

# CSIR: SOUTH AFRICAN PLAYERS IN R&D

*An interview with Sibusiso Sibisi*

Sibisi is chief executive officer of the CSIR, South Africa's Council of Scientific and Industrial Research



Dr Sibusiso Sibisi

*They don't make many headlines, but CSIR research and development is opening the way for new made-in-SA technology and enterprises.*

**Ben Turok: Is it true that CSIR was founded mainly to meet the needs of the defence industry?**

**Sibusiso Sibisi:** The CSIR's mandate is to conduct research in order to promote industrial and scientific development, without saying exactly what scientific development means, or indeed being specific about industrial development. It just so happened that, at the time of its formation immediately after the Second World War, the focus and the expertise was in an area that had been critical during the war, namely radar technology. This continues to be an area of strength, in defence and civil applications as well.

**BT: What kind of applications?**

**SS:** Radar can penetrate cloud, so it becomes possible, for example, to read a satellite to monitor the movement of ships off the coast. Radar is also used from the ground both to monitor and guide movement in space. That is recognised internationally as an area of strength at CSIR.

But let me go back one step. A big proportion of CSIR's defence activity was hived off to what is now called Denel. So the people who make missiles, for example, are housed at Denel, and Denel reports to the department of

defence and the department of public enterprises. But we continue at CSIR to have infrastructure for testing aerospace technology – things that fly in space at various speeds, ranging from helicopters to fighter aircraft to missiles.

Now, do we continue to make weapons in the sense of “things that go bang”? No. Most of what we do has to do with what one might refer to as passive defence. The radar work we do is closely connected to work on electronic warfare. It is more about jamming signals – for example, of an oncoming missile – than it is about effective guidance to attack it. We have been very sensitive to the manner in which we legitimately position our activity as defence work.

You may have seen our commercial about the deployment of speedboats from a frigate. Normally when they deploy such speedboats on to the ocean, the frigate needs to slow down pretty much to a standstill. We have developed a mechanism to deploy the speedboat while the frigate is at speed and these speedboats then pick up speed instantly. They are able to respond in a situation where you are dealing with, for example, piracy off the coast of East Africa and so on. These are the sorts of things that typically characterise our defence activities these days.

## POTENTIAL FOR BENEFICIATION

**BT: I believe that you seek to establish platforms that can help multiple industries, not just one, and that you also take the early risk that a private company might not want to do? Is that right?**

SS: That's absolutely correct, yes. At one level, we do set up individual enterprises – for example, to commercialise a specific piece of technology we may have developed. But a more strategic intention is exactly what you've described: where there's a need for South Africa to be active in some area of industrial activity but it does not yet exist.

Let's look at something that has happened in the past. There used not to be expertise in South Africa to conduct environmental impact assessments (EIAs) of a complex nature. For example, suppose Transnet wants to expand its port in Durban or in Coega. There may be all sorts of environmental implications that we need to take into account and that require a multi-disciplinary approach. CSIR initiated such complex EIA activities, and we are still involved in it. In the Karoo, we have been asked to be involved in a quantitative assessment with regard to the feasibility and the likely implications of fracking. Now today, a number of dedicated companies do EIAs. In this way, we created an industry by taking the early risk, and it enabled a number of people to then set up companies.

Similarly, if it's something like asking how South Africa begins to move down the value chain of beneficiating resources – for example, titanium – it is not obvious that existing industries will spend a lot of money to do so. So we have done quite a bit of work to develop the chemistry necessary to produce titanium powder of a sufficiently rich grade for making components for aerospace, for airplanes. Both Airbus and Boeing



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are now talking to us. We hope there will be a whole slew of companies that come about as a consequence of that work. This kind of thing is in keeping with the mandate, what CSIR is really about.

**BT: I find that the question of downstream value chains – beneficiation – is meeting a lot of resistance from the Chamber of Mines. Many economists say that we cannot do it because we don't have the capabilities.**

SS: I think they are partially right – but to say “we don't have the capabilities” need not lead to the conclusion that “therefore we must not do it”.

**BT: Their conclusion is exactly as you say. Unlike Singapore, they say, we don't have the capability and we shouldn't do it. In other words we should export all our minerals.**

SS: I remember there was a famous economist at Harvard –

**BT: Yes, Ricardo Hausmann.**

SS: He said, “Why are you people fawning about trying to do this stuff? There are people who can beneficiate better

than you. Why don't you just export and then stick to the things that you do well, like financial services and so on.”

