Review of PUS research in South Africa 2010

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Introduction

With South Africa struggling to overcome a well conceptualised and structured 'social engineering' experiment referred to as Apartheid, the post-apartheid African National Congress (ANC) government is still engaged with a process of transformation. The process of transformation is characterised by the cancellation of a number of old legislations (such as Bantu-education, the Bantu-stan based relocation of people and the Immorality Act which separated people on racial grounds). The ANC government introduced, to name a few, a number of new policies , radically changed the tertiary education landscape and engaged in restoring land to original owners who were forcefully removed by the Apartheid government. In this report I will look at a few aspects that directly impacts on the future successful development of research and surveys in the discipline of Public Understanding of Science (PUS) which is indicted as a focus area within the policy of the Department of Science and Technology (S&T) in South Africa.

Background

Globally governmental R&D programmes and incentives indicate how efficient the drive and positioning of PUS research can be achieved. The advantage of this is well argued and documented. However, with South Africa still struggling to emerge from the past Apartheid government (after 1994) it is necessary to consider the development of S&T in South Africa as 'still emerging'. This report will look at a few examples of this emerging socio-political landscape.

The quest for science literacy in Africa

The validity of traditional African philosophical 'systems of thought' has been called into question, given the devastating impact of cultural oppression, slavery and colonialism in Africa. The epistemic status of traditional African philosophical 'systems of thought' are questioned in the light of Eurocentric assumptions that foreground modern scientific rationality and literacy as requirement for the rational expression of philosophical thought.

African philosophers question these assumptions and Isidore Okpewho (1992:3) points to the dominance of oral literature in Africa. He argues that the traditional African oral literature (literature delivered by word of mouth), contains a number of different forms in which traditional African philosophical thought is expressed ('orature', 'traditional literature', 'folk literature' and 'folklore', proverbs, sage literature, etc) . These terms refer to different forms of communication and indicate the richness of African epistemological options.

European colonialists initiated the formal academic study of the oral literature of Africa in the mid-nineteenth century. The aim was to assist the colonials to understand the cultures of the different societies they encountered in their travels in Africa. This process was undermined by misinterpretation and misunderstanding, emanating from a racist sense of cultural superiority on

the part of many of the European colonialists. Isidore Okpewho (1992:17) mentions the book by the British anthropologist, Captain R.S. Rattray's *'Ashanti Proverbs: the Primitive Ethics of a Savage People'* (1916), as a prime example of the racial arrogance that characterised the attitude of colonial administrators and field researchers in the quest of understanding African cultures.

Africa today, with its 54 countries and a population of more than 700 million, speaking over 500 different languages, is rich in resources and history (Jegede, 1998: 157). The population depends (mostly) on subsistence farming and are mainly pastoralists contributing little to the world's industrial output. Colonialism succeeded in reducing Africans to a labour resource reservoir. At the same time, it has also disrupted local development on such a scale that many African countries can no longer feed themselves. Given the devastating impact of neo-colonial (neo-liberal) policies of global economic expansionism, Africa's ability to sustain traditional practises of subsistence has been seriously (some would say irrevocably) undermined. As Phineas Makhurane (1998) declares, many African governments are more interested in the pursuit of self-interest than in the moral imperatives of justice. This results in millions of people in Africa struggling to survive, with the benefits of modernisation going to the privileged few.

Thandika Mkandawire (2005) further points out that Africans are intellectually grappling with developmental issues. Organisations like the Council for the Development of Social Science Research in Africa (CODESRIA) in Dakar, Senegal provides support for the publication of books on developmental issues. The academic support through science and technology in Africa is considered as a crucial and complex part of development. So is the need to support the continued practise of traditional science in Africa. Olugbemiro Jegede (1998:151) argues that the need to develop science and technology must include questioning the link between African art and African technology.

During a UNESCO meeting in 1999 (*Science and Technology in the SADC Region for the 21st Century,* Pretoria, South Africa, 20–21 April), the directors general and heads of S&T in the Southern African Developmental Community (SADC) reported on the status of academic and modern science and technology development in their countries. The report indicated:

The absence of a Ministry or Department of S&T and a lack of academic R&D expertise (Botswana);

Difficulty in monitoring the S&T system due to a lack of S&T indicators (Lesotho);

A lack of statistics on R&D expenditure (Malawi);

No S&T coordinating mechanism (Mozambique);

A low level of human and financial resources for S&T coupled with a lack of S&T coordination, a lack of science and maths teachers and lack of S&T information (Namibia);

The poor dissemination of information related to the impact of research on development linked to a lack of S&T coordination (Zimbabwe).

