he gone? I don't know if he's still here. He's outside, Isaac [unclear 0:37:40], to use those to see them as laboratories which we can, as pilots as it were, where within a constrained environment you might be actually able to develop some causalities and understand them better. It is probably you're doing that already, but to really emphasise the point that they must be seen in that context more, than as system level game changers, which they can't be.

MR X9: I was very happy when you said that it's not public. It is publics. But maybe you have done analysis like Thomas said that one has to go to disaggregate levels. And the barometers that reflect why certain attitude is being reflected in the aggregate need to be analysed. But your presentation here doesn't say anything about publics. That is point number one. Point number two is that, yes, you have percentages in terms of how many people said X or Y thing which is in favour of science. Now as an activist, or a policy maker, both, I would be more interested in the attitude of those people whose answer

is not reflected here. 60% of people say science is good or they are interested in mathematics. But what is the attitude of those people in terms of whatever response they have given, who are not reflected in that bar chart? Otherwise it becomes again deficit model analysis.

PROF KAHN: Thank you. I am going to ask Vijay to respond and then we will take a very quick round because time is pressing. I just want to give you a cheeky answer to your question. And that was somewhere round about 1994 and the run-up to the first elections, addressing a very large public meeting arguing for compulsory science and maths in schooling all the way through and a young man stood up and said we don't want it because some of us find it difficult. There you are.

DR REDDY: Quick responses. The story about language is a very important one. All I can say for this SASAS instruments, the instrument is translated into nine or ten languages. It is administered with the nine languages or ten languages, I can't remember, Michael. But certainly it's a challenge in terms of having a valid instrument because how do you take certain constructs that might be in the English language and do enough research to find out how a recipient will perceive what you are asking? So that we tried to do.

Let me see if I can remember the questions. The question about the link between outreach, where there were outreach programmes and performance, we couldn't do that with TIMSS data because we didn't have that, but one of the programmes that the DST and the youth into science strategy supports is the adopted Dinaledi schools project. And in that data set we've got achievement data as well as a list of interventions, like whether there's science Olympiads or, you know? And we're still in the process of analysing that. But we don't have that, but those are important questions.

XX's point was a comment and I just want to emphasise that point, because even in our paper we say it is about a fingerprint and you've got to decide how it's got to be. Sometimes I forget things as well. Yes, the areas, it's a checklist and I think it was a, because therefore, and the checklist, so we didn't ask for a single response as well which would force somebody to make decisions on things so he could respond and that. And, yes, the role of the DST in all of this, and through the youth into science strategy, you are absolutely right, it's about a laboratory. Because nowhere else are these things happening, of actually looking at the out-of-school activities. The Department of Basic Education is focused on in-school activities, curriculum, teachers, textbooks.

And while the DST has the agenda for excellence in science, and I think that there's no other government department that is looking about science for the whole public, because the, and it is through initiatives like going through SAASTA for the public or the out-of-school activities experiments of the youth into science strategy that I think we can learn far more about all of this, because our position for achievement depends on both the home and the school. So you cannot leave everything to just the school and the intervention in the school, so having that broad, so I think the learnings is what to do on the broader one.

I didn't present all of it, but we try to disaggregate by living standards, measures, age, education, gender, etcetera, and it's necessary and both in terms of the SASAS and in terms of the TIMSS. That is there, and I think if you asked me, Thomas, about gender. Let me see if it is here or not. I can't remember but it's certainly something that, no, we don't seem to have. I think it shows, there is something in the text here, but I can look at it there and let you know, but the data sets, again the data sets are all available and I hope people are interested to undertake further researches.

MR X10: Maybe just before I ask my question, I'd just like to put in a caveat to say that I actually value the work of SASAS. It seems to me in order to improve the role of science in society, we actually need to move beyond an exercise in merely reinforcing priorities. We need to challenge our preconceptions about science in society. So I think with your public attitudes to science, your question and so forth, perhaps one needs a deeper interrogation of the social connections that people have with science. What do they, and moving beyond just what they think and feel about science, but also what their understanding of science is, what do they know about science, but I am not talking here about testing someone's knowledge in an IQ test, but just their perceptions as well. Thank you.

MR X11: That's a very fascinating presentation of things. This is just a slightly off-centre question and it's quite like my previous one really, is there a radical difference between public attitudes to science and learners in Grade 9's attitudes to science, from the attitudes towards learning and knowledge in general?

MS X7: Sitting here I was reminded that in another life I was a methodologist and a social psychologist. So it's actually very good for me to be here today. The results that you presented on your first study, I actually wasn't that surprised because I think it's reflective of certain other research results, even though it maybe have nothing to do with the issue of science and public participation and the public's knowledge and understanding of science. The one question or maybe before I come to that, for example the answer that it showed that it was very high, the issue that the public supported that medicine was important. Now when Thomas asked about how you collected your data, I mean, you answered that and I would assume that medicine came out high because the public is understanding the question in relation possibility to quality and access to health care. The other one that came out very higher with the, from 1999 up until your most recent study, is the public that is seeing or reflecting the fact that faith should be more important than science. And that mirrors a conservative discourse and ideology that is coughing up a in a range of these, but for me that is very, very worrying and we need to understand how do we intervene. You make an important point at the end that these studies are important and I agree with the issue of social laboratories to assist with the theory and the interventions because the issue of attitudes and how we understand and measure attitudes, is very, very complex. And 10, 15 years ago within psychology, in social psychology, there's all the literature that it's beyond attitudes and it's about discourse and ideology. But having said that, I think it's really important that social scientists and social psychologists start working with you from the universities to build on theory that will inform our policy and intervention, because I think that the theory is also lagging behind from psychologists and, not only psychologists, let's say social scientists.

The point [made by XXX] is important and I think that is why UKZN, we have embarked on the language policy in terms of this issue that we have, because it is reflective of that kind of discourse and intervention. Thank you.

DR REDDY: I don't necessarily have to respond. I think they were very interesting comments that were made. I like the idea [mentioned] and the social connections and Michael is developing an instrument now for a study on public understanding of biotechnology, and I think that is going to be very, the most critical part of this study is getting the right instrument. You can, and I think, and that's something in the next few months, we're spending a lot of time to validate this instrument and the notion of social connections is also going to be important in that. In terms of the attitudes of the public …. and one of the publics that we have there is the 16 to 19 year olds, so we have on each of these items a disaggregation by age, so one can put that composite set of attitudes and map it against the other one. It is something, I think what we found is that the attitudes of the younger age are more positive, and it kind of goes through a dip and as people get older there is again a belief in the science, but the sort of middle years, and if even education levels, most of these things have a kind of a, that trough at the very young age or lower education, or no education and very high education have similar kinds of patterns, but for different reasons.

I think that is, and yes, I really think that this whole, I mean like I said I am a big believer on the SASAS, I don't think we have used it enough, but I do think that we need to work far more with social psychologists and what does this all mean and we have to in terms of undertaking the service, have to move beyond the measures.

Operational Prospects for Implementation: A Tactical Reflection

Dr Beverly Damonse, Group Executive, Science Advancement, (NRF).

PROF KAHN: … let's go to our final input before we go for lunch. We are a little behind time but I am sure we will manage. Let me introduce to you Dr Beverley Damonse who, among other roles, was the head of SAASTA for many years before assuming an executive management position in

the NRF where she could look back at her child perhaps and, Beverley, the floor is yours. Let's go for it.

DR DAMONSE: Thank you very much for this opportunity. I think the conversation is going to swing a little bit now, because when Michael, I think towards the end of last month, maybe December, contacted me about the session, I said why? You know, I got the hardest part of it. Because I am part of the group of doctorate students who came through Jonathan Jansen's policy study and if there is anything that we knew at the time of the meet is that a disconnect between policy and practice. And basically that is the situation we find ourselves in. Thomas talked this morning. Talked to a framework, a strategy as we have it which assumes the most policy-like interaction in this particular space. How, what you've asked me to do, Michael, is to look at possibly what are the issues of implementation? I don't have an implementation plan that I am going to put on the table right now because the level of details might be required in that and the thinking through of that is at another level. But what I do want to do, realising that we have this audience here, is to put out some thoughts of where we are thinking and what we have to think about, what we have to deal with and then hopefully you will be through the discussions, the ones that start to help us with what we are looking at. Carina this morning had a very interesting talk and also in abstract, talked about ambitious goals. And if you look at the cover of this or this slide, introductory slide to my presentation, with ambitious goal than what is out there, really out and along critically engage and public or publics, as we heard it come up this morning. And really what that means, how we come back to measure whether this is actually what we have, are all part of thinking through an implementation and so the gap between the ambitious goals and the actions that will be put in place to support the journey towards that ambitious goal is what makes up an implementation process as I understand it, and I see it as a process. Really not as a concrete, once-off type of plan, paper-based document as it were.

So I will just really highlight some of these, and one of the starting points and this slide I just want to put on the table simply to acknowledge that we are not starting from a clean slate. We have an active engagement community. We have a department that has supported it. We have communities, we have networks that have been created and this is just a very small reflection of what is already seen to be a very active community of engagement. Whether it's in all the different connotations of the word that was used here, but we are starting from a base that says there is something going on, just I think as Michael mapped what's happening in the social sciences, we can say exactly the same for the science engagement field, that it is an active community and things have been done and we need to use that as a starting point in moving forward. Sometimes it's easier to start from a clean slate, and other times not. But what we have here is already some significant level of activity and thinking around this particular area of science engagement. I want to go back to the framework intention. And I am looking at it as I was asked to from an implementation point of view. What would be the intentional from looking at the strategy from an implementation point of view? What would we go back to look at as the intention? And I have listed these as I have seen them and the first was to systematise collective efforts of multiple role players. And that is exactly what we have. We have multiple role players working in just about every different part of the system at the issue of engaging with the public in various ways, but up until now, has not been in any ways clearly systematised. And what the framework is trying to do is to bring together these different role players in some way that starts to allow us to measure, allow us to work more effectively, and definitely in line with the second one is to improve coordination. And I really want to point out at this point that coordination does not mean centralisation. And that's important to understand that. Because I have this conversation with people and they say you're just trying to get everything under, create a little fiefdom, as it were, under your godchild, SAASTA. But that coordination is really, that's not the thing. Coordination is not centralisation. It's really how do we start to get maximum benefit from the system in terms of the science in society interface. And so it's important to understand that in your mind don't conflate coordination with centralisation.

And obviously the next two speak to what we've been speaking about all morning, this issue of encouraging the promotion, the communication and actually fostering this valuable science

engagement that's more extensive than one-way communication, but the issue of dialogue, the issue of critical engagements, these types of things become important and then this one is a constant criticism that the framework would have to try to address, is to improve the balance in the portfolio of activities. If anybody knows a lot of what we have been doing in the system in this area, it's been seriously geared towards the natural sciences and seriously geared towards our major technology strategies that we've rolled out. So we can very quickly point to a public understanding of biotechnology, nanotechnology in energy. We are talking directly to something even more specific. We are talking to fuel cell technology, and so these would be the ones that have captured the funding and captured the public mind set and captured our attention in terms of what has been rolled out and always I will get from the social sciences and humanities, so what about the portfolio of conversations that could be taking place that are so relevant to the science in society interface and all you do is bring more of? What's the next thing you're bringing? And so this balance in portfolio of activities needs to be addressed as well.

I think you saw some of that in Vijay's slide as well where she knows that there is these technologies. There is conversations, there is things around energy and yet the idea of nuclear sciences, astronomy investment and what you saw, but as you have also heard, there are other contexts behind that particular analytics as we start to talk about it. And then the framework starts to talk about enhance collective impact. We have all worked either at your institutional level, your department level or, we have individual scientists themselves in institutions that are doing this work unacknowledged, but really doing good work at the coalface, through their research with their research students into the communities where they are, but there is no way in which we are able to pool together collective impact, because of the way in which the system, the funding, the activities themselves are really activity-based as opposed to broader programmatic, long term thinking and tracking over time.

So the framework intention, as I understand it, has it really been to try and address some of these kinds of challenges in terms of what we are going to do, going forward? If we look at the scope. When you, and I called it scope, but when you look at just how broad we intend to work, all the players that I have mentioned in that particular framework, it goes beyond the DST. Actually it would be quite neat if it was the DST. And I think, and that's where we're, we may be functioning in that level right now. DST and its entities, it's still difficult, but it's manageable. But you can see that would just cover the first two. And if you go right down, the strategic partners that are going to be able to help to move beyond this, means that the scope of this particular framework is fairly broad. And just how deep we go into addressing that is something that we will work out as we go towards implementation. But you'd have to see that this, when you start to think about coordination and that word comes up time and time again, just how possible is it, are we able to coordinate?

My own experience in the NRF in the position I occupy right now is, it's not so easy to even coordinate within your own institution and right now I need to coordinate between SAASTA, a facility in the nuclear sciences, three facilities in biodiversity conservation and environmental sciences and all of the astronomy agency. And that's it. For communication and science engagement in that alone, it's quite a thing to manage coordination in a meaningful way that starts to give you collective impact. So this kind of scope in itself is something that we need to grapple with and we need to see from a national system how we are going to really in some cases influence, in others fund, in others cajole, in others really just work with people from a relationship point of view and all of those different mechanisms are going to need to be part of addressing the scope of this particular framework.

From an enabler's point of view you would have seen this morning there was talk about some enablers with a scope like that and those intentions. Part of what was talked about was this effective coordination started to be brought together and the coordinating body then becomes the important central core, the access around which much of this can actually be centred. Adequate funding came up time and time again. We had a meeting last month with some of the groups that I work with and the first thing they said, so where is the new money coming from? And we had that this morning as well. Where is the new money coming from? Where will it come

from? Sometimes there won't be new money, but we do think that there might be new ways of working in the existing system as well in addition to new money that would come. And then the participation, it won't work if we don't get the participation of the relevant stakeholders and the role players and then the establishment of a monitoring and evaluation framework. Because, these … colleagues you would also sure have heard the questions that came off the floor are the questions that sometimes the Minister poses to us when we go and present an annual performance plan.

So you are doing all this work in science engagement and you have all this money and the matric results are poor. And we are like, ooh. It's just not possible for us to be claiming that space. But that is generally where the thinking and where society's thinking is around the issue of science engagement. You must be having some direct influence to science and maths in the classroom and the next question is, so how many people are in first year university because of the interventions that we as a department or as a government have rolled out? And making these direct connections as you have said, is problematic. But it's a problematic that we have to deal with and therefore thinking through monitoring and evaluation and the research that needs to support the work that's going on, is something that has to be grappled with going forward.

The coordination spoken to, even though it's one word, coordination, I just wanted to outline for you what kind, at what levels this coordination is going to be needed. It was said that SAASTA is the national coordinating body, as it were, and I will speak a little bit about this, so at a national level you will have a coordinating body, which is in an institution, but at another level you will start off with what is called intradepartmental coordination. The department out of which this framework is flowing, is the Department of DST and let me tell you, that if you don't have intradepartmental coordination, that is within the Department of Science and Technology itself, not even outside, the rest of us on the outside of the department are not able to function effectively because it can sow confusion on the outside, simply because it would depend on who you speak to, where the money comes from, what you are asked to do, and sometimes in the past we have actually found ourselves as role players working against each other because of different messages, of different funding streams, of different ways of working.

So this level of intradepartmental coordination is going to be key in helping this rollout in terms of the kinds of change, and it is change that we are seeking. Change in the way of thinking, change in the way of working, change in the way of funding, change in really just thinking through what we are doing at this particular time. Interdepartmental coordination, currently I know at SAASTA they work with DST but they also have labour coming in at some stages, environmental affairs, you have different departments. And if we could get those conversations going, because each of those departments have their own science awareness, energy has its own science awareness programmes, communication programmes, water week, all these different kinds of things, so we could actually coordinate much better at that level.

