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The significance of social scientific and humanities research related to science and technology.

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Introduction

This presentation will focus broadly on the interactive role of the social sciences, sciences and humanities in evidence based research for policy development and in specific as a response to the Ministerial Report 2012 and its implication for the development of Science communication and Public Understanding of Science (PUS) in South Africa.

Background:

By definition policy is a set of related decisions originating from multi- decision points that give rise to specific proposals for action or negotiated agreements between government and society. Social/public policy can result in concrete plans informed by the specific focus on regulation or programs of legislation and leads to the establishment of standards and funding priorities. What is of special interest in/for the development of social policy is the knowledge-policy interface characterized by the interaction between life-worlds (worldviews) and social structuring driven by social values and interests. More recently social policy looks at the recognition of science as a inadequate knowledge system when it comes into contact with indigenous knowledge systems (IKS). In this interface we find the 'science and society' paradigm useful in its relation to inherent power positions driven by specific governance structures (democracy), ideologies.

Current debates regarding policy development include discussions around the development of a taxonomy of knowledge types to help us organize, understand and access knowledge most suitable for contributing to policy development. A further challenge is that traditional science research is not well equipped to contribute to policy making. For this purpose we find growing interest in more philosophical debates regarding the complexity of society, the complexity of policy making and the pragmatic contributions currently being generated through a 'science and society' research paradigm. The calls are for multi- and inter- disciplinary research and the application of a transdisciplinary approach that moves beyond the disciplines and situate

knowledge production within society. With this shift come global incentives for a new science communication model as well as the design of new science communication indicators (indexes)

Within all of these debates science communication takes up center stage as facilitator, intellectual driver and disseminator of knowledge systems important for successful policy implementation.

Response on the Ministerial report March 2012.

This response focus on the role of science communication as indicated by The South African Green Paper on S&T: *Preparing for the 21st century* (published in January 1996), The South African White Paper on S&T (September 1996) and the Ministerial Report (March 2012).

The role of science communication and Public Understanding of Science (PUS) featured prominently within both the Green Paper on S&T (1996) and the White Paper on S&T. This role has fallen away in the current Ministerial Report (2012). It is argued that a creative and innovative centralized science communication system, driven by science communication research and international collaboration in such research, needs to be developed to ensure that the process of science communication takes place in a coordinated and strategic manner within the system of innovation proposed by the Ministerial Report (2012).

Serving as background this document includes a brief summary of the report prepared by the Human Sciences Research Council (HSRC): *Science and the Publics: a review of public understanding of science studies* (July 2009) compiled by Reddy, V & Gastrow, M & Bantwini, B, commissioned by the South African Agency for Science and Technology Advancement (SAASTA). This report highlights shortcomings within the current application of S&T and its System of Innovation - without providing explicit solutions to the perceived neglect of developing a science communication system within government. One would expect that the Ministerial Report (2012) will support efforts to rectify the problem and to ensure a sustainable effort in the development of science communication and PUS on national level.

After a careful reading of the Ministerial Report (2012) there is no evidence of the continued uptake of these matters. There is no provision made for either corrective actions (indicting the failures as mentioned in the HSRC report) or further development of the strategic role played by science communication and PUS policy driven surveys in the national system of innovation. The section most appropriate for addressing measures to ensure efficient science communication application (Section 5: Human capital and knowledge infrastructure), makes no mention of a science communication theoretical framework or the value of PUS based surveys to ensure an

unbroken loop between action based research, policy development, policy application and the impact assessment of policy. The role of society in informing these processes is absent. With countries like India and China engaged in science communication and PUS to inform policy over the past 30 years, this oversight limits South Africans from studying and conducting comparative research outside of its own borders.

The South African Green Paper on S&T: *Preparing for the 21st century* was published in January 1996.
The SA Green paper on S&T (1996) mentioned in its mission statement to: *"… formulate, implement and evaluate policy for the advancement of S&T in pursuit of an improved and sustainable quality of life for all South Africans'*

One of the objectives mentioned towards the fulfillment of this mission is*:*
- promote the Public Understanding of S&T, especially in areas of implementation of the Research and Development Programme (RDP)" (South Africa's Green Paper on S&T: Preparing for the 21st century, 1996:38).

