How to grow the South African biotechnology sector

by Donrich W Jordaan

The world is undoubtedly moving towards a knowledge economy, of which biotechnology (biotech) is a key component. By international standards, South Africa's biotech sector is negligible. In order to make South Africa competitive in the dawning knowledge economy, growing a strong biotech sector in SA is therefore crucial. This is the background against which the South African Biotechnology Strategy was conceived, which policy continues to guide all government incentives regarding biotech. In this article I argue that the South African Biotechnology Strategy of 2001 is seriously deficient as a policy paradigm for achieving its own stated objectives of growing the biotech sector, and needs to be reconceptualised.

Biotech is knowledge-driven par excellence. The challenge of growing the biotech sector is therefore largely dependent on the generation and protection of knowledge in the form of patents. In 2001 the position regarding biotech patent generation in South Africa was that *virtually all* biotech patents generated in South Africa were produced by the public sector, i.e. universities and public research institutes, and not the private sector. The South African biotech patent picture was further coloured by the fact that only a small proportion of the biotech patents generated by the public sector was ever commercialised. When confronted with the challenge of how to grow the South African biotech sector, the authors of the Biotechnology Strategy of 2001 identified the low commercialisation rate of patents as a key problem to be addressed by the Strategy. They endeavoured to solve this problem by promoting the establishment of spin-off companies that would commercialise patents generated by the public sector. This created a paradigm in which the universities are the patent generators, doing the research, and biotech entrepreneurs are essentially the commercialisation agents. The idea of a biotech SME (small and medium enterprises) that wishes to conduct research independent of academia to create its own patents is a fundamental anomaly in the Biotechnology Strategy.

At the heart of the Biotechnology Strategy of 2001 is a mistaken assumption – the assumption that the South African universities (and science councils?) are generating a sufficient number of *commercially viable* biotech patents. International reports on innovation cast serious doubts on this assumption. Instead of whipping the half-dead horse of commercialising the under-supply of patents generated by universities, a complete paradigm shift towards supporting SME-driven innovation and patent generation is needed to really grow the South African biotech sector. Such an alternative policy-paradigm would entail the following policy ramifications:

- **Breakdown of academic-centred prejudice:** Biotech entrepreneurs must be seen as drivers of biotech innovation and therefore as legitimate initiators and managers of research. This entails the breakdown of the prejudice that academic or public sector involvement in research is essential.
- **Pre-seed funding:** Developing biotech R&D project proposals and driving them through the funding mechanisms is for all practical purposes a full-time job. Biotech entrepreneurs are taking great professional and financial risk to take on such a challenge and need to be supported from the concept (pre-proposal) stage of a planned R&D project. Funding instruments should therefore have a rapid process for screening potentially viable R&D concepts, and should offer pre-seed funding to enable biotech entrepreneurs to develop their concepts into full project proposals and drive them through subsequent evaluation processes.
- **Biotech incubators:** A significant barrier to entry peculiar to the biotech sector is the high cost of essential infrastructure – while an IT entrepreneur may only need a computer and Internet access, a biotech entrepreneur needs a laboratory with equipment worth millions. In order to build a biotech private sector, this barrier to entry needs to be addressed through the development of biotech incubators, which are essentially fully equipped laboratory units that are available for rent by biotech SMEs at subsidised rates. Such biotech incubators are also essential to wean biotech SMEs from their current (imposed) dependency on university infrastructure.

Why was this alternative policy-paradigm so elusive to the authors of the Biotechnology Strategy of 2001? This was a classical case of in-think: the authors themselves being almost exclusively from the *public* sector – academics and bureaucrats – they found the solution within their own frame of reference: the public sector. Two of the most essential drivers of innovation and biotech industry development that are

internationally used with great success – pre-seed funding and biotech incubation – were therefore *completely omitted* in the National Biotechnology Strategy of 2001. The South African biotech sector can only be grown if SMEs are recognised as an essential driver of innovation and patent generation.

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→ Donrich Jordaan suggests that the South African Biotechnology Strategy is seriously deficient as a policy paradigm for achieving its objectives. He proposes methods for growing the biotech sector.

Call in the bioengineers

Keeping 6 billion people fed boosts global warming more than all the world's cars, trucks, trains, ships, and planes put together. Agriculture accounts for almost 14% of greenhouse gas emissions worldwide, according to the latest report from the Intergovernmental Panel on Climate Change. One response is to eat fewer of the two- and four-legged greenhouse gas factories known as animals. Before you send back that T-bone, though, call in the bioengineers. Genomics experts have been optimising food crops for decades, punching in traits for lower herbicide use, less tilling, and higher yields – carbon cutters, all. But the fountainhead of agricultural emissions is nitrogen-based fertiliser, whose manufacture (mainly from natural gas) and poor take-up rates add up to nearly one-third of agriculture's contribution to global warming. Monsanto, DuPont, and Signet, along with a flotilla of venture-backed startups, are trying to change that. California-based Arcadia Biosciences is already peddling genes for nitrogen-efficient rice that the company reckons could save the equivalent of 50 million tons of carbon dioxide a year. Arcadia's CEO, a lifelong Sierra Club member, is working to get carbon credits for Chinese farmers who make the switch. What some greens deride as Frankencrops are also the only serious hope for biofuels. Right now, their net carbon benefit is negligible. Corn engineered for high yields and low fertiliser will help, but even better will be plants under development whose stalks and leaves can easily be turned into fuel. The plunging cost of gene synthesis should help bio geeks deliver on another big promise: a new economy in which biochemical reactions replace industrial processes. J. Graig Venter's Synthetic Genomics is working with BP on microorganisms that produce cleaner alternatives to gasoline. Rival Amyris Biotechnologies is working on bugs that make jet fuel. Meanwhile, the genetic engineers are cooking up climate friendly meat without feet: The first symposium on lab-grown animal flesh met in Norway in April.

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