This absence of reliable information and statistics on African S&T makes it difficult to estimate the current state of science education on the continent. Reasons for this lack of development are multiple. Governments blame the so-called 'brain drain' of African academics to the west. They relate the low priority ranking of R&D to a lack of funds, technological obsolescence and last but not

least, political instability [1] (www.UNESCO.org.: S&T in SADC, 1999). What is generally agreed upon is the absence of PUST surveys and research in most parts of Africa. PUST surveys provide the dissemination of findings on cultural, economical, political and social values and worldviews. Raza (2002:59) takes this observation a step further by declaring that the determinants of the 'thought complexities' of communities in developing countries need more investigation in order to identify the factors that influence individual and group knowledge systems. Raza (2002:59) maintains that a broad cognitive framework (or worldview) consists of acquired knowledge that has been configured as a socio-cultural construct and is shaped by quotidian (everyday) episodes experienced over generations. To effectively capture these experiences, Raza (2002) proposes that research into knowledge systems should therefore be 'community centric'. He considers 'community centric' research to consist of:

"… a collective which is a repository of knowledge that has been generated through process of distillation of abstract ideas extracted from experiential episodes. The spectrum of such communities is quite wide in developing countries. At the one end of the spectrum are those communities which live in harmony with nature without disturbing the regenerative capabilities of eco-systems and who, for example, practice indigenous systems of medicine developed over centuries. On the other hand there are those artisans who have developed what are often referred to as innovative rural or indigenous technologies" (Raza, 2002:59).

Political independence in Africa is contributing to an increase in understanding local science practises (IKS) by scholars regularly debating the existence of pre-European science in Africa. This is evident in the growing number of publications in this regard (Makhurane, 1998; Jegede, 1998). According to Jegede (1998), deliberations include discussions on the link between African design/art and African science/technology. These deliberations could lead to the incorporation of traditional technological knowledge systems into modern academic science education. Such incorporation could challenge the dominance of western science in African education. The influence of western science, alongside the perceived lack of a broad African contribution to science, is caricaturised by the slogan popularised by Ki-Zerbo: "*Silence, development in progress"* (Ki-Zerbo, 2005:25). Advanced discussions on the role of PUST in disseminating and establishing 'science literacy' as well as the notion of multiple 'publics' and research in the communication of science is absent.

6.6 The social and educational development of science in South Africa

South Africa succinctly reflects the complexity involved in the scientific, social and educational development of S&T. The efforts from government to promote the public communication of S&T is

[1] An Africa Union (AU) report on *Peace and Safety in Africa,* compiled by Hadj Diao Kante (assisted by the University of Pretoria's Institute of Strategic Studies (ISS)), was presented to the Pan-Africa Parliament (PAP) at Midrand, South Africa during May 2008. In this report, the socio-political situation in the central, north-western and north-eastern region of Africa was considered dire (Media24, Africa, 2008). The resolutions of the AU as well as PAP are unable to stem the tide of violence, war and corruption that is rife in these regions. The content of the report is written in 'military language'. Central to the report, however, is the notion of Africa being exhausted by war and conflict and motivated by a desire for peace and stability. African intellectuals like Makhurane (1998:24) considers corruption and bad governance as indication that Africa is still struggling to modernize; proved by the small contribution of African (2%) to the world's industrial output.

mostly inclusive of traditional knowledge practises and, through policy, embraces the worlds of modern as well as traditional technologies. It is a country of contradictions – multiple cultural differences exist in what is often described as a country simultaneously being 'first world' and 'third world'. [2]

However, organised leadership in promoting S&T, science communication and IKS need improvement in South Africa. During the rule of the National Party (1948–1994), the system of *apartheid* effectively separated so-called 'first' and 'third world' communities. Separation was based along racial lines, and effectively implemented through legislation. During the apartheid era, local S&T research developed significantly (this included a highly sophisticated nuclear energy and weapons programme). Because of widespread international sanction against collaboration with the racist regime. S&T research was of 'national importance' and imperative to the security of South Africa – it was highly secretive and well funded. *Apartheid* South Africa maintained the problematic notion of 'race' as an indicator of western superiority. A number of 'Bantu Education Acts' designed the educational system (in support of racially separated educational curricula and facilities) to effectively compartmentalise its different publics and thus alienating the different cultural knowledge systems.