Chapter 9: Human resource development and capacity building devotes section 9.9 on: Public Understanding of Science, Engineering and Technology (SET) and mentions the following:
"Access to information is empowering, enabling people to monitor policy, lobby, learn, collaborate, campaign and react to proposed legislation. It is also one of the most powerful mechanisms through which social and economic progress can be achieved. The democratisation of society and elimination of poverty can only occur if people have equal access to the services and resources they need to perform their productive tasks. Democracy implies being aware of choices and making decisions. The extent to which this is possible depends largely on how much information is available to the people and how accessible it is.

Technological advances have demonstrated the potential of technology to transform the lives of people in a positive manner. Yet disadvantaged populations and women, especially those in rural areas, have little access to information about these technologies. To date, a combination of factors has prevented them from gaining equitable access to the information they need and have thus limited their ability to participate more fully in the transformation process in South Africa.

For the National System of Innovation to become effective and successful all South Africans should participate. This requires a society which understands and values science, engineering and technology and their critical role in ensuring national prosperity and a sustainable

environment. This, in turn requires that SET information be disseminated as widely as possible in ways understood and appreciated by the general public".

Promoting SET literacy encompasses the following:

- familiarity with the natural world and respecting its unity.
- understanding some of the key concepts and principles of SET
- knowing that science, engineering and technology are social tools and
- the ability to use SET knowledge in ways that enhance personal, social, economic and community development.

Promoting the power of SET:
Many countries promote public awareness of S&T developments and devise strategies to help the public understand what is happening to them and their environment through SET developments.
On a personal level, this entails a deeper understanding of the power of SET to transform the relation between people and nature. This political or sociological aspect of the public understanding of SET need not necessary depend on institutionalised education. It is this aspect of the SET awareness campaign that will enable parents with minimal education to understand the value of formal education in Mathematics, science, engineering and technology and thus enable their children to perue these fields. Such parents can then also participate in discussions on and in SET developments and applications affecting their lives and communities.

Point 9.9 further discusses the types of initiatives that are required and recommended to launch the Public Awareness of SET to ensure the sustained and timely delivery of SET information:

Option 1: Institutions be identified that can best respond to disseminating SET information to the public.

Option 2: The kind of information be determined that the public would need to make informed decisions about technology-related issues.

Option 3: The media be identified through which SET information can be made more accessible to the public.

Option 4: The structures be established to ensure that the flow of accessible information will actually reach disadvantaged populations, including women and rural populations.

Option 5: Effective SET awareness initiatives and campaigns be launched aimed specifically at politicians (operating at national, provincial and local levels), policy-makers and decision-makers in government (South Africa's Green Paper on S&T: Preparing for the 21st century, 1996:38).

In conclusion the report mentions that South Africa needs to build a critical mass of SET capacity to break the old-era cycle of insufficient education and the neglect to attract sufficient R&D with the resultant lack of skills development. The main message was that SET information needs social dissemination to empower political decision-making.

White paper on Science and Technology (1996) :

Chapter 9:76 Human resource development and capacity building:
8. Public Awareness of S&T
Access to information is empowering, enabling people to monitor policy, lobby, learn, collaborate, campaign and react to proposed legislation. It is also one of the most powerful mechanisms through which social and economic progress can be achieved. The democratisation of society and elimination of poverty can only occur if people have equal access to the services and resources they need to perform their productive tasks. Democracy implies being aware of choices and making decisions. The extent to which this is possible depends largely on how much information is available to the people and how accessible it is.

For the national system of innovation to become effective and successful all South Africans should participate. This requires a society which understands and values science, engineering and technology and their critical role in ensuring national prosperity and a sustainable environment. This, in turn, requires that S&T information be disseminated as widely as possible in ways that are understood and appreciated by the general public.

Recent history has demonstrated the potential of technology to improve the quality of people's lives. Yet disadvantaged populations in general and women in particular, especially those in rural areas, have little access to information about these technologies. To date, a combination of factors have prevented them from gaining equitable access to the information they need and have thus limited their ability to participate more fully in the transformation process in South Africa.

A campaign to promote awareness and understanding of S&T and of its importance will have two key elements, namely promoting S&T literacy on the one hand, and promoting the power of S&T on the other. These programmes would include

- increasing familiarity with the natural world
- promoting understanding of some of the key concepts and principles of S&T
- demonstrating that science, engineering and technology are social tools and
- fostering the ability to use S&T knowledge in ways that enhance personal, social, economic and community development.

The deficiencies of the current system are multifaceted. The solution of this problem requires an innovative approach in itself. All available SET institutions in South Africa should be actively involved in such an initiative.

