Early adopters

By 2006, a core team of data management 'champions' was ready to embark on a learning process. The team had a strong background in research, research data management and systems development within the HSRC. Its members were keen to investigate ways in which data could be better managed, preserved and made available for future use.

With limited resources the team organised workshops with senior researchers and research managers to raise awareness and to do a needs analysis. This was augmented by international benchmarking and learning.

As a first step to prepare for better data management the HSRC's existing project information system was extended to allow for the capturing of metadata of data sets. The team then started to work on data from the first (2003) South African Social Attitudes Survey (SASAS).

They developed an approach to clean, describe and package the data set so that it could be made available on a platform that would be accessible to internal and external users alike. Further workshops and awareness-raising road shows followed.

Challenges that presented themselves included the need to develop 'rules for access'. The aim was to formulate the rules in such a manner that external users would be able to easily access data but that access should nevertheless be managed and the confidentiality of individual participants, or even participants drawn from identifiable geographical areas, be adequately protected. A dissemination interface linked to project information on the web was developed to prepare for the dissemination of pilot data by the end of 2007.

In February 2008, the HSRC co-hosted an international conference dealing with data curation - evidence of a small but growing community of data management practice in the country. This event developed into the annual African Conference for Digital Scholarship & Curation hosted by members of a community of practice called the Network of Data and Information Curation Communities The HSRC continues to participate in NeDICC activities.

HSRC research staff showed that 94% regarded statistics/ quantitative data as 'very important' to their work

Accelerated implementation

Toward the end of 2008, a new HSRC Act was promulgated. One of the clauses required the HSRC to '... develop and make publicly available new data sets to underpin research, policy development and public discussion of the key issues of development, and to develop new and improved methodologies for use in their development'.

With this new sense of urgency, more status was given to the team who had initiated work in the field of data curation. One of the objectives was to develop a long-term data curation, preservation and dissemination strategy for the HSRC. Based on their earlier work and experience gained through international benchmarking the data curation team could also develop policies and standard operating procedures (SOPs) for data curation. As had been their approach from the beginning, a consultative approach was followed to develop and periodically review these policies.

Engagement with the Research Ethics Committee (REC) of the HSRC ensured that plans for data preservation and sharing would, at least in principle, be built into research protocols from the outset. From 2011 onwards, all HSRC research protocols that were submitted for ethics review were required to be accompanied by a data preservation and sharing plan that would be reviewed by an expert in data curation. This required researchers to think more carefully about the kind of information they would provide to potential research participants about the envisaged use of research data and the kind of consent that would be required.

Managerial support was made even more evident in 2010, with the introduction of a new indicator of institutional performance that would be formally reported on annually the number of research-generated data sets that had been preserved and, where appropriate, made available for future secondary re-use.

Establish practice

In the course of approximately 10 years, the HSRC has experienced much change and growth in the area of data curation. By 2015, institutional practices are in place to support a data management culture included good governance, curation systems and processes, and a dedicated team to provide support for data curation.

Remaining challenges and opportunities

A remaining concern is how best to ensure appropriate recognition of the contribution of investigators and research teams who planned research, developed instruments, and collected and made available original data for further research analysis. If co-authorship of publications is not an option there is a need to insist on proper citation of data sets to demonstrate the impact of good research surveys. Continued funding for data collection and data management - undoubtedly the most cost- and time-consuming activities associated with original research - is dependent on an ongoing demonstration of its value.

The HSRC's data service has matured to such an extent that formal certification is the logical next step. Research data should be considered as valuable research infrastructure, and the long-term preservation of research data should be prioritised as a national commitment.

Note: This article is an abridged version of the original article and do not include references to various publications dealing with the management of science. The headings used in this article are to a large extent derived from John Kotter's 1996 publication, Leading Change. The full article is available on http://jre.sagepub.com/ content/10/3.toc

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Bring back our girls and women to careers in physics

Statistics show that around the world the number of women in physics drops sharply when approaching postgraduate level. What are the barriers that hinder their success in physics, and what can be done about that, ask *Portia Tshigoli, Rodney Managa* and *Palesa Sekhejane*

Sustainable development requires that science and innovation be practiced at local, regional and global level with the equal involvement of women and men, yet women are still underrepresented in physics and related career paths.

A 2015 global survey conducted by Rachel Ivie and Susan White, indicated that women were less likely to access resources and opportunities than men. Using data from the Global Survey of Physicists (GSP), a multi-national collaborative effort arising from a series of international conferences, they found that there were no countries in which women had more resources and opportunities than men. For instance, in countries such as China, Spain and Italy, women physicists had fewer resources and fewer opportunities than men.

Marriage and family

The study also found that in most countries, women were more likely than men to say that their careers as physicists have affected their decisions about marriage and family, and that having children, had slowed their rates of promotion at work. The authors believe that this trend could be ascribed to the disadvantaging norms that apply to women, for example they found that in most countries, women were more likely than men to say that their careers as physicists have affected their decisions about marriage and family, and that having children, had slowed their rates of promotion at work.

