



# How do we know if and when science makes a difference?

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The Academy of Science of South Africa and the *South African Journal of Science* hosted a webinar on 4 August 2021 as part of their participation in South Africa's National Science Week – the annual celebration of science, engineering and technology led by the Department of Science and Innovation. The webinar was entitled: How do we know if and when science makes a difference? The panellists discussed the impact and role of scientists and science in contemporary society.

The panellists included Mwazvita Dalu, an NRF Innovation Postdoctoral Research Fellow at Unisa and Research Associate with the Open University, UK; Ernest Dube, an agronomy research scientist and Senior Lecturer in the School of Natural Resource Management at Nelson Mandela University; and Jennifer Fitchett, an Associate Professor of Physical Geography at the University of the Witwatersrand.

The programme director, Leslie Swartz, a Professor of Psychology at Stellenbosch University and Editor-in-Chief of the *South African Journal of Science*, stressed the importance of the relationship between science and society in his opening. He drew the attention of the audience and the presenters to the interest sparked by this webinar in calling upon scientists to have a conversation on the impact of science on society.

Swartz emphasised that, given the narratives circulating in the public sphere about the COVID-19 pandemic and vaccines, it is indeed important that science be questioned and that scientists be called upon to enlighten society on the difference that science makes in our lives to restore society's trust in science. This is a difficult period for science, and its credibility, because there was once a period in history when science held all authority and was not questioned, Swartz told the audience.

Interestingly, Dalu opened her presentation with reference to the feature film *The Day After Tomorrow* (2004). The film is about an apocalypse which results in a new world covered with ice. This is apt at a time when we are not sure how the world and life post-COVID pandemic will be – will we go back to life as we know it, and if not, what will the 'new normal' look like? Dalu related the narrative of the film to the context of the webinar as support of scientific findings that could make the world a better place for all. In this fictional film, the government, which was initially reluctant to support science, comes to the realisation that science is active and could be used to humanity's advantage. Although fictional, the film conveys the critical question of science and society by showing how humanity can benefit from scientific discoveries. It alludes to science being active and making a difference.

The purpose of science is to better society, Dalu told the participants. As such there is a need to establish clear, impactful and accessible communication channels through which scientists can see the difference they make in society. Essentially, science is for sustainability in the future. The messages packaged 'by science' for society must reach their audience and be deconstructed and easily understood in order to enhance the achievement of a scientific difference.

Currently, scientists see their contributions to society through the number of citations and downloads of their publications. These two metrics, among others, indicate that society is interested in the messages communicated by scientists for various reasons. Citations to scientific discoveries and recommendations in policy documents also indicate that, in the long term, ideas which emerge through scientific engagement, recommendations and discoveries help to shape the world and the future.

Seemingly, the advancement of social media and the mass media has allowed science to come to the doorstep of the public. These tools have made science more accessible. Dalu acknowledged social media platforms as some of the key communication channels through which scientists and society engage to make science a social practice. She acknowledged that the impact factor does not account for these interactions and suggested that the recent relinquishing of the journal impact factor as a measure of performance by some universities will open the space for 'good science' without compromising its quality by populist tendencies associated with career advancement.

On a different note, Dube spoke to the audience about agronomy and food security in South Africa. He maintained that current food production in South Africa is mostly driven by agronomy research. Agronomy is, according to Dube, 'the application of different scientific methodologies for the improvement and management of major stable food crops'. These include wheat and maize in South Africa. He also brought to the attention of the audience the flexibility of agronomy in integrating many other science disciplines such as soil science, ecology, entomology, climatology, sociology and agricultural economics to achieve its greater goals.

The success of farmers is directly linked to their implementation of scientific discoveries and recommendations from agronomy researchers. The advantage of agronomy research is that it is practical and therefore its effects are felt immediately. This suggests that agronomy as a field of science actively participates in making the world a better place. Dube demonstrated that agronomy researchers deal directly with farmers, therefore their effects are seen immediately, unlike in other disciplines where the impact may be felt only later. He emphasised that agronomy research is active and empirical.

Dube further demonstrated the effects of agronomy research in our everyday life. He reminded the audience that the food they had eaten that day was produced with the help of agronomy research. He also noted that – due to various factors such as the constant population growth, climate change, shortage of fertile land for farming,



drought, and the excessive use of pesticides – there is an urgent need to discover and implement various scientific methods to directly answer the call for food security.