Intergovernmental coordination between our, we are looking at areas of commonality between us in terms of both continental programmes and the international agenda and then the coordination with the science and technology research institutions. We don't have a mandate in the higher education institutions, as it were. But the scientists, the researchers are a key part of this particular framework. In fact without them a lot of what you need falls apart or doesn't, is not enabled. Being both the experts, being the communicators, being the interpreters of the information, they are key to this. And yet the coordination with these science and technology research institutions is going to be a key component of that. We know that usually when you get into especially the research institution, your leverage is funding. So if you have funding, then you have access. But we have got to be able to have access to that expertise irrespective of whether there is funding or not. And you can see how hard that type of coordination might start to be.

If I go to each of those four points that I listed, the first was coordination, and under coordination I have listed those types of coordination, I will just very quickly go to the coordinating body as it exists at this particular time. Right? As it exists because if you think of

the role premised for this coordinating body, then you have to think that it's going to have to think about its role very significantly. Currently it is a business unit of the National Research Foundation. Now some people, I certainly see this as a big plus, I mean you have, you are in an organisation that is directly connected to research in the country, access to researchers, to universities, to the science and to the workings of that particular system. Somebody else says, how do you speak outside of NRF? You guys are just too close to the system. It's kind of the question I was asking this morning, and so we stand right now as a business unit of the National Research Foundation. It is funded largely as an implementer of DST projects, largely, there is some other projects outside of that funding. But largely DST projects and so it's a high contract funding base. Contract funding comes with specific objectives on a specific plan and a specific set of funding attached to it. So quite rigid in that sense. Up until now it has also served a dual role, both as an implementer and a funder. And some people say how are you referee and player at the same time? Now these are the kinds of nuances in the system that have developed over time. Through its development and given the nature of the contracts, earlier years the focus has been mainly on maths and science education and that's just where the contracts came from, it's where the emphasis was in our system, the early stages of our system. So the larger support was for maths and science education either in the schools or for learners or career development or exposure to scientists, etcetera. But really the science communication awareness component is growing much stronger in recent years. It has its own website and develops websites, resource production, exhibits, it has infrastructure, project management, and is linked to the national facilities that remain as big, really good scientific infrastructure throughout the country with approximately 50 staff, many of them interns, volunteers and administrative staff and actually a small handful of staff that are directly linked to the content development of actual programmes.

If you look at that and you look at the kinds of intentions of the framework and the scope of the framework, then you got to know that the business model for this particular entity to become a true coordinating body has to be rethought. We have to rethink the business model if it's going to be able to service the kinds of intentions of this particular framework. And that is important for us to do and it's something that we are thinking about and will engage as we go forward. The funding model, currently if I just look and I'm just using the NRF, if I look at the NRF we are divided into five programmes, and if you see programme 2, that's the one that is in science engagement and we have 3% of the NRF budget right now. You would have seen that the new funding formula spoken about this morning says that there may be many sources of funding going forward, you might get funding through the actual line item science awareness in the department's budget submissions to Treasury, there is this top slicing at 4%. Whether it will be 4% or not, but that is what the thinking is right now. Is there top slicing within the DST themselves, from their own programmes and then are there new approaches to funding outside of contracts and how do we access public and then private partnerships? These all need to be engaged going forward.

Market segmentation talks to those many publics and how do you address? It's not a homogeneous plan. You don't draw up a plan that says this is science engagement for 14/15. If you look at the market segmentation as it stands right now, you are talking to higher education, you are talking to tertiary institutions, you are talking to communities. You are talking to industry. You are talking to science communicators. You are talking to policy makers. To the journalist community themselves, so market segmentation and thinking through the requirements that arise because of market segmentation is going to be an important point. And then monitoring evaluation research, I just think your study this morning, Carina, spoke to a point I had at number 1. We need almost for ourselves to start with an audit. Who is doing what, how, why? And your framework, your empirical framework, gives us something to think about in addition to maybe localising it from our own experience of our programmes. I was already doing some of that categorisation while you were talking and we could do something like that. I think it's really good for us to do something because maybe that's the baseline data we need to start with considering we are going to move into a first five-year period. The issue of performance indicators we are struggling with, I'm saying meaningful performance indicators. Right now we know which numbers, quantitative numbers.

You heard this morning about a survey instrument, the need for that. Visitor studies are important. Informal learning, attitudinal studies, long term tracking, media monitoring and analytics and there also skilled M&E practitioners, people with that thinking, the experience around, we don't have a large cohort of people skills within this particular field to drive this kind of. The thinking right now is to do a phased approach and actually a phased approach in three different phases, if possible, but even though I say a phased approach, phase one, phase two, phase three, some can run parallel. There will be intertwining, interlinking, but mostly is if you very quickly look at that, because I started off saying that we have a system that is active right now, there is going to be realignment before there is new. I think that is important. And while we are realigning thinking of what is new and how do we construct data, how do we start to look at baselines, and then this implementation and obviously consolidation and really at the end this full-scale performance monitoring and the actual issue of outcomes.

Now we have outcomes and then we have impact. We always asked about impact. But we are not even capturing inputs and outcomes at this particular stage and that becomes a difficulty for us. So even though we're getting there, we need to start thinking about now before we even get to a phase three. So those are really some of the things. I think we've got to change the conversation in science engagement and using some of the work that you do in customer centricity. These four points come to mind for me if we're going to really implement well and think clearly around change in the conversation. This coordination in the scope of this is really going to be about silo bridging. We function a lot in silos, as institutions, as departments. You hear often about silo busting. But really silo busting sometimes is not possible. The intention is not to bust anything and build something new, it's trying to, how do we bridge these silos between all of us and start to make that communication possible.

Besides the bridging we need shared goals. We're very much on our own organisational or individual goals right now. The framework starts to bring us towards shared goals. And shared goals require a certain attitude, right. If we are working to the same thing, if we are thinking research now, the HSRC is sitting here, they are thinking well that might be a project. I am thinking I need to be in that conversation, but we need to draw in the people in that research group, it's bridges that are being built and shared goals that starts to bring us together.

I think the capability in key areas needs to be developed. All of what we are doing is not possible in all areas because of resource development. Human resource development and capability. And then the connection. We spoke about societal connection, connection at various levels. I think if we don't make the connection between the partners, and blend the partners' offerings, instead of each of us coming to the party with separate offerings, then we're really not going to address both intellectual – and it's a mind thing. It's intellectual conversation that needs to happen about the change. Structural organisational architecture sometimes can be a barrier and then there are emotional barriers. Emotional barriers to my project, my way of doing things. My way of how the system ran before. I think those are the barriers that need to be addressed if we are going to move forward to implementation that is long term, but is also going to be meaningful. Thank you.

PROF KAHN: Thank you very much to Beverley Damonse for your passion, your passion, terrific. With that sort of energy anything can be solved including answering some questions or addressing some comments. From the house here at the back, Carina then. Any other offers? I see one. I see one. Cape Town, anything to add? Nothing in Cape Town. Let's start then with you. Thank you.

DR CORTASSA: Hello? Yes? It's okay. Well, this is a question I was, I wanted to make to Thomas earlier this morning, but I'd like to make it to you. Which ones do you think would be the critical points for the implementation of the plan?

PROF KAHN: So our energy levels have declined just a wee bit, so I don't think the intellectual levels have declined at all. That can't happen. Allow me to put one in and stir the pot. There is one, there are two terms that I haven't heard mentioned at all. Maybe I have been drifting. The

one is accountability. Where does accountability feature in the whole science engagement venture? And the second one is related to that, and it is the whole question of the social contract between science and society. It's been implied but it hasn't been made explicit. So I would put to the house to think about over lunch. What is the nature of the social contract between science in society, in contemporary South Africa or Argentina or Chile, or Rwanda, or Botswana? Who is driving it? It may be explicit, it may be tacit. My assertion is, it's there and a failure to recognise it, can prejudice this entire venture that we are engaged in. The sociologists know a lot about it. The psychologists and the philosophers and it's not something new. So I put it to the house to ponder. I'm not looking specifically at xxx to provide an answer to it, but personally I think it's something that we need to think about. And if there is anyone else who has in interjection, let's hear on that or anything else.

DR DAMONSE: If I go back to the question, your question of the critical parts, I think if I tell you that the critical part for me was even before this stage, was actually to get to this stage. We really, really struggled to get to a point of getting a framework. And not necessarily because of a lack of will to do it, but allowing the critical issues of understanding the beyond, let's say, corporate communication. Beyond organisational reputation, or organisational branding, etcetera. The whole issue of science in society in itself, whether it's through the conversation as a social contract, that in itself was a difficult conversation to have and to drive and champions to drive it. For a long time this has been on the marginal fringes of the main work, if I could describe it like that. If I speak of the late Dr Mike Gaylard, for those people who know the astronomer, he passed away last year. He used to say you do something, he started an environment where you did outreach under the table. You took, you stole money from, not stole, but you took money from this budget, and you took money from that and if there was enough, you would do it. And getting the movement from margins to core conversation has been the most critical movement for me in terms of where we are right now. And this is a very different space to a conversation, even in your time Michael, early days at the beginning of SAASTA, 10, 15 years ago, so I think that's where the big movement was, and that was critical for us. Going forward I think things like funding, etcetera, need to be really thought through, but I think even where those become available, the mind-set around this particular way of working, of what we want to achieve is going to be, it's really a different area. Communication, it's more directly connected to hearts, minds, that type of engagement, some level of [unclear 1:26:29], but other levels of critique and in terms of attitudes, if we're doing science engagement well, the attitude should change and they won't always necessarily change positively. People will become more sceptical, will ask more questions and may not like what it is we're putting out there, but that may be an indicator for success.

So that change, those kinds of changes in terms of how we measure ourselves and, I think, and how we measure success in this particular field is going to be important. Obviously the question of impact, I don't know if we don't get that right how to measure it, how to tell the story of it. I understand even in international communities that's not resolved as yet, but it's still a question we have to grapple with and it's a question that comes to us daily. The accountability, the accountability up until now is necessarily, we have just spoken about, let's say business accountability, which I am almost sure is not the kind of accountability that we are talking about. And it also links definitely to an understanding of the social contract.

In terms of the nature of the science in society interface up until now, we come from a, in the democracy in the way of the country developing, we came from a very critical dialogue engagement, activist, protest type of environment which understood that particular, and we had some of that in terms of the early boycotts of science, when the international community boycotted the science in terms of understanding that link. But I think right now, in a lot of the areas that we worked in, the science in society relationship has been defined by this expert, the scientists as the expert and then the public or the society as the one who needs to receive, who needs to be educated, who needs to have something done to them. And that I think is still a large part which is very different from an activist kind of relationship between science and society. I could be wrong, but that would be my initial answer between the summing of what I, what we have had to encounter as this relationship between science and society.

MR X12: This is just a comment, it is not a request for an answer, but just to reflect on the high level of difficulty in constructing an M&E framework, just from the conversations today it's clear that it will be difficult to apply a logic model or to define a theory of change or for that matter have a coherent set of outcomes and outputs and what is the impact? That's a whole bucket of things to think about. That can be parked on the side for later investigation I think. Difficult one.

PROF KAHN: If I may take the liberty of summing up then. I think what might assist, what Mr X11 is asking about, is for science to develop ways of telling its story that are accurate, reasonable, believable, understandable. The statistician, Fred Gould, talks about indicators as telling *the* story. Well, indicators tell a story, and when you come to this whole messy area of impact, the political principles in the country, the people, not the principles as vague things, they face this problem all the time. Their DG comes with proposals, a pressured Minister has to say yes or no, the DG has to present, or the permanent secretary has to present a convincing argument. Is it going to be in the form of a return on an investment? Will that convince Cabinet? So there is the Minister who asks her advisor, what shall I tell Cabinet? Why should we be spending money on R&D? And the advisor says, well you can do the return on investment calculation, but no one will believe it. And anyway we know the answers, if it's health or agriculture, the social return is enormous. If it's industry is much smaller because of the risk and so on, so why did you do this, Minister? Ask your colleagues 'what did you have for breakfast?' And the Minister wants to throw the advisor out, says what do you mean? Well, the fact is, Minister, everything on your plate that you eat is a product of South African agricultural R&D, over a hundred-year period involving the science institutes, the universities, and agribusiness. It works. That's where the value lies. And perhaps these are the kinds of things, if I leave you for lunch, that we need to think about in our communication strategies.

As things stand, the three most effective organisations for science communication are which? Name them for me please, in this country? We are standing in one. The CSIR, the second is the co-host here, the HSRC, and the third is the MRC. Your communication divisions are outstanding. Whether you tell the truth is another matter. But they're outstanding and the media love you. Now there is a message there. And DST is pretty good too, if I may add that. I won't talk about the ARC because that would be a conflict of interest. And I won't talk about the Council for Geosciences because I think you have a very low profile, and I hear nothing about Mintek these days. Who is left? SABS? Their brand is continental and the fourth one is the NRF. And they do pretty well too. Their corporate communication people are smart. They know how to tell the story. I leave you there. We come back at quarter-to-two. Enjoy lunch. A question in Cape Town when we want to have lunch? We're having lunch and we have got vegetarian food as well.

MS X8: I just want to ask, I can see here it's … between to coordinate and … between players like science centres and science museums and … facilities and all those players that are already involved in some way. But what I would like to ask is how is the strategy going to focus to the broad cadre of scientists, working across all universities, across all disciplines, especially those who are not in science councils? I'm specifically talking about university-based scientists. How are we going to mobilise them and get them involved and give them some incentives and some reason to become part of the strategy of the DST?

DR DAMONSE: I think the thinking, and it's thinking right now, is exactly through places like the NRF who fund most of these researchers, or many of these researchers in higher education, is to think about possible incentives for scientists to get involved in science engagement, through their research grant or the opportunities to apply for top-up grants, should they have the ability to construct or be involved in science engagement through their research. So it is using that, and in there you have already thousands of researchers and masters, doctoral and post doctor students, so that would be a first call, and we've already started to think around those. And then engaging with the researchers in the centres of excellence and the chairs, which has already started. So it's using defined measures that are already in place to access researchers, but just to now instead of especially their grants which are funded for the research, is to introduce to that funding for research engagement, but also some kind of training because it's not

necessarily assumed that every researcher out there is trained in the type of science engagement that we are talking about here. Lots of them talk about, okay, I can produce another brochure or I can, and I know we're thinking beyond that level. Although that's important, but also beyond that level. So our first port of call in terms of our thinking now, is to use our current funding mechanisms and grants through places like the NRF.

[break]

Science and the South African media: challenges and opportunities for engagement

Dr Michael Gastrow, Senior Research Specialist, ESD, HSRC

PROF KAHN: Allow me to introduce Michael Gastrow of the HSRC who is about four days away from receiving his doctorate at the award ceremony. That's a nice way to start. Stretch your arms, you know it's the graveyard session, siesta time and all of that. Okay, we are back. Michael, you are going to talk about your experience and understanding of science in the media. I gave you an intro earlier by talking about the enormously powerful machines in the science council sector and how well they manipulate the print media to believe everything they say. They are very, very powerful brands. If the HSRC reports, the media believes it, if the CSIR says, the media believes it and so does the Minister, and that's how it goes. And one must recognise how this is done and you're going to tell us what you know. Thank you.

DR GASTROW: Thanks, Michael. I see we are on a somewhat diminished post-lunch audience which, it is still interested and also fine by me because if I say something strange, I'll feel under less pressure about it. In any case, I'm going to talk about science in the South African media and relate that to the science engagement framework we've been discussing. But first off I'd like to know by a show of hands, who in the audience recognises these two characters on the screen? One, two, three, four. Your ten year old children, and nieces and nephews, given that they have access to the mainstream media, will know these two characters and they will know some things about them. They'll know they are both scientists, one is also an engineer, they'll know that they are part of a global marketing and media franchise that sells movies and toys. They'll know that they are comic book superheroes that have a morally ambivalent relationship to science, because they both cause huge amounts of damage and also solve problems. These characters will have influenced their perceptions of what science and technology and engineering are. For example, the engineer has much more money than the scientist, and this is very clear from the outset. I'm putting this up because I want to just open up the scope of what we're talking about when we talk about science in the media. But, we also have some narrow scope dated that comes from the SASAS, which we can break down a little bit to try and get a more high resolution understanding of who accesses what messages through what channels.

