THE SKA: CONNECTING THE DOTS TO REACH THE GLOBAL SCIENCE AND TECHNOLOGY FRONTIER

The Square Kilometre Array (SKA) telescope provides an example of how to effectively connect pockets of excellence in the national system of innovation, and align these with the skills and knowledge requirements of employers. This has helped the SKA to attain the critical mass and knowledge intensity required to compete at the global level, ***Michael Gastrow, Glenda Kruss*** and ***Il-Haam Petersen*** found as part of a large study on labour markets in South Africa.

The study forms part of the HSRC-led Labour Market Intelligence Partnership (LMIP) project that aims to set up labour market intelligence systems to enable the government and the business sector to better plan to meet skills development needs.

In the process of determining what was needed for better planning, it became clear that the inequality that characterised South Africa's economic and education systems posed a challenge for policy makers seeking to reap the benefits of the knowledge economy. However, within this unequal system, there existed pockets of excellence where resources, networks and skills were concentrated.

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One objective in such a structure is to effectively connect these pockets of excellence, and align them with the skills and knowledge requirements of employers to attain the critical mass and knowledge intensity to compete at the global level – thus leveraging existing knowledge assets to the overall benefit of the country. This can be achieved through well-developed interactive capabilities – the capacity for forming effective external linkages.

Creating networks to build knowledge and skills

The Square Kilometre Array (SKA) telescope provides an example of such an achievement, and may provide lessons for science and education policy makers. The SKA is a large radio telescope, currently in the design phase, which will ultimately consist of a network of 3 000 large radio receiver dishes and tens of thousands of smaller receivers constructed in aperture arrays. It will be built mostly in South Africa, with components in Botswana, Ghana, Kenya, Madagascar, Mauritius, Mozambique, Namibia and Zambia, as well as Australia and New Zealand.

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The SKA has also necessitated the formation of a global innovation network with universities, research institutes, science facilities, firms and government agencies from 11 SKA partner countries, collaborating to develop the advanced technologies required to design and build the telescope.

The knowledge challenges and skills needs faced by the SKA are extraordinary – including demands at the top the skills spectrum in the domains of astronomy, physics, cosmology, engineering, ICTs and management, and extending to artisanal and vocational skills required for site infrastructure.

The SKA deploys a range of strategies and mechanisms for meeting these needs. The most important of these is the Human Capital Development Programme (HCDP), a publically-funded skills development and research programme that between 2005 and 2014 awarded approximately 600 bursaries, grants and fellowships.

This programme has two main strategic roles. Firstly, to manage structures and mechanisms through which the skills needs of the SKA are assessed, including foresight exercises, through continuous engagement with scientists, engineers and management. Secondly, to engage with education institutions to strengthen their capacity to develop these skills. These roles are inherently dynamic, as technologies are rapidly developing, skills demands for the SKA are rapidly growing, and higher education capabilities are constantly evolving.

Universities also play intermediary roles that contribute to their overall interactive capabilities.

The invaluable role of universities

HCDP administrators closely monitor bursary recipients and research positions supported by the programme, and maintain control over the range of disciplines, skills and research foci that are covered. Decisions about the distribution of funding are taken through intensive interaction with scientists and engineers, both within universities and within the SKA itself. Engagement with universities also takes places through an informal Universities Working Group, which provides a less structured forum for interaction. Personal relationships and networks are also critical – as precursors to formal interaction, as efficient communication 'short cuts', and as channels for the exchange of tacit knowledge.

The main university partners of the SKA include South Africa's leading research universities, drawing on all the substantial pockets of excellence relevant to astronomy and related engineering and ICT that are distributed throughout the higher education system.

The overall institutional strength of these universities, manifested in strong capabilities in planning, internal capacity-building, career pathways development, student support and fundraising, provide the organisational competencies to support the development of niche areas of expertise and strong interactive capabilities within academic departments and research groups.