**BT: And what is your view?**

SS: I am not an economist. I'm not going to argue on the premise of market economy exports because I will lose. I see no reason why we cannot continue doing those things we are good at, like financial services. But I say we *also* seek to be involved in the game of advanced manufacturing to add value to our resources. Why not? Rather than say it cannot be done – and the people who say it cannot be done typically are not the people who would be involved in doing it anyway. I hear economists making these judgment calls, but not actually asking whether it is not the mandate of an institution like CSIR to attempt to do so.

**BT: You are quite right. But as a CSIR scientist: if government or industry asked you whether we have the potential to increase our capabilities using scientific and technological means, how would you respond?**

SS: My response would be a very emphatic yes. Frankly, I would take it further. Even if they were to categorically say we shouldn't do it, I would probably be defiant and do it anyway. I really think this needs to be done.

**BT: Are there other state agencies like yours who take the same attitude?**

SS: Yes, in particular Mintek. Its mandate is minerals processing and we talk with them quite closely. There's no question that we should be creating the industry and getting involved in beneficiation of our minerals.

By the way, when we think of our mineral resources, we tend to think of the obvious: titanium, platinum and so on. But we have started, in a very promising manner, beneficiation of our natural clays. We have clays that express certain properties on a very, very small scale, in the arena referred >>

to as nanotechnology. They are very well suited as additives to moisturiser creams and various other applications. And we are fortunate in having a lot of these nano-clays. It's an area we should bear in mind. In fact, there's huge potential in the cosmetic industry and the medical industry.

## SUPPORT FOR EXISTING AND NEW INDUSTRIES

**BT: You also take some steps towards existing industries. Do they pay for it?**

**SS:** It is a combination of things. If a company is very clear what it is after – if, say, Sasol asks us to do such-and-such a piece of work for them – then we will set up a contract. There are a lot of existing industries that we help with, including the state-owned enterprises. Typically they know what they are after and we then do work with them. They will put up their own money.

We may be commissioned to do something very specific. Transnet was worried about derailment of trains, so we worked with them to develop a technology for very early detection of potential breaks or cracks in railway lines. We do that by sending an acoustic signal down the railway line. If you don't pick up the sound wave properly at the detector further downstream, then you can infer that there must be a crack somewhere because sound will travel extremely well through a piece of railway steel that has no cracks in it. We have deployed it on the Saldanha Bay railway line and it has in fact saved Transnet a great deal of money because each derailment can cost them hundreds of millions of rand.

In other instances, we go to the companies. I'll give an example. We received funding through DST [the department of science and technology] and DTI [the department of trade and industry] to form the National Cleaner Production Centre (NCPC). In fact, it was funded ultimately by the Danish International Development

Agency. The NCPC contacts industries, particularly small industries, to offer assistance with better use of energy, better production processes, supply chain management and so on, to bring down the cost of production. For a small company, it could be a significant intervention.

**BT: Can you tell me something about your encouragement of new enterprises?**

**SS:** In biotechnology, we set up the Biomanufacturing Industry Development Centre (BIDC). We look



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at technologies that can be turned into business propositions without requiring too much technical expertise. Then we find small industry players, typically from different parts of the community. It might be in remote areas – for producing essential oils, for example, which then might be bought by the cosmetic industry. It's ultimately based on technology that we've developed here. I'm not talking about the kind of industry that requires very huge upfront investment – if you want to get into the game of drug discovery and register a drug through the Food and Drug Administration, that's a very lengthy process.

We have a lot of funding from the department of labour to assist

with the formation and support of such enterprises. We are not directly incubating them within CSIR but we go out to them in the community. They may need to use some of our facilities and equipment that are too expensive for them. We will test samples of a new essential oil in our lab before it can be taken further as a commercial venture. IDC might come in as a partner to fund the activity or small business development.

**BT: Do you also work with the Industrial Development Corporation (IDC)?**

**SS:** Yes indeed. For example, we were producing titanium powder in the lab in very small quantities. We then needed to be able to produce significantly more quantities in a given amount of time, kilograms of the stuff, to demonstrate that the process was industrially competitive. We built a pilot plant on our premises at CSIR. IDC is a co-investor in this plant, as well as a pigment company called Tronox, which used to be part of Exarro.

If the process works at that level, we'll need to build a much bigger plant, at which point CSIR might have to exit because we cannot play in that space anymore. It would be billions of rands of investment. Then IDC and other commercial players would be the natural parties to take that on and take it further. It would be founded on the work that we have done initially, as CSIR, and the pilot plant with IDC and Tronox.