So, this is what our data tells us. We asked a nationally representative sample through what channels do you get access to messages about science, and these are the different channels we asked about. So firstly, it's very clear television is the main channel. People learn about science mainly through TV. Secondly radio, then you've got the other channels, which play a slightly lesser role, public space is not featuring too much. Over time there are two main things we can say. Firstly, the internet is growing rapidly as a source of information and everything else is shrinking. So, for the strategy that means we focus now on the internet because that's going to expand. Now we can break it down by demographics and this is a very clear trend. You don't often see such nice, neat trends in data, but it's very clear that there's a near linear relationship between age cohorts and access to science messages. Firstly, TV is predominant across all the cohorts, that's your top line. No matter what age, the biggest channel for messages about science is your television. Radio is the second most common across all the cohorts, accept for the youngest, who use the internet more. That's a sign of things to come. Now, the younger cohorts almost entirely have greater access to messages about science across all the channels. So, if you're younger, you're getting more out of books, more out of newspapers, more out of TV, more out of everything, so you're accessing those messages more. In other words, age is inversely proportional to science information access. And if you add trend lines to all of these sets of data points, each of them shows that trend line. Now we can break it down by levels of education. This really shows the effects of inequality in the system and there are very high levels of variation according to educational level. In other

words, education is the key to gaining access to media channels that give you information about science. Firstly, groups of higher levels of education have greater access across all channels. If you're better educated, you get more messages through newspapers, through books, through internet, through public spaces, you have that access. If you look at the group with no schooling, they use proportionately more radio and television and have zero access through the internet or public spaces. If you aren't literate, there's some serious obstacles through some of these channels. As education levels increase, there's proportionately less reliance on radio and television and access to a more diverse set of channels that you get your messages through, but major roles with internet, and for books and magazines, for newspapers. One outlier is other people, because that's not really a media channel, that's a space in which messages are socially constructed. So, that has a different dynamic to the other channels. But it what it does remind us is in addition to media channels, we need to look at the social construction of these messages through public conversations and social interactions. How does your social environment provide these messages and this information? A very similar story is told if you look at LSM, which is a measure of income and lifestyle, usually used for marketing purposes. And it tells a similar story because LSM is also related to increased access to channels of science information across the board. So, if you have more income, you are likely to get more information through the internet, books, newspapers and it's a steep gradient. So, your access to books, if you're a high LSM, is much higher than if you're lower LSM, and the same for the internet, the same for newspapers. The only exception to this is radio, which is the dominant channel for the lower LSM group. So, if we are targeting the low income sectors of society, we need to use radio. That emerges clearly from the data. Does the framework and the communication implementation of it cater for radio to reach such a large group of the population? TV and radio together are dominant in the medium LSM group and again in the higher LSM group, the high income groups, there's more diversity and again the low income sectors of the population have very little access to the internet or to public spaces, and how does that future in the strategy and how does that feature in the implementation. So overall, just from the SASAS data, there are clear indicators is that we need to look demographic variance to inform any communication, priorities and strategies that emerge.

Now, looking specifically at the internet, as a growth area, we need to think about the properties of the social media. I have only two slices that come from my PhD and this is one of them, to show the impact that the social media can make. This represents tweets on the Twitter platform over the course of a year related to the SKA. At the bottom are the different sources of the messages. The blue bars indicate the number of followers that those sources have, the reddish/purple indicates the number of followers reached by re-tweets, in other words, the viral propagation of those messages. And there are two things we can conclude from this. Firstly there's media integration. So, the same big media corporations release most of the online social media messages about the SKA and news media messages, *News24, Times, Business Day*, etcetera. The second thing is that the SKA had exponentially more re-tweets, more viral propagation of messages in comparison to the other active sending of messages. In other words over here, despite a very small number of followers, because of the management of the communication strategy and the news appeal of the SKA, a significantly greater number of final users were reached through viral propagation of those messages and that raises the question, how is the management of social media, given this property, going to be implemented through the framework? Then it's important to look at demographics, media dynamics but if we shift into, towards a slightly more humanities terrain and a media studies terrain, we also need to look at the content of those messages. It's not enough just to understand that these are the channels for access to information, but what kind of information and how are science and technology and engineering framed in those messages? Are they framed in a constructive way or framed in a way that's not constructive and what are the details around those framings? Is the way it's framed in line with the objectives of the strategy? Is it about having critical citizens and informed citizens and support for priority science projects, whatever those objectives are? Or is the framing not in line with that? So from the study of the SKA it became clear that the SKA project was framed in a particular way that could be measured, if you had the right instrument. So, it became clear that about a third of the news media articles framed it as a symbol of African science and technology achievement, from different points of view, so either as an inherently African project, which is mostly going to be located in Africa in terms of infrastructure, or it positions Africa as part of the global science and technology community, or some related it to Africa Day, or both in African astronomy, some compared it to the Football World Cup as this big national prestige event, whatever the angle was, this is how it was framed by the significant proportion of the media coverage. This prompts us to think about

the messages that come out of institutions, out of media institutions and more broadly, and how they frame and what the broader set of framings that the South African population encounter are.

Now, to combine these two approaches, firstly differently channels and secondly different ways of framing science, we have some kind of tactical dimensions that we can reflect on when it comes to the science engagement framework. So, the different channels that I pointed out as having different features in terms of demographics but each of these channels raises certain questions when it comes to implementation and when it comes to understanding exactly what kind of messages are coming through. So, television, that's our main channel right now, but what information? Is it through the news? Is it through BBC and National Geographic documentaries? Is it through fiction? For radio, what languages? What language barriers are being crossed? What modalities? Is it through news on the radio? Is it through talk shows? Is it through something else? What messages? Newspaper, we return to the issue of science journalism, which as pointed out in the framework has very constrained capabilities in South Africa and low levels of news value and all kinds of challenges that need to be addressed. So we need to look at science journalism capacities and the institutional culture within media organisations.

Like I said earlier, if you look at other people, we need to look at social construction of science, science issues and then in the category of books and magazines is a very steep gradient against education and it raises literacy as an issue of access. Also, if we're looking at books we're looking at popular culture and we're looking at a spread there that we need to understand. Are we talking about popular science magazines, I'll show some examples, or are we looking at fiction or are we looking possibly at something else? In the internet is the question of digital divide between the haves and that haves not in terms of information and through the internet again, the current data doesn't tell us, are people looking at news? Are they looking at magazines? Institutional websites, social media? How is all that happening? And finally public spaces, a feature of the public spaces is that they are a direct mandate of DST entities, so it's easier to pull strings, but there's ongoing research about science centres, libraries, museums and what the potentials and implementation there is.

So these are some of the examples. Are these the sources of information? Popular science magazines, popular science journals? What is their role in cultural production and perceptions of science? Are these the sources? This is a South African science fiction author, she writes about the future dystopian Cape Town where corporations taking everyone over through using nanotechnology and cell phones, and there's a future dystopia in Joburg where all the gangsters have genetically modified sidekick animals, is this where it's coming from? How does this frame, these are dystopian visions of science, entering culture through literary culture. Superhero comics, like in my introductory slide, are part of major international marketing machines. You speak to the ten year olds in your lives and they will understand who these characters are and will tell you their life stories and will have been influenced by them. It's related to the production of icons. So, South African Elon Musk, who renounced South Africa to some extent because of apartheid went to America, is an icon of science and engineering on an international scale. How was that symbol constructed? What does it mean to South Africa? These franchise science fiction marketing machines create images, children will know who those guys are, and they create impressions of science in the course of their entry through various channels, whether it's film, other marketing, television. And there's an interesting literature around that that suggests that the public relationship with science is worked out in these arts contexts as well as in an academic context. We have Chappie, a science fiction movie set in South Africa where a renegade robot is raised by *Die Antwoord*. Right, we're talking insertion into popular culture of science fiction themes. What is the access? What are the effects? What are the messages? We've got books, science fiction books set in a future South Africa where all western and northern powers have been wiped out, and only Africa, India and China remain to kind of contest what's left. What messages are created? How are they framed? Who accesses them? What are the discourses that come out of this? And we have the famous District 9 movie which is a way of looking, taking a science technology lens on issues of inclusion and exclusion and history and there're discourses to look at there.

So, looking over this broad swath of considerations, there's some strategic aspects that we can return to when looking at these science engagement frameworks. Firstly, if you look back at the strategic aims of the framework, the media relevant to all of them, so this is a critical point to get right in terms of implementation. So the mission is to use the most appropriate and innovative means for science

engagement. So, you need to think a little bit out the box in terms of what messages do we want to get out, through what channels, how and what are the dynamics in the media environment that will allow that? Then science centres are currently the core infrastructure for science engagement for the DST. Perhaps we need to look more closely at the media scope that science centres engage. How science centres engage with the media. Do they scream science documentaries? Do they have events that link to the social media? These are questions that we can look at. Then, one of the things that Thomas raised is that the DST's resources permit engagement to a small fraction of learners at the moment. One way to expand that is to have a media strategy that has greater leverage, that accesses more.

Finally, the framing issue must remain on the agenda, so, the framework is to have science, technology, engineering that's fun and accessible and appealing and a career. This is an issue of science culture, this is about how science is positioned within the society and within culture as well as an engagement issue, and the two are linked. And we're talking here about Martin Bouwer's conception of science culture in the science culture index. The research also suggest some new directions. So, firstly and most obviously there need to be expanded new technology platforms. There must be greater use of online social media because that's the growth area. It must be a public space for user-driven engagement, not one directional flow of information, it needs to be user-driven, it can be between the public and DST entities or the public and public sector entities and it might be worthwhile having specialised platforms for controversial issues, fracking, genetic modifications, nuclear energy, because those are issues where there are major vested interests that are trying to twist and turn the debate one way or another and having an online space can only be healthy. Then, even more out the box, we need to think about the mobile environment, phone apps, the younger generation don't even use laptops, we need to think a bit more about that kind of range. Then we need to think specifically about channels and modalities. We have information about channels, we have much less information about the modalities. So from literature, if you look at Claassen and van Rooyen and the study that's been done on South African science journalism it's very clear that science journalism capacities need to be strengthened. But there's more that can be done in the other channels. We need to look at TV and radio as predominant, we need to look at the internet as an access issue, etcetera, and we need to respond tactically to the demographic features that each of these channels have and we need research into the modalities that these channels engage in. The way they frame messages about science, what their sources of information are. On television, are we talking about messages that come from abroad or are we talking about South African generated messages? Who is in in control of this information? Where does it come from? We need a better understanding of all of these issues to really optimally steer a media strategy. We need to think about using the arts and performing arts, it's a one-liner in the science engagement framework, we need to think about what that means and we need to think about working with other parts of the government. What about the SABC? This is the government's communication apparatus. What about the National Arts Council? What about the Department of Arts and Culture?

Finally there's some new research questions and approaches that we can think about. So, we're running our national surveys that gives us longitudinal detail about science media consumption, but there's more that we can do. There need to be some media studies and science communication studies that fill in the blanks about the messages, the modalities, framings, impacts, how it affects discourse in various arenas. Then if we look back at our Mark Ruffalo and Robert Downy Jr picture, we must recognise that the media provided role models for scientists. Someone like Elon Musk is a role model for an entire generation of younger South Africans. How are these framed in a South African context? How are South African science achievements framed in the media? I've referenced some of that when it came to the SKA as an achievement at the national level, but, with a better understanding of that, we can include these as symbols in our communication. What aspects of South African science have taken on that symbolic value in a discourse? Finally, looking at the different sources and the way in which our communication is framed. And that is these two guys. Thank you.

PROF KAHN: Well, that was short and very sweet and very entertaining. Thank you very much, Michael Gastrow. You've taken us to 14:25 and the floor is open. Cape Town, are you still alive and well? Would you like to comment on the media? Nothing in Cape Town. How are we doing in the room here? We're doing good, someone said "good", that means you're alive, okay.

MR X13: Thanks, Michael. I anticipated some things I wanted to put to our discussions, but let me do it like this, from the title of our gathering, the role of the social sciences and science engagement and as someone from the humanities, as you asked me just before your talk, what are you doing here, you're from the humanities, I just wanted to raise something about that question. Because, a lot of what we're talking about, what I'm wondering about is, how firmly established is it in the higher education and education system? After all, much of what we're talking about comes from science studies, something over the past 50 years or so, with its roots in disciplines which are not really well established in South Africa, notably the history and philosophy of science or people from Popper and Kuhn to Latour and numerous others, a whole field of study which I'm wondering where that exists in South Africa? And it's primarily philosophers, it's primarily historians, it's driven in literary and cultural history particularly around the rise of science in the 17th century, so much of what we're discussing here, has a rich history and is derived from work in the humanities which has a spectral presence here. I mean, yours is the closest that it's come to a full presence in the discussions and I raise that question simply to say that for what we're discussing, education is undoubtedly the key but where is education in and around the disciplines that are discussions in the social sciences, ultimately drawn from, historically speaking?

MS X8: Okay, hello. Can I say Dr? Michael? Thank you so much for this, this is really interesting. I mean, my domain is media studies and that's what I did when I studied. I think I need to sort of gather my thoughts, it's more a comment that I want to make….. there are two challenges that I face personally on a day-to-day basis. One is resources and the other one is funding. Resources in terms of human capacity. We have science advancement outreach people who are more your older generation. So, now you're talking about new, innovative, fresh, sort of media and when you speak to the older generation, they say newspapers. They say advertise if you have to in a magazine, but you get the others on the opposite spectrum our SKA sort of counterparts, I'm so jealous of them, because they get a lot of money. And they're able to do like the TV and the radio. We get compared to those type of a guy, but we don't have resources or the funding. I'm just putting it out there. Thank you.

DR CORTASSA: Thank you, Michael. You raised the question about how does science handle popular culture. I have a hypothesis about it. I study social representations of science and technology and I think science enters popular culture more through social representations than through information because when people get information that it's also mediated by the set of images, stereotypes, prejudices, images of science, scientists, etc. You emphasized in the end of your talking the interests of some perspectives like framing theory, for instance, older social representation theory to analyse the messages that are delivered on television, fiction, films, movies, etc. I wanted to commend you that a group of colleagues in Latin America have developed a set of variables to analyse science on TV because science on TV was one of the lesson study medium and they are working hard in seeing how is science represented on television, under which frames and maybe that's an interesting line of resource to advance in our knowledge of how the science enter popular culture under the framings and their social representations that are transmitted through some media like TV, movies, comics, films and some things like that.

MS X9: Thanks for a very, very interesting presentation. I wanted to comment on what Mr XX has said and I am of the opinion, Michael, that you couldn't be doing what you're doing, and I'm assuming, and I recognise you as a critical thinker, if you did not, if you were not exposed to Keene and Popper and [Unclear 0:32:34] at some stage in your career. I've been walking around you today, people say I'm surprised to see you and I'm assuming they're going to say to you I'm surprised to see you because DVCs don't come to spaces like this, we're too busy managing finances and dealings and all of that, but then I realise that people are surprised that I'm here because I head the largest college of humanities in the country. But that's why we should be here, so I am hearing what Mr XXX is possibly saying and for me, when I still was a professor at University of Pretoria, I used to teach theory of science and theory of knowledge in a course that we used to teach, the masters in research psychologists, but I think it's a very relevant question that you're asking is where is it taught at this stage? It is important for persons and scholars to be exposed to what you're mentioning, to be able to emerge as a critical academic or scholar as Michael is. But my concern is that many universities don't have the human resources or the capacity or the knowledge to be able to teach what you are suggesting needs to be taught to be able to have a presentation like this. And when we're talking about the next generation of academics, my concern is that it can't also just be numbers, we need to start asking, but what are they taught to be able to become critical thinkers? And we also need to move humanities from beyond the critical thinkers, this older

generation that are very good critical thinkers but there's also a cognitive dissonance between where they are and where I believe an academic like Dr Gastrow is moving, to move us towards.

DR GASTROW: Thank you for the questions. I'll start with …. the theory of science and the theory of knowledge is taught right now. The only place to my knowledge, that it's taught within a programme, is at CREST, at Stellenbosch. The other place where it's taught is on-the-job at the HSRC and sometimes you can learn more that way. But, the direction it's taken when it comes to looking at science technology and innovation, is the predominance of an innovation systems approach which comes from economics. So, in the last five years, the work we've done on science technology has been from an economics lens, almost entirely with the exception of the work on the public understanding of science. It's about configuring actors and networks and resources and systems and technological change, and the economic spill-overs and multipliers that come from – it's an economics lens, and because there's been a policy objective for those projects and those research activities it demands an economics lens. So, that's my comment on that.