Government will institute via DACST the delivery of S&T public awareness programmes in collaboration with consortia of institutions, including societies for the advancement of science, professional associations, academies of science, science museums and libraries, media (printed and electronic), educational institutions and private business.

Problems identified with the original S&T policy regarding the Public Understanding of Science (PUS):

Providing a comprehensive overview of PUS research in South Africa, the Human Sciences Research Council (HSRC) compiled a report: *Science and the Publics: a review of public understanding of science studies* (July 2009) compiled by Reddy, V & Gastrow, M & Bantwini, B, commissioned by the South African Agency for Science and Technology Advancement (SAASTA).
The Human Sciences Research Council (HSRC) report: *Science and the Publics: a review of public understanding of science studies* clearly indicates that South Africa does not have a systematic, comprehensive and nuanced assessment of the public's relationship with science. It refers to policies that indicate a transformation process of an economy that is resource based to one that is increasingly knowledge-based – with the expressed aim to harness the growth potential of a knowledge economy for socio-economic development. With South Africa being a highly stratified society it is recommended to consider the society under a *'public(s)' relationship with science'*. There is also recognition that the public's relationship with science is shaped by the culture in which that public is located[1].

In the conclusion of the (HSRC) report: *Science and the Publics: a review of public understanding of science studies* the indication is that:

[1] A limited amount of surveys were conducted in the past by the Foundation for Education, Science and Technology (FEST) which later became the South African Agency for Science and Technology Advancement (SAASTA) between the periods 1991 to 2007.

- Science communication perceptions are still dominated by race perceptions with a near complete absence of a fair demographical representation.
- The public(*s*) perceptions exist in theory only.
- The public is still perceived in 'deficient' terms with scientists following the by now globally contested 'deficit model' of science communication.
- A fairly recent new focus is developing on a bi-directional relationship between the public and science with related issues such as understanding the communication of messages about S&T, the dynamics of attitude and belief formation regarding S&T and, most importantly, access to information about S&T.

The HSRC report, in reference to the 'scientific literacy model' developed and adopted in Europe, originally theorised by Jon Miller (1983) with a preference to measure formal science, is considered as inadequate for South African needs. In the South African context there is *a priori* reason to focus on practical science literacy [2].

The key findings in the 2009 HSRC report indicate a number of areas in South Africa that requires attention:

- Policy in support of PUS is in place – Department of S&T.
- Policy commitment has not yet been translated into programmes and projects (except for awareness strategies for biotechnology and climate changes)
- There is general agreement regarding the positive contribution of PUS
- There is still uncertainty regarding the definition of science – currently epitomized by the debates around western science and Indigenous Knowledge Systems (IKS).
- The science and society framework is conductive for PUS research. South Africa's stratified public(s) need understanding.
- South Africa needs to develop an appropriate assessment framework.
- More efforts are needed to understand the S&T needs of the school-going population.

2 Reference, in this regard, is made to Gauhar Raza's (2002:57) comment regarding the complex and heterogeneous nature of society: *"There is an increasing global need to look for alternative models of development which are more compatible with socio-cultural structures prevalent in the so-called third world. The gap between the social, cultural and economic conditions of the west and the developing countries poses numerous problems in implementing developmental strategies as devised by the developed world. The developmental models meant for third world countries often originate in the west. The lack of understanding of culture, which is a decisive force and which inhibits or accelerates the pace of accepting science and technology in a society, introduces distortions in the social fabric. Thus a deeper insight into the cultural complexities of thought that prevail in a society is imperative for suggesting workable solutions to socio-technical problems".*

- South Africa has not undertaken a systematic, comprehensive and nuanced assessment of PUS.
- The high incidence of 'don't know' responses in surveys on biotechnology and climate change needs the careful consideration of items and samples to be surveyed.
- South Africa has not undertaken PUS surveys on S&T attitudes among the school-going population.
- We need to grow an academic understanding of issues related to science communication.
- Too little is known about South African's attitude towards and understanding of science(s).
- Policy makers and academia need baseline information describing key indicators, they need to build a record of 'tracking changes' over time and the public's input in policy formulation.
- South Africa needs to review conceptual and theoretical frameworks and tools to understand the impact of S&T and science communication on society.

Sub-studies are recommended in the following areas:

- PUS on post-school level.
- PUS on school level.
- Specialized PUS surveys on nanotechnology, climate change, environment, agriculture, health, bio-technology and sustainable development.
- Analysis of science communication strategies and their impact on the public(s).
- Qualitative studies on the enhancement of science communication strategies.