These niches have been highly responsive to the changing needs of the astronomy sector and the SKA: new curricula and courses have been developed, postgraduate research has been aligned with the future needs of the SKA, centres of astronomy science and engineering research have expanded in line with the future requirements of the SKA, and strong informal relationships have been built with the SKA, as well as other actors in its innovation network, such as firms and science facilities. The strong interactive capabilities present at these universities thus form a critical part of the total interactive capability the SKA's innovation network.

Universities also play intermediary roles that contribute to their overall interactive capabilities. One example is the National Astrophysics and Space Science Programme (NASSP), a nationally co-ordinated postgraduate programme based at UCT that includes teaching and supervision from all the universities active in astronomy in South Africa. Through this the NASSP aims to make the most of South Africa's uneven and fragmented competences and capabilities in the space science and astronomy domains. The NASSP steering committee and the structure that determines its curriculum include both SKA representatives and university academics, and are therefore important fora for these actors to create alignment and inform curriculum development that meets future skills requirements.

The MeerKAT radio telescope currently being built in the Northern Cape. MeerKAT is a precursor to the SKA telescope and will be integrated into the mid-frequency component of SKA Phase. Source: http://www.ska.ac.za/media/visuals.php

The structure and characteristics of interactive capabilities differ across academic disciplines and research fields. In astronomy, interactive capabilities are largely vested within individual academics and at the departmental level. In engineering, faculty structures are critical, and provide examples of good practice in terms of responsiveness to the requirements of the workplace, including close relationships to the engineering professional body, and the encouragement of direct interaction with employers. For example, the provision of one day per week for engineering academics to work externally has made it possible for academics at a leading research university to consult for firms in the SKA's innovation network and supply chain. This has also allowed them to form their own start ups, often in partnership with postgraduate students or postdoctoral fellows, to participate in these networks and contribute to the SKA's technology development efforts.

Interactive capabilities form a lever for access to the global science and technology frontier.

Engaging colleges for better quality graduates

Universities are not the only actors in the skills development landscape. Over the course of several years, the SKA has sought to engage with Further Education and Training (FET) colleges, but due to limited basic competences at the colleges there have been few graduates produced from this engagement. Colleges have limited capacities to internalise planning and specific skills requirements. This is a reflection of South Africa's FET system, which has been challenged by multiple policy changes, low levels of independence, and weak overall capabilities. However, the SKA has continued to engage with colleges in order to build internal competences and capabilities, and this is leading to a gradual improvement in the quantity and quality of graduates.

The rich and complex system of interactions that co-ordinates alignment between skills demand and skills supply for the SKA has connected and leveraged existing competences, and orientated them towards the production of skills needed by the SKA. The case of the SKA reveals how, in highly unequal developing countries such as South Africa, interactive capabilities form a lever for access to the global science and technology frontier. For policy makers, this highlights the potential of other knowledge-intensive sectors that are situated in a fragmented and unequal knowledge economy, but are characterised by pockets of excellence and the promise of attaining critical mass and international competitiveness. ■

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TEACHERS' VIEWS ON SEXUALITY EDUCATION FOR CHILDREN WITH DISABILITIES

Do we need to teach sexuality education to children with disabilities, and who should be responsible for teaching programmes related to HIV/AIDS to these learners? ***Julia Louw*** raises these important questions in investigating how teachers and childcare providers feel about teaching sexuality and HIV/AIDS programmes to their learners with disabilities.

The aim of the study was to examine teachers' and childcare providers' views and perceptions of teaching sexuality and HIV/AIDS programmes to learners with disabilities in special needs schools (SNS).

Providing children and young people with sexuality education is imperative. However, providing sexuality education to children and young people with disability has turned out to be a priority of low importance. This is mainly due to the misconception that people with disabilities are not sexually active or are asexual.

Behavioural risk factors for HIV among people with disabilities are the same as those for the general population.

Limited access to such information places this highly vulnerable and marginalised group at an increased risk of HIV infection, as behavioural risk factors for HIV associated with sexual activity among people with disabilities are the same as those for the general population.

Methods

Teachers have a vital role in formal programmes of sexuality education and at times, they are often the main or the only people explicitly discussing sexuality with children