Restrictions on resources and funding, those are challenges that a lot of entities face, the challenges that the implementation framework will face, so they are strategic questions. Trying to branch in new media channels, lobbying for that, building capacity to have that, trying to find the funding, these are all questions on the table, I guess. For Carina, on the social representations of science and technology and looking at framing theory, social representation theory, that is definitely something that is on the agenda, or should be on the agenda to fill in some gaps that exist at the moment. So, I think that's something we can take on perhaps in collaboration, or at least we need to look at what's being done in other countries. Yes, that's it.

MR X14: Just a comment that Michael mentioned about, it draws on the field of economics. But perhaps to be more specific it draws on the field of evolutionary economics which is a field that was developed by Thorstein Veblen, I think it was in the late 19th century and he doesn't only draw on economics, he draws on psychology, anthropology and sociology. So, it's a very broad church and it's actually quite, if you look for this kind of field, you will find it in many departments in South African universities.

DR REDDY: Two comments ….. 20 years ago, I went to those courses at UCT and loved it and they aren't there anymore. But of course things change and I want to just bring another dimension into how we look at, how the research agendas get shaped. One is yes, we reflect on and we must not be proud of being atheoretical, so, having the theory, but the other thing is that as the domain evolves, for me working, Michael is part of the programme, it's to allow younger people who come with the multi-disciplinarity a space to grow their ideas and shape their ideas and to lead in particular areas. And I think, I recognise how far I can go and I know no further than that and so, again, the spaces for newly emerging academics is something that we have to allow these spaces, allow them to grow and develop and to take the fields further, and that's a big part of it. The second part of the question, Michael, all the categorisations that you did there, it's great, but I imagine that it would appeal more to a middle class audience and doesn't exclude anything else but, and I think that one has to, the radio will be in terms of the low income groups, and what have you. Now the one area, and again I know nothing about it, but I didn't see it, this notion of blogging as a sort of communication tool. Now, of course it's not only the technology of blogging or the channel of blogging, but who blogs and I know, Carina, we're talking about not getting, the difficulty in getting the scientists into physical spaces to engage with others, but can we encourage them to sort of lead some blogging? Because it doesn't takes them away from their desks and that they write the messages, because when it gets translated a few times on it gets changed and how do we encourage that kind of communication? And in particular, I would like scientists to sort of blog about the importance of schooling and how their ideas got shaped in schools and to use that as a kind of way to inspire and encourage kids to see that schooling is a sexy and exciting place and not a heavy kind of place.

MR X15: Just kind of follows on from that, I think, but one way of thinking about how to get people engaged in science is that we need some projects which will have a simple side and a complex academic side and those projects are very simply projects of intellectual biography. Why do people become scientists? What were their role-models? What was their education? What images of science led them into science? In putting those biographies out there, you create a kind of buzz about science. Steven Hawking studies an extremely obscure subject and yet there's a new film, he's one of the most famous

intellectuals in the world, there's a role for biography in this, which is absolutely crucial. Why I say it has two sides, one side is like the blogging, it's like an accessible journalistic radio, TV, film, documentary popular form, but the other side of that, if we're in the higher education system, is the complexity of intellectual history in a country as fractured as South Africa, which has really significant academic historical philosophical dimensions. Those dimensions are essential to this project, just as much as the quantitative things we're talking about as well. So, that's just like a concrete recommendation is that one thing that is a means to this end is a project of intellectual biography. But it needs to have not just a journalistic side, but a higher education side which some of us are wondering, how well equipped are we as a higher education system to do that kind of work?

MS X9: Okay, I just wanted to maybe comment on the gentleman who spoke about the role of sociology of science and philosophy of science. I've certainly become convinced, more than ever, about the importance of social sciences in public science engagement and the need for more collaboration between social scientists and other disciplines in this field. As Michael pointed out, there is a programme of course at CREST at Stellenbosch University where students can study philosophy of science and sociology of science combined with science communication. But I also just wanted to add that in an online course that we're currently offering in science communication, we've got students from social science backgrounds and it's been absolutely eye-opening how they have enriched the conversation about creative ways to communicate science, understanding how people learn, what persuasive communication really is about, understanding the context for science communication and also the different techniques in science communication. I really think that this is a theme, the whole theme of today is the role of social sciences and this is something that we really need to think about. How are we going to get natural scientists and engineers to work together with social scientists in future, on public science engagement?

MR X16: Yes, I just want to say I agree very much with the comment about the Steven Hawking movie, it's extremely well-done but other dimensions to think about are, believe it or not, soapies on TV, late afternoon. I remember when I was lecturing in Soweto, I was totally flabbergasted at how many people wanted to be home early from the geography practical so that they could watch *Sewende Laan*, or whatever it was, *Generations*. I do know about some health NGOs that put messages into those soapies very effectively and it just totally popularises issues that people would never otherwise think about. Another example is a friend of mine, David Block, you may have heard of him, he is an astronomer, he does a regular feature on an internet based radio run by, what's the guy's name? Gareth Cliff, he used to be on Radio 5 or whatever, very popular. So there are multiple possibilities there.

MR X17: I particularly enjoyed your slide and your analyses in terms of the different media channels and the way you have broken it down by education and LSM and all that, it was really good. Did you at any point look at the, what would you call it? An investment of trust that the public has in certain channels or certain communication channels? My concern is not around the volume of communication and the types of channels, but who is behind that and the critical, the aspect of critical thinking that the public needs to develop in order to understand and evaluate the information coming their way. I mean, key here would be, there were a number of documentaries or what they now call them, mockumentaries on Animal Planet, with that detailed, lots of information that was, well, I don't think there's bad information, I just think there is inaccurate information. If you look at some of that and the way information spreads virally across the internet and people invest a lot of trust in the internet, has your research in any way touched on those subjects?

DR GASTROW: Right, I'll go through those questions. ….Some of the channels that are usable and a lot of the channels are only relevant for middle class and the tiny one-percenters, for example the internet and books. What about the much larger set of South Africans that formed a lower LSM. This is why radio must be a serious priority. From our indication, it's likely to reach a bigger public than all the other messages, especially in the low income demographics where I'm assuming we really want to make an impact. Then in terms of blogging and other social media, now the frame of reference is a very heterogeneous set of platforms on the social media of which blogging is one manifestation, but the new manifestations crop of faster that I can really keep track of, so there's Twitter and Instagram and Facebook and comments on institutional websites where trolls come in and trolls troll the trolls and it gets out of hand. It's evolving very, very rapidly. So it's about getting the expertise to get a handle on that evolution and using that.

Then … the ideas of an intellectual biography and I really fully agree with that as an avenue for research. I think it's qualitative work like that that can put us on firmer footing on a number of ways, firmer theoretical footing and firmer empirical footing because our surveys and even a media analysis can only tell us so much, it can give us a quantitative picture, it can give us correlations between different kind of things, but it doesn't give us rich qualitative information about the kinds of causal mechanisms that can connect social construction of science attitudes towards eventually actually becoming a scientist and feeding back into the system and I think that's a very promising avenue.

Then X and Y raised questions of different channels and these are all, this is a wide-open debate, so TV soapies, sure, there are spaces for messages. If we look at trust in different channels, that's a serious issue. I was going to say earlier to Carina, if we're looking at TV, we can look at DStv and SABC, who do you distrust more, big corporations of the government? It's kind of a neck-and-neck race there. So, all of these questions are valid and they're all part of the research agenda as far as I can see, but I think the issue of intellectual biography is something where we don't have much depth in the HSRC to tackle, so we would need some collaborative work.

Discussion and the way forward: reflections on the role of the social sciences in science engagement

Prof Michael Kahn, University of Stellenbosch

PROF KAHN: ….. What I would like to do is to ask Vijay and Carina to come and sit in front, join us here at the front, and Vijay, Nkosi made inputs, Temba at the back, Temba Masilela? You've been very quiet and you are a man with a lot of journalistic experience. Would you like to join us or not? He prefers to be excused, okay. So you're leaving it to me? ….. I'm going to kick off where Michael Gastrow took us to, Michael took a very gentle sideswipe at system of innovation thinking and because I came into this process rather late, I've had to construct some thoughts on the fly, that's why I've been playing with the laptop, and I thought I would start with this depiction of a system of innovation that speaks not to triple Helix but quadruple Helix, and the four major components, the one is missing today from this room, business, higher education, government and civil society and the way I construct the diagram is to place civil society at the centre. This particular depiction comes out of a piece of writing I did trying to understand the relationship between social entrepreneurship and [silence 0:54:21- 0:54:21]. I honed in on the HIV/AIDS story. Note carefully, I say HIV/AIDS. I'm not a government hack who says HIV and AIDS, I stick to the original story, the original storyline. I'm very pleased that the framework document we've seen acknowledges the HIV/AIDS catastrophe. It's rare to see that in government documents. Now what's the relevance here? The argument of what I've written elsewhere is to claim that what the TAC could do depended critically not just on itself and its communication and engagement skills but also on the fact that we have a functioning system of innovation. That's the link. The TAC success is very strongly around its ability to engage and communicate and to work with various allies. There's another dimension which I will come to a little bit later. So, there are three slides here which I hope will assist some of our thinking.

The second is just a bit of a repeat of where I started the day, social sciences, R&D, is consistent with the size of the sector, it underpins the services sector and that is the sector that has grown consistently in South Africa for the past 30 years. When you talk about 2% growth, it's because the services sector is responsible for that. The others have been in declining, manufacturing, mining and agriculture too, and the fact of our global brands. That's all driven by the marketing people, the financial gurus, that social science work, it's business science, it's not heavy duty R&D, so, SSH R&D matters. Now the third bullet point is something I would like to give to you as a take-away. It's an argument that pre-1994 we had a social contract which on the one side was science working for its paymaster, and that is not to suggest that science was a uniform hold, it was not, because the government of the day was quite content for scientists to carry on doing their own thing. So, that's where you get the embarrassment. It wasn't embarrassment of the world's first human heart transplant. The National Party government actually didn't know what to do with it. I mean, for heaven's sake! It was a renegade Afrikaner putting a brown heart into a

Jew. I mean, you couldn't have a worse combination than that. It was a PR nightmare. So, Christiaan Barnard, well, *wie is hy*? Who is he? What do we do with him? You can't wish it away. But that agenda was "own science", it was not driven by the state and the combination you get there is, what I argue, "own science" and it's deliberately in inverted commas, because in those days there were something called "own affairs", which basically meant we white people run the place and you darkies just tag along, own affairs. In Afrikaans, "*eie sake*", own business. So, I call it "own science" just to take a poke at the past plus science for the apartheid war, that's everything from nuclear weapons to artillery and biological and chemical warfare and food security and wood security and all other kinds of security.

In that time already, fourth point, our spend on basic R&D as a percentage of the total spend, was very, very high given our state of national development. Comparisons: Korea had a similar state of development and it was spending 5% of its total on basic R&D. We are way behind Korea today and what are we spending, 25%? It's incredibly high. Korea spent its money on applied science and development, we're spending our money on basic research. Why? Because we know we're better than everybody else or something like that. My argument would be that today the social contract still walks on two legs and the two legs are own science – "don't you tell me what I must research, I am a researcher, I'm a scientist, I do what I want to do", and the flipside, instead of science for apartheid, is big science. Do I have to spell out what big science is? I think we know. Big science is sexy. It gets media attention, it makes us look good. It, to quote someone famous, "tells a good story, we hope." The South Africans in the room know what I'm referring to. So, the big question then is, if this is correct, if we have own science and big science, is this consistent with the big messages we're giving in the national development plan? Are there disjunctures in what we do and what we say? My argument is, this forms part of the science engagement debate.

Next one, understanding the community of scientists. I'm grateful to XX for speaking about some of the intellectual giants of evolutionary economics. One of them, of course, is Dick Nelson, the attribution at the foot there, and I stole this out of a paper by Roberto Mazzoleni and Richard R. Nelson (*Public research institutions and economic catch-up. Research Policy 36 (2007) 1512–1528*). We need to look at our institutions, what they represent and how they work and before you read it quickly, let's just go back to that one. When we in the room talk about science engagement, who are we?

We are pretty much here, here and here. Who are we talking to, who are we trying to engage with? It's here, who are we trying to engage with? Are we engaging with one another? So that's internationalisation of higher education. Are we engaging with government to try and get money out of them? Are we engaging with business to solve their problems? Do we even know what their problems are or are we really just living in our own little backyards? And then there's civil society. Are we engaging with civil society? Let me give you a beautiful example. Sitting in listening to a discussion in the portfolio committee on science and technology and one of the members says to the speaker who is talking about S&T, "Can you explain why it is, when I go back to my constituency in Limpopo things always look the same. There's no running water, there's this problem and that problem." And the place goes silent. And the presenter thinks and says, "Well, honourable member, that's a very political question and I'm an official, I don't know if I can give a political answer." And the member says, "No, please, go ahead. Of course you can. Of course you can." And so the reply comes, "Honourable member, it's not a poverty of technology, it's a poverty of politics." So, there's that whole dimension here hidden inside this, it's all the political processes, you can communicate as much as you want, but if there's a disjuncture and a misalignment with the political messages, it ain't going to get feet.

So, here is Mazzoleni and Nelson talking about the interests of the science community itself, that goes back to own science. We see it very strongly. I'm not knocking CSIR in particular, we see the highly effective machines that, I promise you, watch my lips, in August this year there will be a big announcement from CSIR about something new and wonderful and there will be an even bigger one from the MRC that will have shock value. It will be, generally speaking, about the behaviour of bad men, because that guarantees you a newspaper black-out. And that shows

how important the MRC is to us and therefore they will get their money for the next year. So, here is a message to think very critically about the self-interest of the scientific community. When we want to talk science engagement you have to factor that one in, because you're not dealing with a neutral entity. It's a living thing and it means a lot to the people who are benefiting from it. And then the last one, this came as a surprise to a lot of people. It was a little study done for ICSU, International Council of Scientific Unions, who were doing a comparison of the ways that different countries obtain their scientific advice and the question was put to somebody, that happens to be me, "Can you write us four pages very quickly? We need it tomorrow morning. How do we get scientific advice in South Africa?" And if I could quickly cover it up? And I ask you, you might say, well, it comes from NACI, the National Advisory Council on Innovation.

It turns out that we have a highly centralised and decentralised system. And the way that government right to this very day, obtained science advice which is part of the science engagement, is quite well developed, but not in a coordinated way. So, all the departments of government request advice from time to time, there are calls for advice, there are calls for public responses, there are even tenders. And this advice now comes from hundreds of institutions, I should have put on there, I was typing this now, I should have put on there "and individuals", the institutions, the science councils, the water research commission, marine and coastal management, or whatever it's called today, the weather service. We all know these people, they're the museums, scientific services. Then there're all the associations, there are hundreds of industry associations who have something to say. Carina made mention of Argentina and GM. We in South Africa are in the top three of GM crops employment, soya, you're number one. Yes, so you win. Soya, wheat and maize, but not hops, we don't do GM hops because the beer drinkers won't allow you to and guess what, we don't do GM potatoes because the small growers have been told, if you cannot certify that your potatoes are GM free, we can't sell them to McCain for chips, for export and they want that certification that cost too much money, so there's no GM work on potatoes going on in South Africa and we do GM [unclear 1:05:31] as well.