Ministerial Report March 2012;

Section 5: Human resource development and capacity building:
In this section there is a complete absence of looking at the development of humans (as knowledge resources) and no mention of any system to measure the success or failure of, as example, education systems to be developed in support of human resource development.

Conclusion:

There are two problems that need to be addressed. In the first place there is a lack of differentiation in the policy comments between Science Communication (SC) and Public

Understanding of Science (PUS). It is important to note the difference between the two disciplines. Science communicators use the impact of the media and other channels of communication to disseminate science findings. The focus is on a multi-media *communication process* through journalistic reporting, displays in science museums and science reporting in the media, TV and radio. There are two types of science communication that scientists are involved with which Hans Peters (2008:131) describes: *"the first is popularisation of research as the public reconstruction of scientific projects, discoveries, achievements and theories from a science-focused point of view: the second is meta-discourses about S&T and the science-society relationship, such as disputes about risky technologies and conflicts between science and social values (animal experimentation, etc.)"*. Scientists in society occupy dual roles: scientists as (policy) advisors and scientists as public communicators (with political impact). Popular topics that construct a 'social reality' or 'public reality' include: climate change, depletion of the ozone layer, biotechnology, stem cell research, nuclear safety and health issues such as HIV/AIDS and other epidemics (mad cow disease, bird flu). A 'pluralistic knowledge society' receives science communication with existing knowledge that developed in competition with other research communities and from extra-scientific domains. The practice of everyday knowledge, especially knowledge based on practical experience (traditional indigenous knowledge) that stems from religion, belief systems, folk wisdom and indigenous culture adds complexity to science communication.

Main areas for science communication are:

- Science museums and science centres that reflect the encyclopaedic spirit of the scientific community and fulfil a crucial role in communicating science to the publics in support of science research.
- The media, TV and public communication forums, conferences and public lectures.
- Publications on science communication that can be found in the *Journal for Science Communication*.

The public's attitude towards and understanding of science developed as a discipline in relation to the growing complexity of the relation between science and society. The term *'public understanding of science'* has a dual meaning. According to Martin Bauer (2008:111) it covers, in the first place, *"… a wide field of activities that aim at bringing science closer to the people and promoting PUS in the tradition of a public rhetoric of science. Secondly it refers to social research that investigates, using empirical methods, what the public's understanding of science might be and how this might vary across time and context. This includes the conceptual analysis of the term 'understanding'".* As a specialised discipline PUS developed, during the early 1960's, a special focus on conducting surveys to establish what people know about science (eg. their levels

of science literacy). PUS surveys became well established in Europe and the methods developed there initially dominated the way in which PUS research was applied and used by policy makers in governments. However, the discussions of PUS have been limited to national or regional data within developed and industrialised countries.

Since the 1960's the field of PUS has grown into a globally recognized research based discipline. In its historical development Martin Bauer (2008) identified three distinct paradigmatic changes that are described as:

- The *Scientific literacy* paradigm (1960s to mid-1980s) that built on two ideas: science education is essentially part of the secular drive for basic literacy in reading, writing and numeracy; and that science literacy is a necessary part of civic competence (Bauer, 2008: 115). Bauer (2008: 115) further stated that the perception was created that scientists, in support of politicians, are informed and educated and "… the public, *de facto*, ignorant and disqualified in participating in policy decisions". To interpret survey data the *deficit model* was applied since communication was considered as a linear process whereby the scientists informed the public.
- The *Public understanding of science* paradigm (1985 to mid-1990s): in this paradigm the concern emerged amongst scientists that a better understanding is required regarding the attitudinal deficit about science amongst the public. A process to better appreciate science was put forward since science was "… important for making informed consumer choices; it enhances the competitiveness of industry and commerce; and it is part of national tradition and culture" (Bauer, 2008:119). A number of models were considered during this period, based on science *communication* needs, which brought into consideration the aspect of a two-way communication process.
- The *'science-in-and-of-society'* paradigm (mid-1990s to present) is currently giving recognition to the fact that "… science and technology operate in society and therefore stand relative to other sectors of society" (Bauer, 2008:122). Most significantly, in the current 'science and society' paradigm, the field of PUS is now recognised as a fully established and multi-disciplinary (social sciences, sociology, philosophy, anthropology and others) based area of research. However, there is a deficit of trust in science mirrored by a deficit in promoting S&T. This is resulting in a shift in focus: looking at the lack of attention by the science experts and their prejudices about the public (Bauer, 2008:122).