The trend in South Africa follows the same pattern. As shown in Figure 1, there is a general incline in the enrolment of women at the undergraduate level, however, this figure declines at postgraduate level, with severe decline at the PhD level.

In most countries, women were more likely than men to say that their careers as physicists have affected their decisions about marriage and family

Figure 1: The actual number of female graduates from 2002 to 2006 in South Africa. Source: Diale et al., 2009.



What's to be done?

In response to the concern of not having fair representation of women in physics, the organisation Women in Physics in South Africa (WiPiSA) was launched in November 2005 in Durban to address this concern. How to achieve that? Through creating enabling environments by fostering networks, stimulating viable discussions and proposing solutions towards addressing the under-representation of women in these fields.

The HSRC, with the support of WiPiSA, held a seminar to address challenges that hinder women from participating in physics related studies and careers.

Keynote speaker Dr Malebo Tibane, a senior lecturer in physics at the University of South Africa, (Unisa), emphasised the importance of having women and girls in physics with the aim of pushing gender parity in the 21st century as failure to do to so will threaten the development of the nation and economic growth.

The HSRC seminar benefited young school learners (boys and girls) from grade 10-12, university students and postgraduate scholars in various fields with the hopes of generating a cohort of future physicists and scientists. On the African continent the role of physicists is undermined by various factors such as reluctance to invest financially and development of institutions to breed and drive economic development through physics.

Failure to [pushing gender parity in physics] will threaten the development of the nation and economic growth.

The McKinsey Global Institute report (2015) on gender parity reported the economic consequences of not having a gender equal society. The findings demonstrated that there is a potential to contribute USD \$28 trillion to the GDP if women and men had participated identically in the labour markets (Figure 2). There are more women than men globally; if women are marginalised in the labour market it means that a large portion of the economy is being neglected, resulting in a weakened economic status.

Figure 2: Closing the gender gap could deliver \$12 trillion to \$28 trillion of additional GDP in 2025



¹ Represents difference between annual GDP in 2014 and in 2025 for the business-as-usual scenario. NOTE: Numbers may not sum due to rounding

Source: McKinsey Global Institute report, 2015

Key Issues

Challenges facing women in physics and related sectors

Statistics show that women around the world face similar barriers that hinder their success in physics. Even in countries where it is as common for girls to study physics as boys, the number of women physicists drops sharply at postgraduate level. Participants at the seminar debated various key issues that are believed to create barriers for women preventing them from making breakthroughs into physics careers.

- The poor image of physics as perceived to be difficult and dull and understood to be a career for men. Physics is portrayed in a masculine manner that consequentially undermines the effort of women to participate and make a breakthrough into the field.
- The teaching of physics in schools is not structured in a way that inspires girls and is presented as difficult and unexciting; a perception worsened by the lack of women teachers.
- Social challenges have a huge impact on the educational success of women as most societies and cultures still believe that women are destined for marriage rather than having a profession.
- Sexual harassment is still rife and women are intimidated not to progress in their careers because male colleagues do not see women as equal, but rather as objects.
- Married women say their careers are not deemed as being as important as that of their husbands – and the issue of gender inequality needs to be addressed on multiple levels, including in home-based education.
- Some organisations have historically denied jobs and opportunities to women on the principle that women's careers are likely to be disrupted by life events such as

maternity leave. It further discourages women who wish to start families from participating in the field.

Recommendations

- There must be an easily accessible database of women who are in the physics and related sectors in order to measure progress and encourage collaboration.
- Women's forums for physical science must be established at local, regional and national level to exchange and disseminate knowledge.
- Women were advised that in order to be successful in taking physics further they need to surround themselves with positive minded people, link up with potential mentors who will encourage them and to have discussions with their peers to stimulate their interest. To drive this, it will require special funding and sponsorship be made available to the women role models and mentors to initiate mentoring programmes in local areas.
- Institutional policies need to be revised with the focus of achieving gender parity as means of addressing the inequalities of the past.
- Collaboration and socialising among the women is essential, so support or formation of peer groups needs to be encouraged among young girls.
- Though women are empowered, they must understand that to make a success, they need the support of men.
- Societal problems of discouraging equal participation in physics needs to be solved collectively, meaning that both men and women must be involved in creating and providing solutions. Discussants also pointed out that women need to challenge policies that limit funding to women who are 35 and above to further their studies.
- Another omitted, but critical issue is the financial and



mobility support for disabled women to participate in physics related fields. Most institutions do not cater for disabled women scientists as the equipment and buildings are not user friendly.

Physics is portrayed in a masculine manner that consequentially undermines the effort of women to participate and make a breakthrough into the field

Science for global development

The seminar was useful to the attendees, HSRC and WiPiSA as well. Vibrant discussions after the presentations gave the high-school learners and university students a rich glimpse of the existing challenges and ideas on how to overcome identified challenges to become the ideal 21st century women in physics.

It was recommended that the teaching of the sciences should be developed at early stages of learning; and prominent in the discussion was that science must be put to good use for global development and not for purposes that could lead to destruction, such as war.

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