How does that – what did I do? Sorry. Where do I get recent? I need my last slide. It's there, okay. Got it, got it. It's okay. The advice flows from hundreds of points, the learned associations, learned bodies, it's both spontaneous and solicited. Ultimately the public is the watchdog and the public needs to be empowered to do that, I've mentioned the difficulty of coordination and where you see this advice really at work, is when there are national risks and it flows very, very well. So, this is all part for me of some of the things that perhaps have not been included in today's discussion, so, as I said, I will always abuse being a Chair and add some in. I'm not quite finished. Over lunch I was discussing with somebody about this idea of ring fencing. In many northern countries, large science projects by degree, by regulation, have to have a certain percentage for monitoring and evaluation and a certain percentage for communication, whether it's 1%, 1%, it's built into the budget, you have to do it, you will be judged on it. So, that gets rid of that one. Then, Mr XX was talking about TV and soapies. What you probably…. remember, but you're probably the only one because I'd even forgotten. We had a very, very creative TV series using puppet characters to popularise science in the '90s and the company that put it together, who did the production, are world famous, it's the Handspring Puppet Company. The idiot who came with the suggestion to begin with, is talking to you now. So, I started it and it then went into the hands of professional script writers and I moved aside and I won't say anything more about that. So, we've been there, tried that and done that. I'm not sure what evaluations you can find on Spider's Place, as it was called, but it is worth looking into. Michael, this is your stuff, this is real media at work. And then the last one is not scientific literacy per se. We have a quite creative junior high science curriculum except for the fact that in order to bow down to interests, it is silent on something called evolution. And …. Mr XX, I would love you to ask Professor Block for the dates that the universe started, because you will not get the answer that is generally current in the scientific community, it will probably be around 5 411 years or so. [correction… he is comfortable with 14 billion years] …. Is he? Then he's shifted. I'm pleased to hear it. The last one is math literacy. We have a very creative math literacy curriculum. This is really for our guests to key into and maybe some in the room as well. Math literacy was not part

of the original education policy proposals of 1994. It came from somewhere else, I think it's an import from an underdeveloped country called Australia and it's good in principle. I know a lot about it because I tutored a young lady who has done grade 10, 11, 12, so I've seen it in the house. And the engagement with everyday maths is great. The principle behind it is great. The killing factor…. is language because the language level demand for math literacy is the same as for first language learners and if you have a problem with the English language, and your teacher has a problem with the English language, you are lost, it's not going to work. It ain't gonna fly. And just to end my little input, I give this parody, in math, in conventional math class, you get the question six minus one equals, okay, we all know the answer to that. In a math literacy class, you will get the following: A farmer in a deep rural area observes six crows on her fence. She takes a shotgun and fires a warning shot into the ground, no, at the fence. One crow is killed, how many are left on the fence? …. None, but the correct answer is five.

And I can offer you a challenge, go and Google up the math literacy exam papers and Google up a math subject paper for the same grade and then put it through Word count, and you will be shocked. The average math lit paper is 2 000 words long, the average math paper about 500. So, what are we testing? And is this part of science engagement? So, I've said a bit too much, got rid of a few pet ideas and the house is now open. Cape Town, if you're still with us or anyone else, you can put any question you like, you can offer any opinion you want, you can address it to someone or no-one and we'll do our best to stay with you. Thank you. Thank you.

PROF LE MAREC: Thank you for all the very interesting issues. I was wondering if the circles about, with whom do we engage, do we engage universities, with government to get more money for, with business, because business is like a powerful part of societies, and there is also another power, very strong I think in Europe but the worst medias because they rule for their own issues, they get some autonomy in their interest and I think that all profession of communication, industry of communication, economy of communication, we can ask also with whom do they engage when they make something about science, telling that they are doing it for society or for promoting science, etcetera. So, I wanted to, your point of view.

PROF KAHN: It's a good observation. This is an extract which should be in a bigger picture. One should really have a cloud around it and the cloud would include the world system, you can include culture, it could include the legal system, the macroeconomic system and I would put the media in the same cloud, so this sits inside that bigger hole.

MR X17: Thanks. I see a lot of parallels between the discourse on science engagement and the discourse on community engagement in higher education. I seem to remember, when the council of higher education introduced community engagement as a reporting requirement from universities and many universities obviously found community engagement, although it's a third mission but very much a Cinderella mission. All the universities went into kind of a state, they started to create these community engagement officers, there was a South African higher education community engagement forum that was created as well. After that we were all under the impression that community engagement was going to be deeply embedded in the universities. It was actually going to be interconnected with research and teaching as well. But when you speak to people that work in that space now, you find that since the hoo-hah is over, the dust is settled, community engagement is still largely a Cinderella mission, largely underfunded and there's very little work that's going on there. My fear also now, with science engagement, how do we ensure that there is substance behind it, that it doesn't just become a rhetorical device, that it really becomes entrenched in any institutions and it's integrated with the work of research as well and teaching as well. This is something to think about, I mean, for those people who are interested in this, science engagement, higher education, community engagement, these things are ripe for [unclear 1:16:19] discourse analyses.

DR CORTASSA: Well, the last question is very interesting. How to make science engagement more than a rhetorical device. Well, it was … was something I questioned during the study I presented this morning. I think we have to look it more carefully to actors. Usually we have focused in our studies of public understanding of science and science communication two main

agents, the public perceptions and the media performances and I think that for science engagement to be more than a rhetorical device, we should analyse it and engage the other two communities. It's a scientific community, first of all, and then the governmental areas. We need the governmental areas to drive the process and we need the scientific community to give it content. So, I think that science, in this way, I think that science engagement could be more than a rhetorical device with the compromise of those sectors or those actors with the process, because unless we count on them, we count on the scientific community and unless we count on the governmental funds, basically that's why we need to have done … found some coordination and things like that. I think we'll stay at the level of the rhetorical device and a discussion in the scientific community off the field.

DR REDDY: It raises the interesting question that if we're involved in science engagements, whose interests are served? And I think we need to grapple and problematise that. I mean, there is no innocence in all of this and I think we need to recognise that, and if the pharmaceutical companies translating its research and communicating its research, it's not only for the purposes of knowledge transmission. And when you asked that question it reminded of looking at history, so for the people of the humanities, it's important. I'm just thinking, Michael, some of the numbers in the data I would have forgotten, but why is this issue about public understanding of science, science engagement important? I think the scientists were quite happy working on their own and let society do its thing and listen to the science and the impetus for all of this came with the space race in 1959, that's the Russians sent Laika to space and through that startling event for the US, it was about, now how do we get more money for science or space research? And if you want to get money and you have an electorate, so you need to educate, I mean, that's the deficit model, you need to educate the electorate about these important developments. And looking at this debate historically, the initial part was to inform the electorate about what we are doing so that when they vote, they vote these kinds of things. Of course the debate has shifted, public understanding, the scientific literacy public understanding of science, science in society kind of debate, when now it's a more dialogical relationship. So, I think a short answer to your question would it be, how would we ensure that it is just not a rhetorical segment, it's about, how do we get an active citizenry? And there must be a demand for information and it's about, and with the critical actors citizenry of the constant evaluation of this information because it's not necessary. Yes, I mean, depending on who's providing the information, it could be for, you just don't accept it in one way. So, the demand for information has to be there, I think.

DR GASTROW: Thanks for the last questions. Firstly in terms of the interests that are served by science communications, it's an important topic obviously and something that needs to be thought through, it hasn't been fully discussed, but it's been alluded to and there needs to be some scenario planning for this. For example, say the framework creates an online platform for discussion of controversial issues and they come on the table and say you have fracking. Now, the DST's principals might have political instructions that we are in favour of fracking. What happens if the public discourse comes out against it? What's the response? How do you manage the situation where your political principals say we are going nuclear, maybe in favour, what happens with the? How do you manage that … and from a media point of view? So there's … or controversy situations that you have in these difference scenarios and have stable responses to them.

We're just closing out [unclear 1:22:41] Africa for the IDRC, [unclear 1:22:44] university community engagements in countries, and there's some findings that are emerging that are salient. So, as you said, it's largely underfunded but there are factors that you can identify that are drivers in the absence of funding, there's some factors. One is individual champions. So, there might be an academic that is passionate about a cause, a community leader that is set on leading, if they connect, something emerges at a time, etcetera, and another one is looking at the motivations of academics. If they can get academic benefit from it, if they can get an arena for post-graduate research, if they can get inputs to research that leads to publications and conferences and field building, then they are motivated to participate, and they're drivers from the community point of view. So, the point is, if we're looking at science communication, science

engagement as a potential risk of falling into being a rhetorical device, we need to look at what are the drivers, what would motivate the scientists, what would motivate the communicators, etcetera, and try and understand more detail about those drivers.

MR X18: I would just like to throw an elephant into the room, if I may. With the role of the social sciences in science engagement, is this western science engagement? I mean, something on which we haven't talked about is a kind of, you were talking about some contradictions just now, but we haven't really talked about, are there conflicts between the commitment to indigenous knowledge and the projective western science?

MR X19: … probably 10 years ago and one of the papers that I wrote from that data pertained to values and beliefs, and South Africa is a very conservative society. Probably between 70% and 90% are opposed to abortion, opposed to same sex relationships, are in favour of the death penalty, etcetera, and one needs to take these things into account when you're communicating innovative technological things that might be offensive to people's beliefs and values. And there needs to be a respect, for example, a respect between people who are believers, religious believers and look for compatibilities, for example, between evolution and creation, those types of debates, rather than just imposing things and offending people and switching them off. Just a point to bear in mind that South Africa is way behind Europe, for example, in terms of liberal thought.

DR GASTROW: Thank you for the last minute animals. This is raising a number of issues with such a short amount of time, but I'll keep the thoughts short. Firstly, studying the public engagement with science is like being on an island in the sea surrounded by sharks, because as soon as you push your theoretical boundary too far, you end of getting eaten. This is related to [the] earlier comment on the difference between science technology and engineering. Because if you start off with science, and you push your theoretical boundaries, you end up either taking a relativistic position, which is problematic, or you take a position where a western science and a scientific method are epistemologically acceptable and others aren't. In the matter where you try and manoeuvre, you're going to hit some kind of problem. So, firstly, one has to kind of find a middle ground between all these different decisions and I think one option is to try and avoid having a normative starting point that says western science is your good position and IKS is now an alternative or less valued position. We have to aim to rather be descriptive as a starting point and then practical as an end point. But it's true that if you ask too many questions, you run out of answers pretty quickly. For example …. you have to treat science technology and engineering differently, it's inherently true because when you talk about science, we're talking about epistemological questions and boundaries to our definitions and to the kind of concepts we use. And the doubts that are raised and the questions that are raised are, why is our indigenous knowledge not valid? Why is western knowledge valid, etcetera, and when you look at technology, it's are the genetically modified foods safe? Apparently someone in Spain died by eating a tomato because he had a fish allergy. These are questions, is nuclear energy in the long run good or bad? Is fracking good or bad? These are technology questions and they're different questions with different problems and different solutions. So, I think those kinds of issues are … also be on the agenda.

MS X10: I suppose I'm not in the position that you've got a dichotomy between IKS and western science, whatever that might be. And I think that it's far more integrated and I think, I might get this wrong, but in India there isn't this thing as a debate of an either or, it is far more fluid and, between these knowledge systems because if you look at purpose. And I think, for me, the helpful bridge and looking at these, is actually the history of science and very much, if you look at the history of the physics constructs or so, so they give a great deal of help in terms of how to see what knowledge is being produced, what's at the local level, what's at the universal level and so those are more helpful hangers in terms of having the debate rather than the IKS is for some poor area, I mean, and the western science is the one to aspire to. Similarly, picking up on XX's point, I have less of a view that if the South African attitudes are 70% are against abortion or believe in creation or so, that one should take a value position and if western communities, which you call liberal, is a different point. This is the fingerprint of the South African attitudes to

whatever it is and the question is, if one thinks that you want to change something towards abortion and of course, that's a value position, then how do you, or what should you do, but I would not set up the South African position as something that's got be changed because European countries have this or so. And that the attitudes are the attitudes, and this is our society and this our context and I would rather approach the debate from, so what is the, as Michael reminded us, what is the South African imprint or fingerprint? How do they feel about things in a less value-laden position?

PROF KAHN: Thank you. I think we should thank our impromptu panel for giving us a good closing session. Vijay, you're going to do the closing on us. Thank you very much. I ask your forbearance, I've got a plane to catch. I'm going to run.

DR REDDY: Okay, but before you go, then give me 30 seconds. Sorry, we're all out to planes, and it's not so much getting the plane it's getting the traffic on this R21 that I'm mildly nervous about, that's there. I'll keep mine to a total of three minutes. I thought, at first I was going to say, Michael, I wouldn't do this session, you do it, but I think it's important that I do the final comments and the thank you. This has been an amazing day. I sometimes get [unclear 1:32:08] and I come into sessions where there's a whole day workshop, rather sceptical, thinking oh my God, I could have been writing two lines of a paper on this whole day's time. I thoroughly enjoyed the discussions, the debates, the presentations and so I think it was a very good day. I'd like to use this opportunity to, a couple of thanks. Firstly to the Department of Science and Technology and I'll get the whole thing wrong, it's a science dialogue, whatever the series is called, Temba? I think it's the collaboration between the DST and the HSRC and with the DST playing a strong role. So, thank you very much firstly to the DST for the support on this. I'd like to thank RIAU, the Research Impact Assessment Unit under the leadership of Temba Masilela, our DCEO who I'm very sorry we didn't get to hear. He's a brilliant man when it comes to science communication, and you can't get away like this, Temba. And when he does present something, he's absolutely brilliant. But, thank you very much Temba, for the opportunity for us, Michael and I, to participate and shape this particular session and to the whole of the RIA team, Arlene and the others, for the organising.

I'd like to thank our presenters for the very, very high quality of presentation and I think, yes, some people might have left at lunch time, but let's not look at that. A lot of people stayed after lunch time and we thank you. I'd like to thank or Programme Director, Michael Kahn. This morning when I had breakfast I said to Michael, tell them that Vijay selected you because we knew that (a) Michael has a long history and we seem, again, the history keeps coming up for the people in humanities. I'm an organic chemist, so – but it's just how important and we seem to, the institutional memories lost and people have worked a long time with many, many ideas and they said, the two reasons why Michael Kahn was chosen for the, to be the programme director (a) he has a history and he's knowledgeable and he shapes many of the things. Secondly, Michael would say what Michael wanted to say. There was no holds barred, there was going to be no shaping of the agenda and I was totally appreciative of that. So, Michael, thank you very much for the excellent job and shaping and the discussions for today, and it was lovely to see you again.

And thank you to all the participants that came, sorry, because I'm rushing here, I need to give special thanks to Carina for coming across, you know when they go between New York and London, they say to go across the, yes, we'll see you. Lots of love. So, Carina, when they go between London and New York, they say, "Oh, we just came across the pond." So, when you came from Argentina to here, so you came across the southern pond and Michael can see you from Cape Town and so, thank you. Because it's a hardship to make for a few hours and you will pay dearly when you go back and you have to go to the office next Monday, but really appreciative of (a) your presence and (b) the excellent presentation. I think we were nudging each other and whispering – it helps for us to move this debate as we are, there's many dimensions of the science engagements, as we understand it and, Michael and I, the ideas that you present, help us to move the debate forward. And we would like to continue the collaboration with you. So, thank you very much everybody. And did I say, oh, sorry, you see I

don’t, I forget. The person that has been responsible from the EST’s side to set up this seminar has been Michael Gastrow, and I need to thank him as well for shaping the programme and connecting with all the speakers. Thanks.