After the first democratic elections (1994) the African National Congress (ANC) became the ruling party and was given the task of restructuring this complex and fractured society. Science communication became one of the tools to address restrictive practises of the past. South Africa's disparate *publics* required information and education.

With the new ANC government in place (1994) the South African Minister of Arts, Culture, Science and Technology, Dr. Ben Ngubane declared that:

"With the publication of key reports such as the UNDP 2001 World Human Development Report, it is becoming clear that the relationship between science, knowledge and the availability of human capital to address the issues of sustainable development is crucial. This is a very different approach from the traditional and narrow thinking of development economics. Few, if any, future scenarios for Africa talk about the contributions of African science and technology to the sustainable development of our planet. This is surely not right. Perhaps we have convinced ourselves that Africa cannot be a player in the knowledge economy. I believe that it is this mindset that needs to be fractured and removed from our consciousness. Science and technology are often seen by policymakers as instruments that have well-defined functionality. Under these conditions, science and technology becomes the handmaiden of greater goals such as economic development or quality of life. This instrumentalist approach does great damage because it does not recognise that the potential of people trained in the science and technology is far greater than the primary scientific knowledge that they hold. Scientists and technologists are problem solvers, innovators, entrepreneurs, business people, community leaders and artists" (*Sunday Times*, November 11, 2001).

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[2] These 'worlds' were part of what was identified during the Cold War period as an ideology-based, tripartite structure of a *first world* (western industrialized, capitalist nations), a *second world* (centralized, command economies in communist countries) and a *third world* (new nations who were previously colonized by the first world). Clear preference was given to the capitalist structure of the developing world whereby "… the ideological underpinnings of this asymmetric structure politicized the three groups, tainting the transfer of aid and technical assistance with propagandistic overtones" (Margolin, 2007:111).

The new government proposed that science education must be transformed in order to create a much desired 'science literate' community. During the transformation process, the previously neglected research field of IKS, however, must be included. Ben Ngubane fittingly indicated that:

"I am not only talking of what is sometimes wrongly called Western or 'first-world' science. South Africa, like many countries, is recognising the unique potential of the knowledge resources of our people. Indigenous knowledge systems, as they have been called, hold great promise in providing a way of lowering the alienation many people feel from science and technology as traditionally taught. Indigenous knowledge projects in South Africa have already shown a rich potential for better curriculum development, as well as new technological innovation" (*Sunday Times*, November 11, 2001).

Government support towards the development of PUST is spelled out in *The South African Green Paper on Science and Technology: Preparing for the 21st Century*. This report (1996:84) indicated the launch of campaigns and initiatives to promote public understanding of science and technology. However, insufficient data are available to assess the outcome of these campaigns. Institutions in South Africa are identified that can play a key role in promoting science initiatives; for example, societies for the advancement of science, science museums and libraries, media (printed and electronic), educational institutions, private business, government and parliament. The same report (Point 9: Public understanding of science, Engineering and Technology (SET).1996: 84) presented further options in the development and promotion of public awareness of S&T:

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

2. The kind of information that is required is to be determined by the public who would need to make informed decisions about technology related issues.

3. The media is identified as the best channel through which SET information can be made more accessible to the public.

4. Structures must be established to ensure that the flow of accessible information will actually reach disadvantaged populations, including women and rural populations.

5. Effective S&T awareness initiatives and campaigns must be launched, aimed specifically at politicians (operating at national, provincial and local levels), policy-makers and decision-makers in government (SA Green Paper on S&T, 1996:84).

Prominent initiatives to promote and develop S&T were undertaken during the past few years:

African educators and international scholars under the auspices of the African Forum for Children's Literacy in S&T (AFCLIST) participated in December 1995 in a conference to reflect on the continent's needs for S&T education and to plan future interventions to promote science education.

The National Research Foundation (NRF), a governmental funding institution for research, hosted the second National Conference on the Public Understanding of S&T in Southern Africa in November 1998.

The South African Agency for Science and Technology Advancement (SAASTA), which is responsible for a number of science communication activities, hosted the first African Science Communication Conference in December 2006 followed by a second international conference in 2009.