His urgency is accurate given that statistics show that almost double the current global food supply will be needed in 2050 to feed a population of approximately 9 billion people.<sup>1</sup> However, the alarming rate at which the global population is increasing may mean that there could be a shortage of land, water and energy required to feed people and agronomy research should be employed to address this challenge.

To Dube, this challenge is fuelled by the current spike in urbanisation and the increased consumption of wheat. He argued that urbanisation has increased the change in people's diets. Currently, South Africa produces 2 million tons of wheat but consumes 3.2 million tons per annum. This suggests that there is an overall shortfall of 1.2 million tons. Therefore, conservation agriculture should be adopted to cover this shortfall while also conserving the environment. This method of farming must also be adopted to help reduce farmers' input costs, and to keep food safer through reducing the use of pesticides.

Dube concluded his presentation by illustrating how the agricultural value chain contributes significantly and directly to life and the economy through employment of farm and mill workers. This must indeed be seen as a qualitative and tangible difference made by science.

Fitchett, the last presenter, opened her presentation by posing the question 'When does science make/not make a difference?' She then went on to draw the attention of the audience and the other presenters to yet another crucial question: 'What does difference mean?' In essence she asked, what is this 'scientific difference' that is being talked about? To further interrogate the question, she posited that 'science always makes a difference' and centred her discussion around this sentiment.

In substantiating her thesis Fitchett argued that:

*The pursuit and production of new knowledge and the process involved therein and the engagement with knowledge as a tangible and often growing outcome is something in itself that is inherently making a difference.*

She maintained that any work done in science, whether in the social sciences or any other field, is a stepping stone to future breakthroughs. If such a premise is accepted, then even if we think that one particular piece of work is not groundbreaking, the fact that it was done as research suggests that there was a need, and as such, the work will ultimately make a difference. This is because it will at some point allow someone else to build on it to enable breakthroughs and developments.

In some way echoing the words of Dalu on the impact factor, Fitchett maintained that science makes a difference when we see breakthroughs and discoveries, solve societal ills and raise awareness of problems. She further argued that society's understanding of issues and the world is often driven by science, and these should be seen as quantifiable results of science. Like Dalu, Fitchett calls for quantitative markers of science's

contribution to society other than the impact factor for fair judgement of impact.

For Fitchett, the very process of conducting science and of being engaged in scientific research always makes a difference. She told the audience that society is able to see the inherent difference that science makes, through the process and the output which includes, but is not limited to, the training of researchers, the communication of scientific research findings through various means and platforms such as publications, webinars, conferences, public lectures and other communicable methods.

Interestingly, Fitchett acknowledged that science is a coin with two sides: just as it can do good, it can also be detrimental and catastrophic. Some of the major challenges in the world today, such as global warming, are partially an aftermath of scientific advancement. She asserted that today's solutions might be detrimental in the future, and that what may seem insignificant now, could be impacting on other systems and may have a greater impact years down the line – the butterfly effect. To come back to her initial question on what scientific difference is, Fitchett suggested that the difference is not always positive. But whether it is good or bad, science always makes a difference.

Fitchett further acknowledged that scientific difference is subjective. It is dependent on research institutions, universities and personal conventions. It is dependent on what researchers see and hold as important and worth pursuing. Therefore, scientific difference should not be viewed narrowly or simplistically.

In concluding her presentation, she commented on society's participation in science. Fitchett suggested that society should ask itself how it can support science and should never regard any output as insignificant and not impactful. There is a need to encourage and support 'science for good' organisations and help them in achieving their goals. It is important for society to help scientists to see the difference they are making and to encourage them to celebrate these differences. In a way, Fitchett called for a circular communication model of science in which scientists get feedback on how their science impacts society.

Clearly the presenters all share a similar sentiment about the vigor of science. They all maintained that science is not just a philosophical theory, but an empirical subject and an active social practice.

*The National Science Week webinar entitled 'How do we know if and when science makes a difference?' can be viewed at <https://youtu.be/4JBRGTE12UY>*

## Competing interests

I have no competing interests to declare.

## Reference

1. Whitfield B. The upside of down: How chaos and uncertainty breed opportunity in South Africa. Johannesburg: Pan Macmillan; 2021.