Appendix 1: Programme & Abstracts

Date: 10th March 2015

Venue: Council for Scientific and Industrial Research

Rapporteur: *Dr Stephen Rule*
Chair: *Prof Michael Kahn, University of Stellenbosch*

08:30 - 09:00	**Registration, Tea & Coffee**
09:00 - 09:10	**Introduction**
09:00-09:10	**Welcome and Introductions** *Dr Vijay Reddy, Executive Director: Education and Skills Development Research Programme (ESD), HSRC* *Dr Temba Masilela, Deputy CEO: Research, HSRC*
09:10 – 09:50	**Session 1**
09:10 - 09:30	**The DST Science Engagement Strategy: facilitating the science: society interface** *Dr Thomas Auf der Heyde, Deputy Director-General: Research Development and Support, DST*
09:30 -09:45	***Q&A***
09:45 – 10:00	**Tea break**
10:00 – 10:45	**Session 2**
10:00 – 10:30	**Promoting a Scientific Culture: A Review of Public Policies in Ibero-American Countries** *Dr Carina Cortassa, Researcher, REDES (Argentina), an associated institution to the CONICYT (National Council of Science and Technology)*
10:30 – 10:45	***Q&A***
10:45 – 11:45	**Session 3**
10:45 – 11:30	**Attitudes to science: part of the puzzle to improve educational achievement?** *Dr Vijay Reddy, Executive Director, ESD, HSRC and* Andrea Juan, *ESD, HSRC*
11:30 – 11:45	***Q&A***
11:45 – 12:30	**Session 4**
11:45 – 12:15	**Operational Prospects for Implementation: A Tactical Reflection** *Dr Beverly Damonse, Group Executive, Science Advancement, (NRF)*
12:15 – 12:30	***Q&A***
12:30 – 13:30	**LUNCH**

13:30 – 14:15	**Session 5**

13:30 – 14:00 **Science and the South African media: challenges and opportunities for engagement**
Dr Michael Gastrow, Senior Research Specialist, ESD, HSRC

14:00 – 14:15 ***Q&A***

14:15 – 15:00	**Session 6**

14:15 – 14:45 **Discussion and the way forward: reflections on the role of the social sciences in science engagement**
Prof Michael Kahn, University of Stellenbosch

14:45 – 15:00 **Closure**
Dr Vijay Reddy, Executive Director, ESD, HSRC

ABSTRACTS

1. **Promoting a Scientific Culture: A Review of Public Policies in Ibero-American Countries**

Dr Carina Cortassa*, Researcher, REDES (Argentina), an associated institution to the CONICYT (National Council of Science and Technology)*

This presentation provides an overview of a recent study aimed at describing how the efforts to improve the public engagement with science have gained ground in the broader frame of public policies for Science, Technology and Innovation (ST&I) in Ibero-American countries. The purpose was to assess to what extent the discourse of public agencies reflected concern about the matter, and in which way, beneath the level of rhetoric, the usual 'loud and clear' claims were translated into operative strategies, actions and tools. Documentary research included the 22 countries of the Organization of Ibero-American States. Current National Plans for ST&I were analysed, and actions promoted by governmental agencies were identified and classified. The outcomes show a complex scenario. Most countries explicitly encompass the topic of scientific culture and the need to improve public engagement with science in their respective sectoral plans. This implies a shift in visibility from a certain status of "note in the margin" held by this domain in the past. The launch of specific governmental areas responsible for sketching the general strategies and carrying forward concrete activities also indicates intentions to strengthen this progress. However, although the general outline is promising, a set of pending issues emerges. Firstly, there remains a gap between the ambitious goals expressed in rhetoric and the limited actions actually carried out. Secondly, the broad diversity of practices labelled in each context under the tags of popularization, social appropriation of knowledge, scientific culture, public engagement, and so on, makes it difficult to achieve a reliable picture of regional policies, and also hinders the possibility of assessment and comparison. Concluding remarks highlight the need to develop set of common indicators that facilitate more comparative cross-sectional studies.

2. Attitudes to science: part of the puzzle to improve educational achievement?

Dr Vijay Reddy, Executive Director, ESD, HSRC and Andrea Juan, *ESD, HSRC*

Learning is influenced by both cognitive and non-cognitive factors. While there is a substantial body of research about the cognitive domain, less is known about the non-cognitive and its influences on the learning processes. The emerging literature examining the relationship between attitudes to learning science and science achievement is mixed, with some studies exhibiting consistent positive correlation, some slight correlation, and others exhibiting no relationship. This paper examines the attitudinal patterns and the relationship between attitudes to learning science and science achievement in South Africa. The paper uses TIMSS 2011 science achievement and science attitudinal data (enjoyment, valuing science and self-confidence in ability to learn science) to examine the relationship. The key findings are: (i) students who enjoy science value the utility of science highly and are modest in evaluating their science abilities (ii) self confidence in learning science and the enjoyment of science are positively correlated with achievement (iii) each attitudinal scale point increase in enjoyment improves performance by 16 TIMSS points and the increase in self-confidence improves performance by 10 TIMSS points.

3. **Operational Prospects for Implementation: A Tactical Reflection**

Dr Beverly Damonse, Group Executive, Science Advancement, (NRF).

After extensive consultation and several draft preparations, the Department of Science and Technology's' Science Engagement Framework was finally approved in December 2014. This document provides an overarching strategic framework to advance science engagement in South Africa. It is intended to improve coordination of and encourage science promotion, communication and engagement activities across the Department, its entities, universities, other Government departments and science councils, museums, and partners outside the public sector. Furthermore, the Framework recognises key enablers of successful implementation, which include: (a) an effective coordination function to promote and ensure strategic and operational alignment of science engagement initiatives across a wide range of stakeholders; (b) an enabling regulatory framework; (c) funding to broaden the scope and scale of the DST's current science engagement portfolio; and (d) a science engagement information management system. Tales of mismatch between policy (strategic) implementation and situated practice abound within the policy field, and especially in areas such as educational change. As officials, entities and communities generally develop responses to new policies or strategic directions, implementation issues are usually revealed in all their complexity, intractability and inevitably. This session will thus provide a tactical reflection on operational prospects for implementation of the Science Engagement Framework, with the understanding that the connections between policy and practice

ultimately will be made or missed in the science engagement professional communities (researchers, science communicators, science centres, educators, learners etc.).

4. Science and the South African media: challenges and opportunities for engagement

Dr Michael Gastrow, Senior Research Specialist, ESD, HSRC

The media, including the news media and online social media, are important mediators between the institutions of science and the broader public. Extant research highlights some of the complexities of this relationship. The South African news media have low levels of science journalism capacity, and editorial structures rarely include dedicated science news apparatus. The news value of science is perceived to be low, although this varies across publications. This generally results in relatively low levels of news coverage of science stories in comparison to the domains of politics, sport, business, and the arts. However, there are some exceptions to these trends that highlight opportunities for improvement. Publications that host dedicated science journalists, and those that include editorial structures for science news, show higher levels of science news outputs. Some science news stories, for example that of the Square Kilometre Array (SKA) telescope, have received substantial media coverage. We consider the application of these findings for the implementation of the Science Engagement Framework, drawing on the case of the SKA to illustrate drivers and mechanisms for successful science engagement.

Appendix 2: Biographies

DR THOMAS AUF DER HEYDE

Currently Deputy Director-General (Research Development and Support) 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, and has held academic and research positions in South Africa, Switzerland, the UK and the United States.

DR CARINA CORTASSA

Dr Cortassa is a researcher at the Department of Public Perception and Communication of Science. Centro REDES - Center for Studies in Science, Development and Higher Education (Buenos Aires, Argentina), associated institution to the National Council of Scientific and Technical Research (CONICET). Full Professor at the Faculty of Educational Sciences (National University of Entre Ríos). She holds a Ph.D. in Science and Culture from the Autonomous University of Madrid and a M.Sc. in Science, Technology and Society Studies from the University of Salamanca (Spain). Her areas of research interests include public understanding of science, science communication, social representations of science and technology and STS Studies. Carina Cortassa has published a number of articles in specialized journals and the book (in Spanish) Science in Public. The epistemic and cultural dimensions of the public understanding of science. At the present time she is co-directing the Project Practices and Values of the Social Communication of Science in Ibero-America, funded by the Observatory of Science, Technology and Society of the Organization of Ibero-American States (OEI).

DR VIJAY REDDY

Dr Vijay Reddy is the executive director of the Education and Skills Development research programme at the HSRC. She holds a PhD in science education from the University of KwaZulu-Natal. She has extensive experience in successfully managing and overseeing large-scale, long-term collaborative research projects such as the Trends in Mathematics and Science Study (TIMSS), from 2003 to 2015 (ongoing), the Literacy and Numeracy Research Programme funded by the Royal Netherlands Embassy (RNE), which started in 2007 and will be concluded in December 2011, and the Department of Labour Critical Research Projects (2007-2008) with follow-up research, Impact Assessment of National Skills Development Strategy II, awarded by the Department of Labour following a competitive application process. Before joining the HSRC, Dr Reddy initially worked as a school science teacher, then in NGOs involved in in-service education for science teachers. Thereafter she taught chemistry in university bridging programmes, and worked for a monitoring and evaluation NGO. Immediately before joining the HSRC, Dr Reddy was responsible for graduate programmes at the University of KwaZulu-Natal. Dr Reddy has extensive experience in social scientific research, especially in the areas of research design and methodology, planning and management of large-scale surveys, and life history research. She has undertaken projects for organisations such as the National Research Foundation (NRF) and the United Nations Educational, Scientific and Cultural Organization (UNESCO).

DR BEVERLEY DAMONSE

Beverley Damonse is the Group Executive: Science Engagement and Corporate Relations of the National Research Foundation (NRF), driving strategy development and implementation in the areas of science communication, education, public engagement with science and corporate relations. Prior to taking up this position in 2011, she was the Executive Director of the South African Agency for Science and Technology Advancement (SAASTA). She obtained a BSc (Microbiology and Plant Pathology), B.Ed. and MEd from the then University of Natal (now UKZN) and a doctorate degree (Education Policy and Management) from the University of Pretoria. Beverley is a member of the International Women's Forum of South Africa (IWFSA), invited member of the NRF Board, a member of The Technology and Human Resources for Industry Programme (THRIP) Advisory Council, the Board of the Cape Town Science Centre, the Sci-Enza Advisory Committee (University of Pretoria) and the South African Young Academy of Science (SAYAS) Advisory Board.

DR MICHAEL GASTROW

Dr Michael Gastrow is a Senior Research Specialist in the Education and Skills Development research programme of the HSRC. He holds a PhD in Journalism from the University of Stellenbosch, focussing on science communication. His areas of research interest include innovation studies, skills development, the

public understanding of science, and science communication. His publication record includes the authoring and co-authoring of twelve peer-reviewed journal articles and fourteen conference presentations. His current research focuses on innovation for inclusive development (for the IDRC), labour market intelligence (for the Department of Higher Education and Training), and a national survey of public attitudes towards biotechnology (for the South African Agency for Science and Technology Advancement – a business unit of the National Research Foundation).

PROF. MICHAEL KAHN

Prof. Michael Kahn is Senior Research Fellow in the Centre for Research on Science and Technology of the University of Stellenbosch and Professor Extraordinaire at the Tshwane University of Technology. He was formerly Executive Director of Knowledge Systems and the founding Head of the Centre for Science, Technology and Innovation Indicators (CeSTII) at the Human Sciences Research Council. As Head of CeSTII he was responsible for establishing, designing and conducting the official R&D and Innovation surveys. He has played a key role in developing innovation policy for South Africa, as well as further afield within the NEPAD and African Union S&T initiatives, both as analyst and trainer. His contributions to policy include drafting the Green and White Papers on S&T, leading the initial phase of the National Research and Technology Foresight study and writing the Foresight Synthesis Report. Other contributions are the Performance Measurement System for the Science Councils, the Flight of the Flamingoes study on researcher mobility, and a study on the benefits of publicly-funded R&D for the National Advisory Council on Innovation. Prof. Kahn is a member of the Academy of Sciences of South Africa, serves on the advisory board of the journal Research Policy, and is a board member of the Agriculture Research Council.

DR TEMBA MASILELA

Temba Sipho B. Masilela is 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 and Capacity Enhancement cross-cutting programme at the HSRC.

DR STEPHEN RULE

Dr. Rule is an independent research consultant and Director of Outsourced Insight and has extensive experience in the design and management of social surveys and data analysis throughout southern Africa. He has managed quantitative and qualitative research on, and monitoring and evaluation of educational and developmental projects, and religious and political issues. He was a Board member (2011-14) of the South African Monitoring and Evaluation Association (SAMEA). Previously he has been a Director of Surveys at the HSRC, a research director in the Department of Social Development, and chairman of the research committee of the National Development Agency (2003-07). From 1986-96 he lectured in urban and political geography at Vista University in Soweto (now part of the University of Johannesburg). He holds a PhD in Political Geography from the University of Witwatersrand.

Appendix 3: Attendance

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Appendix 4: Presentations

Dr Thomas Auf der Heyde

DST SCIENCE ENGAGEMENT STRATEGY:
FACILITATING THE SCIENCE:SOCIETY INTERFACE

science & technology
Department: Science and Technology
REPUBLIC OF SOUTH AFRICA

Outline

- Science engagement landscape
- Challenges
- Strategic objectives and responses
- Enablers for successful implementation of the Strategy
- Funding the strategy/framework
- Way forward

Science engagement landscape: *Policy context*

- **National Development Plan**
  - To "promote technological advances, developing countries should invest in education for youth, ... and should ensure that knowledge is shared as widely as possible across society"
- **White Paper on Science & Technology**
  - "Development of the NSI requires among others, a society that values and understands science and technology as social tools, and their role in sustainable development"
- **National Research and Development Strategy**
  - Expressed the DST's intention to extensively invest in science promotion towards making science attractive, accessible and relevant

Science engagement landscape: *Operational context*

- SAASTA informally playing a coordinating role and largely project management function.
- A reliable network exists of cross-sector institutions collaborating with the DST in promoting science engagement (SE), including science centres and other government departments.
- DST entities are involved in SE through their outreach or corporate communication.
- South Africa is involved in cross-border and international SE activities.
- Two science communication chairs have been established under the SARChI, and the scientometric CoE has a SE function.

Challenges (1/2)

- Scientific literacy is low (e.g., decreasing interest among young; challenges in school science teaching; social levels of scientific ignorance).
- Popularisation of SET in South Africa is happening on a small scale leading to a decrease in the percentage of learners following mathematics and physical science at school.
- Empowerment of the general public to engage critically with science and technology is limited, yet it has a corollary in the need to empower "science" as a social phenomenon to engage publicly.
- While the DST and its entities have been fairly successful in profiling specific successes of South African science – such as in HIV/AIDS, astronomy, and palaeosciences – there is general agreement more can be achieved.

Challenges (2/2)

- Coordination of SE programmes has so far been pursued on an *ad hoc* basis, with SAASTA playing a related role without a formal mandate and with inadequate resources.
- There is no systematic approach to coordination of SE activities across the span of DST entities.
- Lack of effective monitoring and evaluation instruments, as well as meaningful indicators to measure outcomes and impact.

Purpose

- Systematise DST science communication, PUSET, etc.
- Ramp up DST (corporate) science communications
- Raise status of S&T in public and political perception
- Transcend deficit model philosophy

Strategic objectives

- To popularise science, engineering, technology and innovation as attractive, relevant and accessible in order to enhance scientific literacy and awaken interest in relevant careers.
- To develop a critical public that actively engages and participates in the national discourse of science and technology to the benefit of society.
- To promote science communication that will enhance science engagement in South Africa.
- To profile South African science and science achievements domestically and internationally, demonstrating their contribution to national development and global science, thereby enhancing its public standing.

Strategic responses (1)

- *To popularise science, engineering, technology and innovation as attractive, relevant and accessible in order to enhance scientific literacy and awaken interest in relevant careers.*
  - Will seek to create an atmosphere that enables the public to engage with the social consequences (positive or negative) of science and technology.
  - Science and mathematics Olympiads and competitions provide school-going aspirant scientists an opportunity to communicate science as they have to explain their science projects to the audience. These will be promoted and expanded.
  - Provision of information about careers in science is crucial in increasing the number of students who follow science-based careers in activities such as role-modelling campaigns and career booklets

Strategic responses (2)

- *To develop a critical public that actively engages and participates in the national discourse of science and technology to the benefit of society.*
  - An active attempt by the academic/researcher sector to bridge the gap between universities/science councils and the public (community engagement).
  - Increased access to scientific knowledge for the public at local and municipal levels.
  - A stronger focus on applicability of science (solving practical problems) and co-operation with other societal actors (e.g., formal dialogue across sectoral divides such between the public and the private sector, labour, etc.).
  - Promoting public engagement in research.
  - Using media as a form of dialogue between science and society.

Dr Carina Cortassa

Human and Social Dynamics (HSD) Research Seminar Series

"The role of the Social Sciences in Science Engagement"

PRETORIA – 10 March 2015

Promoting Scientific Culture: a Review of Public Policies in Ibero-American Countries

Dra. CARINA CORTASSA
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Buenos Aires. Argentina

How is the promotion of Scientific Culture integrated in the public policies for STI in the context of Ibero-American countries?

