Frontier technology and big science: The need to be inclusive

The Fourth Industrial Revolution is characterised by technological advances becoming more embedded in society than ever before, further supporting globalisation that also allows South African scientists to compete internationally. Is this bringing about development and transformation or further exclusion in our marginalised communities? HSRC researchers spoke about this at the annual Science Forum South Africa (SFSA) in Pretoria. *Antoinette Oosthuizen* reports.

The 4th Industrial Revolution is driven by technological advancements such as artificial intelligence, expanded broadband connectivity and the Internet of Things, a network of devices that will connect via the internet in almost every sphere of modern life. Elite scientists are also making breakthroughs in fields like quantum computing, nanotechnology and robotics, striving to be globally competitive. The change is rapid and analysts are already attempting to predict the impact.

A social revolution

Dr Hester du Plessis, a chief research specialist in the HSRC's Research Use and Impact Assessment unit, warned that this is not only an industrial revolution that is taking place, but also a social revolution that is generating a new global class structure.

Instead of the traditional three-class system, we now see a tiny plutocracy who own most of the money and property on the planet. They are atop a much bigger elite, called the salariat, who are in relatively secure salaried jobs. The proficians are the freelance professionals, the precariat are working class and the lumpen-precariat are an under-class characterised by severe poverty.

"The social uprisings are the first indication that the precariat is currently grouping and identifying their socio-political power in the market-place," Du Plessis said. "For many years, the precariat has been internally divided and scarcely conscious of its commodity. However, this is rapidly changing and more of those in or close to being in the precariat realise that their situation is structural rather than a reflection of personal inadequacy, and that together they have the ability and energy to force transformative changes."

New, but 'inferior' jobs

Du Plessis said it is a misconception that technology displaces jobs. It generates new labour, but this labour is still considered to be 'unprofessional' and often falls outside the regulations of minimum and living wages.

"An example is what is known as microwork. This involves breaking down complex, data-driven activities such as categorising images for search engines, transcribing audio or video clips, or updating databases, activities that machines are not good at. This is low-skill and low-pay work, with little possibility for professional development and job progression. As a result of such work, we see increasing resistance to the inadequate labour laws."

Intellectual property rights and tax

Du Plessis also said that highly contested and outdated intellectual property rights (IPR) laws do not meet the needs of the precariat, because of their duration and the way they make technology inaccessible to the public. "An example is a mobile phone, which might have over 3 000 patents. When you buy the phone, you pay against these patents to keep yourself from breaking the law. This leads to a very costly economy that does not depend on real labour.

"The precariat is also exposing the dirty underworld of tax. This includes the growth of politically manipulated think tanks that are changing thinking in the world to suit specific intentions, and there are all kinds of private structures that maximise tax obligations that do not suit the precariat in the work space. So, very often we find that they'll revert to cash payments to avoid tax."

Knowledge in uncontrolled spaces

"The knowledge that the precariat share is in uncontrolled spaces, which makes dissent and revelations of truth, previously tightly controlled by institutions, possible outside of the manipulative spaces of the ideologies, politics, religion and the academy. In other words, there are no peer reviewers anymore and the public has now become the peer reviewer. And that is a very unstable situation that governments can't control," Du Plessis said.

She said mental emotional and behavioural changes are taking place that are consistent with the spread of precariatisation.

"There is no respect in the digitised world for contemplation and reflection. It delivers instant stimulation and gratification and it is forcing our brains to give most of our attention to short-term decisions and actions. Although this has certain advantages and we talk about the multitasking aspects of our lives, a casualty is the literate

mind and the idea of intellectual individuality. There's a move away from a society made up of individuals with distinctive combinations of knowledge, experience and learning to one in which most people have socially constructed, rapidly acquired views that are superficial and geared towards group approval rather than originality and creativity."

Anger and anxiety

Du Plessis said the precariat has a weakened sense of social memory, because everything is instant, fast and superficial. They experience a mix of rising anger, anomie, anxiety and alienation "the flip side of a society that has made 'flexibility' and 'insecurity' the cornerstones of the economic system".

She says the precariat is much bigger than people think. In some countries, it takes up 40% of the work force. "You might already be part of the precariat or moving into that space. I think that in the end most people move into that space. It is not because you do not have knowledge and you are not a professional, it is just because the conventional labour market does not make space for you."

Balancing mandates in science

Dr Glenda Kruss, the deputy executive director of the HSRC's Centre for Science, Technology and Innovation Indicators, took delegates through the history of South Africa's science councils in another session. She said that HSRC research showed that many of the researchers at these councils are still motivated by individual scientific interests, the need to publish and developing their own careers rather than addressing a development mandate. "If we want to orient our science system towards the public good and towards developmental challenges, we need to have more interactive mechanisms between scientists, industry, communities and the government," Kruss said.

SKA's interventions

Dr Michael Gastrow, a chief research specialist in the HSRC's Education and Skills Development programme, spoke about the human development aspects of the Square Kilometre Array (SKA), which is set be become the largest radio telescope on Earth and the largest science project in Africa. He said that big science has improved the lives of people by laying the foundation for technology that supports a modern economy, such as the internet, devices and genetic medicine. "However, frontier technology and big science are seen to be very far apart from inclusive development and in a sense exclusive, because these projects harness the best skills and capabilities, often from the ranks of the privileged."

Although it was not a formal SKA's mandate, the project launched several interventions to develop communities in the Karoo.

"It is a bit of a juxtaposition. The SKA took advantage of the apex of the unequal system drawing from and competing on the global stage, but then it hits the ground in the Karoo, which is a very marginalised part of South Africa. There is a low population; it is mostly rural with high unemployment and alcohol abuse. So the situation demanded that the project became more inclusive."

Significant investments were made in local communities through supplier development programmes and education interventions in local schools. Gastrow believes the development mandate of such projects need to be reconsidered. See a review of his book *The Stars in our Eyes* on page 40.

Harnessing knowledge from the marginalised

Dr Alexis Habiyaremye, an African research fellow at the HSRC, emphasised the need to tap into the creativity and knowledge of local communities. He spoke about the value of the Living Labs concept where the knowledge of would-be users of technology in communities are included in the development and testing phases of new technology. This empowers them and facilitates absorption of technologies. He also shared the story of the Nelson Mandela Metropolitan University's engagement with the local community to optimise a healthcare programme that monitors new cases in the healthcare system and improves delivery with the help and input from the local community. In a project in North West, researchers engaged with rural women to learn more about the nutritional characteristics of traditional foods, work that may benefit food security in the region.

Dr Peter Jacobs, a research director at the HSRC shared the success of the Rural Innovation Assessment Toolbox that promote science and innovation in local municipalities and networking with universities.

The gender issue

Prof. Heidi van Rooyen, the executive director in the HSD unit said that recent data show that men are twice more likely to have access to the internet than women. "We need to challenge the stereotype that technology is for boys. One of the fundamental differences between girls and boys in technology is the way in which we socially produce girls to think about themselves. A big challenge (in learning to code) is that girls are scared to take risks and to make mistakes, but if you are dealing with code you need to take risks…. boys make mistakes so they crack the codes."