The South African government saw fit to initiate a National System of Innovation and established the National Advisory Council on Innovation (NACI) in 1998. One of the objectives of NACI is to promote the public understanding of science and technology. NACI is required to play a supportive role in innovation for rural development and social progress. To further these aims the establishment of a Foundation for Technological Innovation (FTI) was presented to Parliament in June 2007 to bridge the so-called innovation chasm that exist between industry, tertiary educational institutions and government departments. These efforts are ongoing and are yet to show concrete results.

Development of R&D strategies and policy

To embark on a more inclusive and efficient R&D programme in South Africa, after the end of the Apartheid Government (1994), a new national research and development strategy was finalised in August 2002 in which the following is indicated:

- The termination of key technological missions - such as military dominance in the subcontinent and energy self-sufficiency - by the previous government between 1990 and 1994 (the dismantling of the nuclear program for military purposes including the dismantling of the 6 nuclear bombs developed by the previous government).
- New strategic considerations – human, economic and security.
- Review/renew human resources (racial based transformation process)
- Upgrade levels of investment and performance by SA private sector in R&D (SA has a mineral based economy)
- Address crucial issues such as Intellectual property legislation and infrastructure (new IP Bill at Universities).
- Synergise the fragmentation of government departments

The new R&D strategy as indicator is based on:

- Innovation
- Science, engineering and Technology (SET) human resources and transformation
- Creating an effective government S&T system

Part of the long range initiatives included the expansion of S&T activities in collaboration with other African countries. To further this aim the new Partnership for African Development (NEPAD) was initiated under the leadership of the past President Thabo Mbeki.

A policy framework for a National System of Innovation (NSI) was formulated in 1996. This indicates a desire to promote the idea of ‘innovation pull’ rather than ‘science push’.

Key weaknesses in the R&D system were identified as:

- Lack of funding for the NSI
- No adequate development of competencies across the system (universities, research councils and private sector)
- Inadequate development of human resources
- Declining R&D in private sector
- IP challenges
- Fragmentation of government S&T

As a result of these aspect mentioned above some strategic objectives were identified:

- Innovation: achieving mastery of technological change in the economy and society
- Human capital and transformation: increase investment in South Africa's science base
- Alignment and delivery: creating an effective government S&T system.

To achieve these objectives examples from newly industrialised South Korea, natural resources orientated Chile and Australia, high-technology fast-follower Malaysia and research and development intensive Finland were selected to inform the forming of new policies within the various governmental departments in South Africa.

The development of PUS research in South Africa.

(extract from the Human Sciences Research Council (HSRC) report: *Science and the Publics: a review of public understanding of science studies.* Report 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 the 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.

A few 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) and can be summarised as:

1991: 1,300 respondents (face to face in white suburbs) *Understanding and appreciation of science amongst the public in SA.* A. Pouros.

1993: 400 white and 400 black respondents (face to face amongst teenagers) *Understanding and appreciation of science amongst South African teenagers.* A. Pouros

1995: Omnibus survey HSRC.

2001:1,000 white households. *Public attitudes and sources of scientific information in SA*. A. Pouros

2003: 7,000 respondents (face to face in white suburbs) *Biotechnology.* HSRC

2004: 1,000 white households. (face to face in white suburbs) *Assessing Public support for Biotechnology in SA.* A. Pouros.

2007: 3,164 respondents. *Climate Change.* HSRC.

Conclusions:

- 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.

Scientific literacy: a contested perception.

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. 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".

The biggest and least addressed problem of the 'science literacy model' is, however, the consideration that people who hold superstition and religious beliefs are to be considered as

scientific illiterate. People live in culturally subjective worlds. People, at the same time, practise cultural rituals that are closely linked to conflicting and coexisting belief systems.

Within the current 'science and society' framework of PUS research, the deficit science literacy model is being re-evaluated in South Africa. New models, such as the 'cultural distance model' as proposed by Raza and his research team, are attracting considerable attention. Coupled with the realisation of the S&T embedded in traditional knowledge practices, the complexity of the South African society and the ambitions of the South African government towards the development of an innovative and science literate society that can compete internationally, there is a current urgency in rolling out national, all inclusive surveys that can reflect the science knowledge of all. This incentive is crucial towards the planning of development policies and the understanding of the public(s) interests, needs and dreams.

Recommendations and the way forward

The key findings in the 2009 HSRC report indicates a number of areas in South Africa that are still neglected:

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 epitomised 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.

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 need 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.
- Specialised PUS surveys on nanotechnology, climate change and sustainable development.
- Analysis of science communication strategies and their impact on the public(s).
- Qualitative studies on the enhancement of science communication strategies.