- At the rethorical level of sectorial laws and current policy plans in each context
- At the institutional level of governing bodies
- At the practical level of the concrete actions promoted, supported and/or executed by each agency

Methodology

- Documental analysis / Desk review
- Focus: 22 countries members of the Ibero-American community
- First stage (September-December 2013):

  Identification of the STI agencies by countries (STI Policies' Platform: http://www.politicascti.net/)

  Location of the current STI policy documents

  Survey of promoted actions by these agencies that responded to key words like: *scientific culture, science (and technology) communication, popularisation, social appropriation.*
- Second Stage (January-July 2014):

  Information update and verification with key informants

Visibility and Institutionality of the Scientific Culture in the STI Policies

- 19 countries (out of 22) show some degree of interest in the foster of scientific culture and public engagement with science
  - Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Spain, Guatemala, Mexico, Panama, Paraguay, Peru, Portugal, Uruguay and Venezuela.
- 17 countries explicitly refer to the topic in their STI laws and/or recent policy documents
- 11 countries have a specific government office responsible for these activities
- 18 countries have at least 1 concrete action
- These variables are not always concordant: references in documents and/or the existence of a particular agency not necessarily imply practical actions, neither the absence of the former implies lack of activity.

The polysemy in the policies' documents

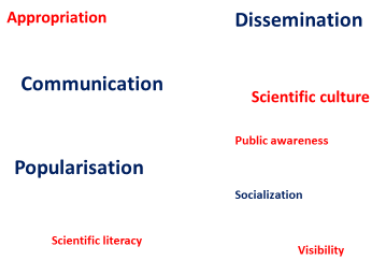

TABLE 1. COUNTRIES AND ACTIONS	
Country	Actions
Portugal	17
Chile	17
Argentina	16
Brazil	15
Mexico	11
Colombia	11
Costa Rica	11
Spain	9
Venezuela	9
Uruguay	7
Panama	6
Bolivia	5
Guatemala	5
Peru	5
Cuba	4
Paraguay	3
Ecuador	2
El Salvador	1
Total	154

Actions and tools to incentivate Scientific Culture

Naturalistic approach

The survey included all the actions and tools that the corresponding agencies and programs considered part of its strategies in the area, without adopting any *a priori* normative stance of what *it is* and what *it is not* relevant to the point

Chart 1. Qualitative distribution of the countries according to their rethoric and practical interest in SC

How to classify the diversity of registered actions?

CRITERIA	CATEGORY
(I) Modality	1. Awards and contests 2. Competitive funds 3. School activities 4. Events 5. Own media and/or products of Sci Comm and Culture 6. Perception surveys 7. Others
(II) Involvement of the Govt. Agency	1. Direct 2. Collaborative 3. Indirect
(III) Intentionality	1. Popularisation of knowledge 2. Pedagogical-Educative 3. Promotion of human resources in Sci Comm and Culture 5. Research 6. Public hearing and participation 7. Others
(IV) Target Audience	1. General 2. Children and adolescents 3. College students 4. Scientific institutions and communities 5. Journalists, content producers 6. Specific groups and minorities 7. Diverse audiences 8. Not possible to identify

TABLE 2 – MODALITY OF THE ACTIONS		
MODALITIES	Cases	%
Awards and Contests	39	26%
Events	36	23%
School Activities	23	15%
Own media and products	19	13%
Competitive Funds	13	9%
Perception Surveys	12	7,5%
Others	12	7,5%
Total	154	100%

Table 3. INVOLVEMENT OF THE GOVT. AGENCIES		
Participation	Cases	%
Collaborative	85	56%
Direct	56	36%
Indirect	13	8%
Total	154	100%

PARTNERS

- educative and/or scientific institutions (28 cases)
- other governmental agencies (13)
- international institutions (13)
- other national institutions (9)
- collaborative networks that gather several public and private organisms, national or international (22)

TABLE 4 – INTENTIONALITY		
Intencionality	Cases	% *
Popularisation of knowledge	66	42%
Pedagogical-Educative	49	32%
Promotion of human resources in SC	28	18%
Research	13	8,5%
Public hearing and participation	2	1%
Others	14	9%

*Activites can have more than a single intention, thus percentages exceed the 100%.

TABLE 5 –TARGET AUDIENCES		
Audiences	Cases	%
General	53	34%
Children and adolescentes	32	21%
Diverse audiences	26	17%
Scientific institutions and communities	18	12%
Journalists, content producers	13	8%
Specific groups and minorities	6	4%
College students	2	1,5%
Not possible to identify	4	2,5%
Total	154	100%

Closing remarks

- Encouraging signs
  - Growing visibility and institutionality of the Scientific Culture among the official STI agencies in the region
  - In some countries, activities are numerous and varied and show a certain degree of continuity
- Heterogeneity
  - In the terms and applied concepts (not always comparable)
  - In the practices grouped under those labels

Concluding remarks

Future agenda

- **An in-depth debate about the goal/s of improving Scientific Culture: the empowerment of citizens or the achievement of their support for the STI development? How to make both levels converge?**
- **Discussion about the coherence between goals, means, ends, strategies and promoted contents for SC**
- **Conceptual clarifications and agreements regarding the concepts of scientific culture, appropriation, popularisation, communication…**
  - **in order to be able to operationalise them in a set of indicators that allows to assess the impact of the activities and to facilitate the comparison of the initiatives in the region and other contexts.**

Thanks for your attention

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TABLE. Visibility and institutionality of Scientific Culture in the frame of STI Public Policies in Ibero-American Countries

COUNTRY	SC is mentioned in the STI Law and/or current policy document	Agency responsible for SC	Activities
ARGENTINA	Law 25.467 / 2001. Innovative Argentina 2020. National Plan for STI. Strategic guidelines 2012-2015.	National Program of Popularisation of STI	Yes
BRAZIL	National Strategy for STI 2012 – 2015 *	Departament of Popularisation and Dissemination of S&T	Yes
COLOMBIA	Law 1286 / 2009. Document CONPES 3582/2009. National Policy for STI	Networks of Knowledge Dept. ONDAS Program	Yes
SPAIN	Law 14/2011. Spanish Strategy for STI 2013-2020	Dept. of Scientific Culture. Spanish Foundation for S&T (FECYT)	Yes
GUATEMALA	National Plan for STI 2005 – 2014.	National Program for the dissemination, popularisation and transfer of STI	Yes
MEXICO	Law of S&T 2002 Program fo S&T 2008-2012	Dept. of Popularisation and Dissemination of S&T	Yes

TABLE. Visibility and institutionality of Scientific Culture in the frame of STI Public Policies in Ibero-American Countries

COUNTRY	SC is mentioned in the STI Law and/or current policy document	Agency responsible for SC	Activities
PANAMA	Law 13 / 1997 (mod. 2005) National Strategic Plan for STI 2010-2014	Dept. for Innovation in Learning	Yes
PORTUGAL	Activities Plan of the National Foundation for S&T 2013 y 2014.	Science Alive. National Agency for Scientific and Technological Culture	Yes
URUGUAY	National Strategic Plan for STI 2010	Departament of Scientific Culture	Yes
VENEZUELA	Organic Law of STI/2010. National Plan for STI 2005-2030.	Visibility and Popularisation of Sciences Unit	Yes
COSTA RICA	La4 7169 / 1996. National Plan for STI 2011-2014	--	Yes
ECUADOR	Strategic Plan 2009-2015	--	Yes
PERU	Law 28303/2004. National Strategic Plan for STI 2006-2021	--	Yes

TABLE. Visibility and institutionality of Scientific Culture in the frame of STI Public Policies in Ibero-American Countries

COUNTRY	SC is mentioned in the STI Law and/or current policy document	Agency responsible for SC	Activities
BOLIVIA	Law 2209/2001. National Plan for Development 2006-2011	--	Yes
EL SALVADOR	National Plan for the Scientific and Technological Development 2010-2014	--	Yes
CHILE	-- **	EXPLORA. National Program of Popularisation and Appreciation of S&T	Yes
CUBA	--	--	Yes
DOMINICAN REP.	Strategic Plan for STI 2008-2018	--	No

Project Practices and Values of the Social Communication of Science in Ibero-America.

Modalities of Actions by Countries

Country	Awards & Contests	Events	School Activities	Media and products	Competitive Funds	Surveys	Others	Total
Portugal	5	5	1	1	3	1	1	17
Chile	2	4	5	3	2	1	0	17
Argentina	6	4	2	1	2	1	0	16
Brazil	8	1	2	1	1	1	1	15
Colombia	2	2	1	1	2	1	2	11
Costa Rica	3	2	3	0	0	1	2	11
Mexico	3	2	0	3	1	1	1	11
Spain	1	1	1	3	1	1	1	9
Venezuela	0	2	0	4	1	1	1	9
Uruguay	2	1	3	0	0	1	0	7
Panama	0	2	2	0	0	1	1	6
Bolivia	1	2	1	0	0	0	1	5
Guatemala	1	3	0	0	0	0	1	5
Peru	1	2	2	0	0	0	0	5
Cuba	1	1	0	2	0	0	0	4
Paraguay	2	1	0	0	0	0	0	3
Ecuador	1	0	0	0	0	1	0	2
El Salvador	0	1	0	0	0	0	0	1
Total	39	36	23	19	13	12	12	154

Intentionality of the Actions by Countries

Country	Popularisaton	Pedagogical -Educative	Promotion of HR	Research	Public Participation	Others
Argentina	8	7	1	1	0	2
Bolivia	2	2	2	0	0	0
Brazil	5	3	2	1	0	5
Chile	8	7	2	1	0	1
Colombia	4	3	2	2	1	0
Costa Rica	2	4	3	1	0	1
Cuba	2	0	2	0	0	0
Ecuador	0	0	0	1	0	1
Spain	7	2	0	1	0	0
Guatemala	2	1	2	0	0	1
Mexico	6	3	2	1	0	1
Panama	1	3	1	1	0	0
Paraguay	0	0	3	0	0	0
Peru	2	3	1	0	0	0
Portugal	7	6	3	1	0	2
Uruguay	2	4	1	1	0	0
Venezuela	7	1	0	1	1	0
El Salvador	1	0	0	0	0	0

Involvement of the Govt. Agencies by Countries

Country	Collaborative	Direct	Indirect	Total
Portugal	13	2	2	17
Chile	7	7	3	17
Argentina	8	6	2	16
Brazil	6	8	1	15
Colombia	7	2	2	11
Costa Rica	6	5	0	11
Mexico	4	6	1	11
Spain	4	4	1	9
Venezuela	5	3	1	9
Uruguay	5	2	0	7
Panama	4	2	0	6
Bolivia	5	0	0	5
Guatemala	1	4	0	5
Peru	5	0	0	5
Cuba	3	1	0	4
Paraguay	2	1	0	3
Ecuador	0	2	0	2
El Salvador	0	1	0	1
Total	85	56	13	154

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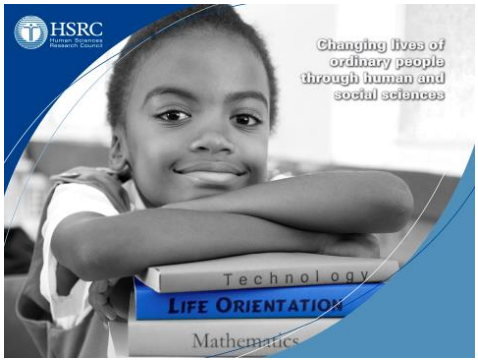
Dr Vijay Reddy



Storyline of this presentation

This section is to reflect on studies undertaken on science engagements. At the HSRC we are trying to build a research agenda on public attitudes to science. In this presentation we will report on findings from two studies.

i. public attitudes to science with data from the South African Social Attitudes Survey (SASAS) and
ii. one slice of the public, viz. grade 9 school students attitudinal data obtained from the Trends in International Math and Science Study (TIMSS).

Sub-text of my presentation is importance of research in this field

Papers and Publications

Reddy V, Juan A, Hannan S, Arends F, Gastrow M (2015) Science Awareness, Attitudes and Astronomy. Report to the Department of Science and Technology

- Reddy V, Gastrow M, Juan A (2013) Public attitudes to science in South Africa. South African Journal of Science
- Juan A, Reddy V and Hannan S (2014) Attitudes to Science: Part of the Puzzle to Improve Educational Achievement
- Science and society OR society and science
- PublicS

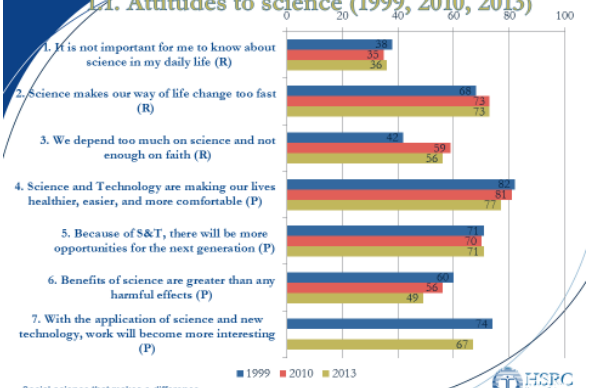
1. PUBLIC ATTITUDES TO SCIENCE

Measuring attitudes by SASAS

- **In 2013, 2739 adults over 16 years old participated**
- **Nationally representative stratified sample, weighted on 2011 census results**
- **Broader survey instrument includes social, cultural, demographic, and geographical data**

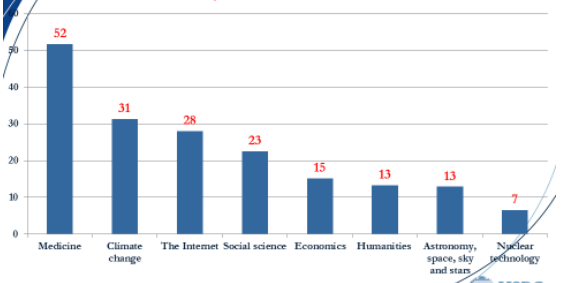
- **SASAS included internationally used measure of attitudes to science and technology:**
  - **Four items measure "promise" /benefits of science**
  - **Three items measure "reservation"/risks of science**

1.1. Attitudes to science (1999, 2010, 2013)

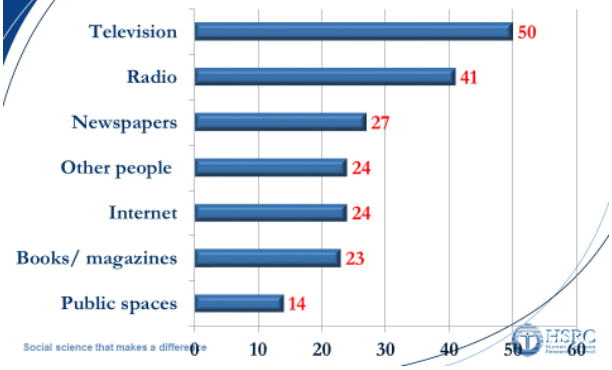


1.2. Interest in Science Developments

Which of the following science and technology developments are you most interested in?



1.3. How does the public access information



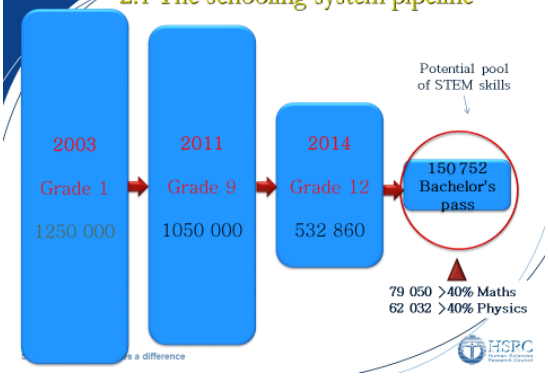
1.4. Science in schools

Statement	Agree %
The science I learnt at school has been useful in my daily life	33
The science I learnt at school has been useful in my job	36
Jobs in science are very interesting	60
Studying science will get you a good job.	47
Science is a career suitable for women	66

2. Grade 9 learners attitudes to science

- TIMSS assesses and benchmark South African mathematics and science performance in an international study. TIMSS is conducted every four years since 1995. In TIMSS 2011, 45 countries participated at the grade 8/9 level.
- In August 2011, the HSRC administered the TIMSS 2011 mathematics and science instruments in 285 schools to 11969 grade 9 learners in public and independent schools.
- A set of 21 items related to learner attitudes to science.
- Three indices were created from the items:
  - **Enjoyment**: intrinsic motivation
  - **Valuing:** Extrinsic & seeing the utility of science
  - **Self-confidence:** ability beliefs to learn science.