## THE BOTTOM LINE

**BT: Can we turn to the question of funding? Can you give us a rough breakdown of public sector funding and private contracts?**

**SS:** Just over 30 percent of the money we receive is a parliamentary grant that we can use at our discretion to conduct research in a variety



Source: CSIR

of areas. Beyond that, the bulk of what we get through contracts is actually still public sector money. That would include money from, say, the department of energy or the department of defence to develop some work for them. We do a lot of work with the likes of Eskom and Transnet, state-owned enterprises that are in the public sector but not government departments. Funding from contracts in the actual private sector is fairly small...

**BT: One third?**

SS: Less than 20 percent. It is quite small but this tends to get conflated. The private sector might spend a lot of money that arises as a consequence of work that we do, but which doesn't

appear on our income statement. As I mentioned, Tronox invested directly in a scaling-up plant to test our technology for beneficiating titanium, but you are not going to see that on my income statement. So if that is used as the proxy for how much the private sector is spending, you'd get the wrong impression. You'd say, "Look at how little money CSIR is making from the private sector." But my immediate interest is not necessarily to make money out of a company or state enterprise, but to stimulate them to spend money. If any company decides to spend money on R&D as a consequence of something we have done, that is good – even though that money is not going to be reflected as income to CSIR.

**INDUSTRIAL POLICY SUPPORT**

**BT: You also have a policy role with the DTI and others. How does that work?**

SS: One way is in the formulation of the Industrial Policy Action Plan. We might be asked to make a contribution in particular sectors, such as aerospace. We have an expertise in South Africa, both in CSIR and Denel, in unmanned aerial vehicles – drones. It has become very much a commodity area, with many people making drones on a smaller scale. In policy terms, is this an opportunity for us? We can say what expertise exists in South Africa, in materials, in technology, and so on, and the direction that the industry is going. So that kind of thing might make its way into the Industrial Policy Action Plan. >>

Or it might be through environmental impact assessments, like with fracking. Let's take the emotion out of it a bit and talk about what really is there underneath the ground. Are the estimates reliable about how much gas we can extract? What are the likely consequences? How much is it really going to affect the environment? And then take an evidence-based approach.

## SCIENTISTS, ENGINEERS AND TECHNICIANS

### BT: What are the employment numbers at CSIR?

SS: Of 2 500 employees, around 1 700 are involved in research in one form or the other – scientists, engineers or technicians.

### BT: Where do you get them? Everybody says, especially some of my economist friends, that we don't have skills.

SS: Well, if you want to build a new institute from scratch and you need five hundred scientists, I suppose you would struggle. But we are replenishing people at the turnover rate of 10 percent per year, so we can recruit from the universities. We try, as best we can, to provide bursaries to students without necessarily obliging them come and work here, so they look upon CSIR as a prospective employer. There are quite a number of PhDs applying, from not just within South Africa but from different parts of the world.

As you know, scientific endeavour is an international activity. The director of our nanotechnology centre is from India and he is very well respected internationally. In this case, we approached him. We are particularly keen to be a home for African scientists who want to be on the African continent, so there are a number of extremely good scientists from



southern Africa, East Africa, Cameroon, Nigeria, and so on. I think it is a very good thing. People can go work in the US or the UK for a long time, then ultimately they get to the point where they want to come back to Africa.

### BT: What about the supply from South African universities?

SS: I am hesitant to answer definitively yes or no. It could be better. In an ideal world, if someone pops up and has just finished a PhD and is looking for a job, I could say instantly, "Yes, I have a position for you." But sometimes



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it does not pan out that way. By and large, we would like to be able to accommodate, and I say this with some caution, virtually any South African who says that they are interested in research.

### BT: And the quality is good enough?

SS: We have a number of very young people in our research cohort, which is a very healthy thing. When the individual has just finished a PhD, it is not entirely fair to ask of them the quality of question you would of someone with twenty years' experience. So there are areas of excellent quality, but there is always room to get better. I am by no means gloomy about things, not in the slightest.

### BT: Do you do a lot of training?

SS: Training has been ongoing and is embedded into everything that we do. We spend quite a bit on bursaries and on further developing people already working in our organisation. Where I am a little unsure is how much we should spend on taking people abroad. We think that such exposure is important, but this can get extremely expensive. If we had more money, I would say – in the spirit of South Korea – go out there and pursue higher degrees at MIT, Cambridge, Oxford and Harvard, stay there a while, and then come back three years, ten years, even fifteen years later.

### BT: I think some of the economists ought to come and visit you! We don't appreciate the significance of the CSIR as part of our scientific and research capabilities.

SS: I think that would be very helpful. We can have a conversation and they can speak from their perspective. We can show them what we're doing and ask if they really think we are being silly. Why shouldn't we try to be players in these areas, in our part of the world? **NA**