Main areas for PUS activities are:

- Agency (government) commissioned surveys over the past 40 years. This includes surveys such as the Eurobarometer survey series (since 1978) covering initially 8 and recently 32 European countries and the UK Wellcome Trust series. In South Africa we find the Afrobarometer surveys conducted by IDASA.
- Science communication and PUS for policy development.
- Publications (*Journal for Public Understanding of Science*).

What is becoming clear within a global context that science communication and PUS based research currently calls for advanced internationally compatible research opportunities in the areas of secondary analysis, dynamic modeling and global comparisons. To do so requires countries to:

- Integrate the different national and international surveys as far as possible into a global database, maybe under the EU, World Bank, UNESCO or UN flag, and in collaboration with existing social science data archives.
- Encourage sophisticated secondary analysis and the continued documentation of this growing database.
- Construct dynamic models of PUS over time, including cohort analytical and quasi-panel models, and to test these in different contexts.
- Work towards global indicators of a 'culture of science' based on these surveys.
- Seriously commit to and develop alternative data streams, such as mass media monitoring and longitudinal qualitative research efforts (Bauer, 2008:125).

Though South Africa clearly indicated a drive for the promotion and application of PUS initiatives in its S&T policy Green and white paers, little has been done to develop this area of research on the ground. The reasons are manifold and include aspects like the lack of uptake of this area of research within Higher Education institutions. A further reason can be found in the lack of a policy for PUS research and development.

Towards a policy for PUS.

Researchers in the area of PUS should drive the development of a PUS policy through the simultaneous development of a theory 'embedded in the African worldview'. A critique about the literacy paradigm as a continuum or threshold measure is required. Questions regarding 'textbook knowledge' in relation to 'indigenous knowledge' pose a challenge when the developing world participates in PUS surveys. The coexistence of belief systems (superstition) and (western) scientific literacy must be intensely debated. Knowledge items embedded in socially different worldviews are becoming increasingly controversial (evolution versus fundamentalist religious

culture) and require intense debates. The need to evaluate the complex original source of science knowledge by the public(s) instead of evaluating the actions of mediators (journalists, TV commentators) could lead to new insights in the theoretical development of a more representative African based PUS.

Answering the policy issue; *what is the scope and severity of the problem* as I identified it in the above, I would like to pose the following recommendations that should serve as driver for the development of a PUS Policy which could change the problem of effective communication of science in future.

- Clarify the advantages of a dedicated PUS policy.

- Develop a PUS policy to serve as driver for national surveys and to assist in the development of alternative data streams and longitudinal qualitative research efforts.
- Interrogate existing notions of being 'scientifically literate' against the embedded knowledge of indigenous (local) populations.
- Promote a 'scientific temper' amongst the general population - using the example of the post-colonial government (after 1947) under Nehru in India.
- Address the specific advancement of science challenges in Africa in general and within South Africa in specific.
- Provide clear directories and pointers for PUS research.
- Put in place indicators specific to the assessment of the impact of PUS research for effective governance.
- Earmark specific areas of funding for the development and application of PUS research in all fields and disciplines that could be loosely grouped under the topic of Climate Change.
- Develop and promote clear career paths within Higher Education, government and industry towards effective communication of science.
- List the responsibilities of the South African Science Counsels as well as the South African Agency for Science and Technology Advancement (SAASTA) of the National Research Foundation (NRF) in the promotion of science amongst the public(s).
- Establish clear links with global research bodies – specifically in developing countries – such as with the National Institute for Science Communication and Information Resources (NISCAIR), CSIR, India and the China Research Institute for Science Popularization (CRISP), Beijing, China.

Bibliography:

Bauer, M. 2008. Survey research and the public understanding of science (pp 111–129). In: Bucchi, Massimiano & Trench, Brian (eds.). Handbook of public communication of science and technology. London: Routledge.

Miller, J. 1998. The measurement of civic scientific literacy (p 203–223). In: *Journal of Public Understanding of Science*, vol. 7 (3).

Peters, H. 2008. Scientists as public experts. In : Bucchi, Massimiano & Trench, Brian (eds.). *Handbook of public communication of science and technology*. London: Routledge.

Raza, G & du Plessis, H. 2002. *Science, craft and knowledge*. Pretoria: Protea Boekhuis.