2.1 The schooling system pipeline



2.2.Why the interest in science attitudes for school learners

Emerging literature highlights the importance of cognitive (academic) and non-cognitive (motivation, values, interests, and attitudes) in producing the desired educational, social and economic outcomes.

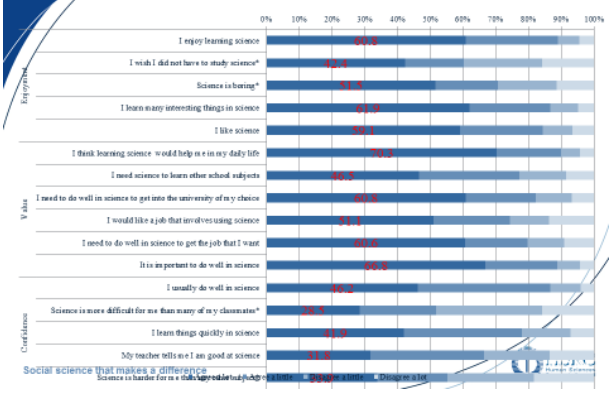
There is a bi-directional relationship between cognitive & non-cognitive aspects.

Evidence suggests that while both cognitive and non-cognitive traits evolve over the lifecycle, non-cognitive skills can be influenced more successfully and later in life than basic cognitive skills.

Social policy focusing on non-cognitive traits, such as attitudes, may therefore be effective in addressing low math achievement.

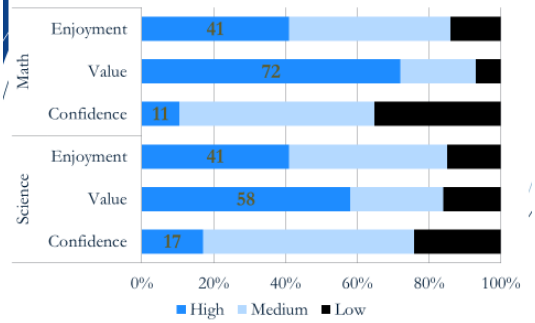
Social science that makes a difference

2.3. Learner views of science

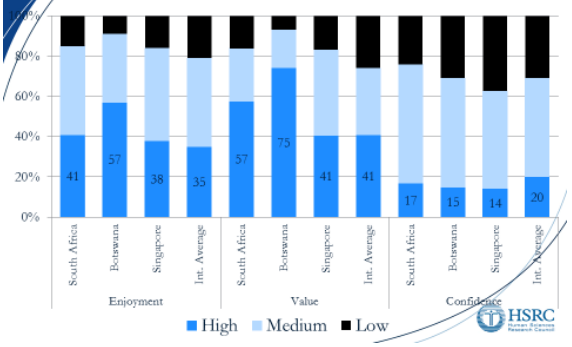


Social science that makes a difference

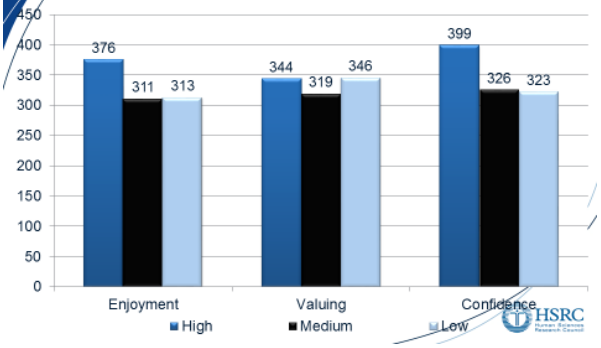
2.4 Enjoyment, Value and Confidence in Mathematics and Science in TIMSS 2011



2.5. Science Attitudinal patterns of Singapore, Botswana, and South Africa



2.6. Enjoyment, Valuing and Self-Concept of Science by average achievement score



2.7. The relationship between attitudes and achievement

Enjoyment = 24 Achievement points

Self confidence = 10 Achievement points

Value = 15 Achievement points

Social science that makes a difference

3. Overall Implications

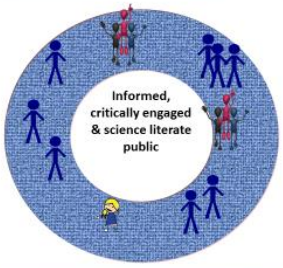
Need for an instrument to measure views/ attitudes of public to science.

- Need to have a theory of change that will facilitate programmes to change attitudes
- For the schooling system need to focus on encouraging the enjoyment of science, as well as building students self-confidence in their ability to learn science.

Social science that makes a difference

Dr Beverly Damonse

Operational Prospects for Implementation: A Reflection



BA Damonse, March 10 2015

Framework Intention

- ❑Systematise collective effort of multiple role players
- ❑Improve co-ordination
- ❑Encourage science promotion and communication
- ❑Foster better, more valuable science engagement
- ❑Improve balance in portfolio of activities
- ❑Enhance collective impact

Framework Scope

- ❑Across DST (intra- departmental)
- ❑Its entities (NRF, CSIR, HSRC, SANSA, ASSAf)
- ❑Universities, museums, science centres
- ❑Other Science Councils
- ❑Other Government departments
- ❑Private sector
- ❑International opportunities

Strategic Partners

Framework Enablers

- ❑Effective coordination – coordinating body
- ❑Adequate funding
- ❑Participation of relevant stakeholders and role players
- ❑Establishment of a monitoring and evaluation framework

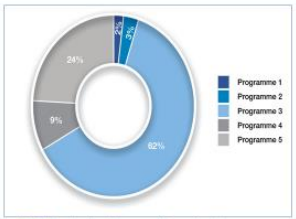
Framework Coordination

- ❑National – SAASTA
- ❑Intra-departmental – across DST
- ❑Inter-departmental – clusters
- ❑Inter–governmental – continental, international
- ❑Coordination with Science and Technology Research Institutions

SAASTA

- ❑ Business unit of NRF
- ❑ DST projects (largely)
- ❑ High level of contract funding (13/14 approx R90M)
- ❑ Dual role – funder and practical implementer
- ❑ Maths and Science Education – strong focus
- ❑ Science communication and awareness increasing in recent years
- ❑ Website(s), resource production, exhibits, infrastructure, project management
- ❑ Approx. 50 staff

Funding Model(s)



NRF Projected Expenditure (incl. capital) for 2015/16

- ❑ New Funding Formula
- ❑ SOURCES
  Science Awareness ENE
  Top slicing 4% - DST entities
  Top slicing 4% - within DST (P2-5)
- ❑ New approach(es) for funding transfer to SAASTA
- ❑ Private partnerships

Market Segmentation

Monitoring, Evaluation & Research

- ❑Audit –who is doing what? How? Why?
- ❑Meaningful Performance Indicators
- ❑ National SURVEY instrument
- ❑ Visitor studies, informal learning, attitudinal studies
- ❑ Long term tracking studies
- ❑ Media monitoring and analysis
- ❑ Skilled M&E Practioners

Phased Approach

Phase 1

- ❑ Securing stakeholder buy-in
- ❑ Consolidating existing systems , identification of new systems
- ❑ Re-alignment of existing projects
- ❑ Conceptualisation of new programmes.
- ❑ Implementing programmatic activities not adversely affected by absence of and/or lack of adequate systems.
- ❑ Reconstruction of baseline data for input, output, outcome and impact indicators.

Phased Approach

Phase 2

- ❑ Implementation of all the systems developed in Phase 1.
- ❑ Continuation and consolidation of programmes
- ❑ Monitoring and Evaluation Framework

Phased Approach

Phase 3

- ❑Full scale system performance monitoring and project-based evaluations to establish emerging impacts and outcomes, which includes periodic international benchmarking and comparative studies.
- ❑Growing reach while concomitantly increasing efficiencies of the institutions, programmes and systems developed

Changing the conversation…

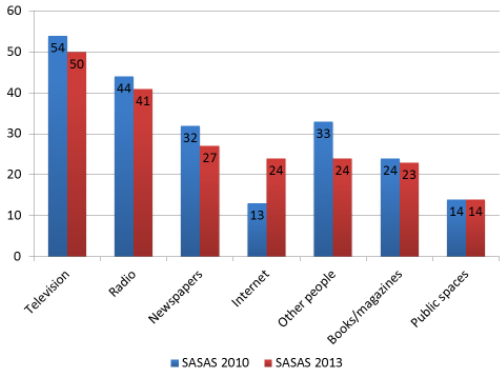
- ❑ Coordination – silo bridging
- ❑ Cooperation – shared goals/attitudes
- ❑ Capability –skills development
- ❑ Connection – blending of partners offerings

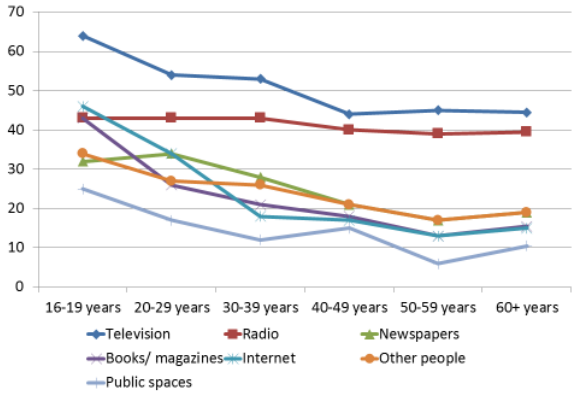
ADDRESS

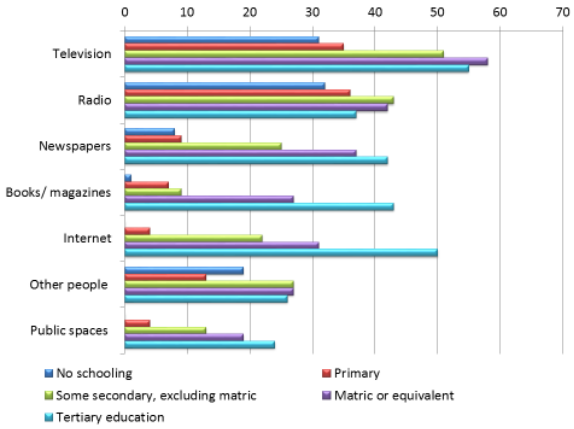
Intellectual, structural and emotional barriers to change

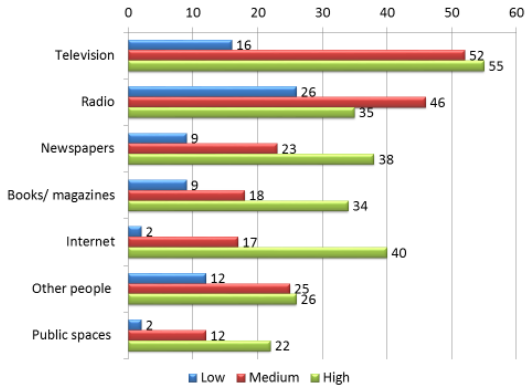
Dr Michael Gastrow

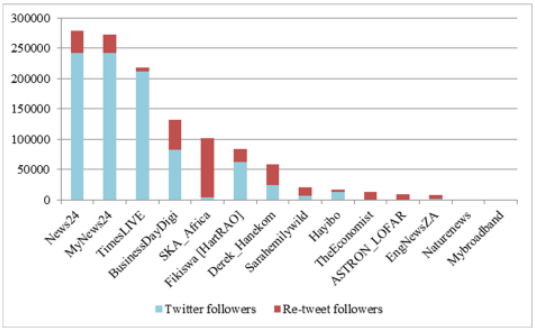
Science and the South African media









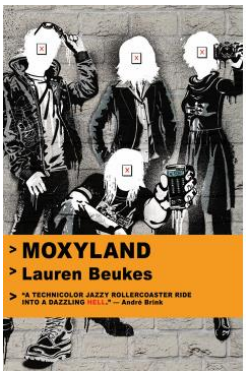


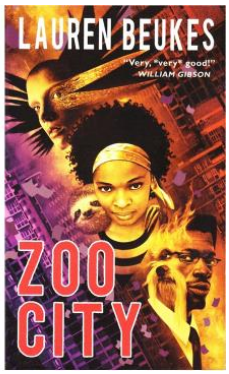
	% of sample
SKA framed as an African project	21
Affirmation of African S&T capabilities	10
Affirmation of South African S&T capabilities	9
External views of South African S&T capabilities	8
Africa as part of global S&T	7
Comparison to World Cup 2010	6
External views of African S&T capabilities	5
Africa Day	4
African growth in astronomy	2
Refutation of Afro-pessimism	2
Reference to Afro-pessimism	2
African astronomy historical perspective	0
TOTAL references to the SKA as symbol of African science & technology	35

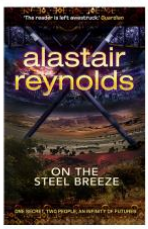
Beyond the news media: How does science enter popular culture?

*Common for youth/high education/LSM, little access for older cohorts/low education/LSM

Channel	Features	Questions
Television	Dominant overall channel	News? Documentary? Fiction?
Radio	Dominant channel for low LSM	Modalities? Languages?
Newspaper*	Science journalism as a critical issue	Science journalism capacities and institutional culture
Other people	"Channel" of communication is through social interaction/construction	Social construction of science
Book/magazine*	Steep gradient vs education. Raises literacy as an issue of access.	Popular science? Fiction?
Internet*	Digital divide	News? Science magazines/media? Social media? Institutional sites?
Public spaces*	Direct mandate of DST entities	Science centres? Libraries? Museums?







In *Iron Man 2*, Tony Stark discovers an entirely new element (and builds his own particle accelerator to synthesize it) to replace the palladium power source that was poisoning him.

What can you discover/build/create/innovate with science?

"Super-hero comics incorporate the same tensions that inform academic discussions and as such they should be seen as just as much a part of the collective working out of the questions and problems raised by modern science. This working out involves us all; in this, we are all the experts" (Locke, 2005: 42)

Strategic considerations

- Media is relevant to all four strategic aims of the framework – thus a critical point for research and implementation plan
- Mission: science engagement 'using the most appropriate and innovative means' – challenges us to think out the box
- Science centres as the core infrastructure for science engagement? Need to expand their media scope/channels and roles.
- DST's resources currently permit engagement access to only a small fraction of learners – need to look at a broader media strategy
- Frame STEM as more fun, appealing, accessible, etc. This is an issue of 'science culture' as well as 'science engagement'.

New platforms, channels, modalities

New technology platforms:

- Greater use of online social media to provide a public space for user-driven engagement between the public and DST entities (including SAASTA)
- Online social media platforms specifically to debate controversial science issues
- A phone app?

New communication channels and modalities:

- Clear need to strengthen science journalism capabilities…
- But also focus on the other main channels of science communication – TV, radio, internet, books/magazines
  - tactical responses to their demographic features
  - Research focus on modalities, framing, sources of information, demographics…
- How do we think about "*Promoting the communication of science using the arts and performing arts*"?
- "*Bilateral agreements with the relevant departments*" – SABC? NAC? DAC?

New research questions and approaches

- **National surveys** (e.g. SASAS) for longitudinal detail
- **Media studies/science communication studies** of the channels, messages, modalities and impact of science in the media and related public discourse
- The media provide **role models** for scientists, engineers, etc. – how are these framed in a South African context?
- How are South African science **achievements** framed in the media – for example the SKA as a symbol of (South) African science and technology achievement? How can we include these **symbols** in our science communication?
- **Global vs (South) African science media content?**
- Is science **framed** as 'accessible', 'interesting' etc. in line with Framework objectives?

Science and the South African media