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Assessing the Debate in Zambia, Kenya, and South Africa

A Report of the CSIS Global Food Security Project

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INTRODUCTION

The use of genetically modified organisms (GMOs) to boost agricultural productivity is often touted in Washington policy circles as a potentially powerful tool for boosting agricultural productivity and reducing food insecurity in Africa. That confidence has not been shared by African governments, many of whom remain wary of transgenic technologies.

The Green Revolution in agriculture passed largely unnoticed in Africa. While in Asia and Latin America the introduction of improved crop varieties and the application of scientific farming methods enabled food production to outstrip population growth, in Africa agricultural productivity actually declined. On a per capita basis, Africa's farms produced almost a fifth less in 2005 than they did in 1970.[1] Africa currently imports a quarter of its food, even though 70 percent of its people are engaged in agriculture.

Many factors explain Africa's chronic food insecurity. They include infrastructural deficits, soil quality and water scarcity, the predominance of small-scale over large-scale production, a shortage of inputs, climate variability and the effects of climate change, national agricultural policies that stymie farmer incentives, and international trade barriers that favor the developed over the developing world. Weighing the relative importance of these factors is impossible. But it is striking that the marriage of science and farming in the rest of the world during the late 1960s and 1970s coincided with dramatic gains in agricultural productivity while in Africa productivity levels atrophied. Between 1976 and 1996, spending on agricultural research increased by just 1.5 percent in sub-Saharan Africa compared with a growth rate of 4.5 percent in the rest of the developing world.[2]

Given the relative paucity of science and research capacities in Africa, it should not be surprising that the arrival of genetic engineering and its application to farming techniques was in many places viewed with suspicion.[3] The absence of a scientific community—outside of South Africa—meant there was no constituency to lead and inform the debate on genetic modification (GM) technology. As a result, those debates quickly became drowned out by non-African voices. On the one hand, some U.S.-based biotech companies were guilty of hyperbolic statements, presenting GM technology as the key to unlocking the problem of food security in Africa. On the other hand, a well-organized group of predominantly Europe-based nongovernmental organizations, or NGOs, backed by elements of the press, made sometimes exaggerated claims about the health

1. Cited in Robert Paarlberg, *Starved for Science: How Biotechnology Is Being Kept out of Africa* (Cambridge: Harvard University Press 2009).

2. Mark Rosengrant et al., *Looking Ahead: Long-Term Prospects for Africa's Agricultural Development and Food Security*, 2020 Discussion Paper No. 41 (Washington, D.C.: International Food Policy Research Institute, 2005).

3. Genetically engineered agricultural crops, known as GMOs, are crops designed in a laboratory to contain desirable traits, such as resistance to disease, drought, or herbicide. They are made by inserting a gene or modified gene containing the desirable trait into the living DNA of a host plant. The plant can pass on this desired trait when it reproduces.

and environmental risks of GMOs and their implications for trade and dependence on Western corporate interests.

Opposition to GMOs in Africa has manifested itself in several ways. African governments adopted tight restrictions on the international movement of living GMO crops and seeds under the Cartagena Protocol, a UN Convention on biological diversity launched in 1996. The position against GMOs has acted as a brake on scientific research. Currently, only three African nations produce biotech crops—South Africa, Egypt, and Burkina Faso. Only the first two grow GM food crops, and only South Africa grows them in significant quantities. Africans have yet to mount a serious debate among themselves on the pros and cons of GM crops, although regional groupings—the Common Market for Eastern and Southern Africa (COMESA), the Southern African Development Community (SADC), and the Economic Community of West African States (ECOWAS)—and the African Union (AU) are becoming more actively engaged.

This report gauges the current status of the debate on biotechnology in Africa with a snapshot of three countries at different stages along the thought process on GMOs: Zambia, where a strong emphasis on the precautionary principle remains very much in place; Kenya, where recent legislation has opened the door to eventual commercialization of GM crops; and South Africa, where GM food crops are widespread and where elaborate regulatory capacities are fully established. It looks at what practical steps countries are taking to settle the question and examines the wider issue of what debates around GM technology say about the role of science in Africa. The research is based on interviews conducted with policymakers, scientists, farmers' groups, anti-GMO campaigners, and other interest groups in all three countries in October through December 2009.

This report is intended to supplement the CSIS Task Force on Global Food Security, chaired by Senators Richard Lugar and Robert Casey. Its final report, *Cultivating Global Food Security,*[4] published in April 2010, calls on the U.S. government to pursue a multifaceted response to food insecurity, driven by strong White House leadership, focused on specific country needs, and drawing on the strengths of the research community and the private sector. The role of GM technology in enhancing food security does not feature prominently in the work of the task force, but because the issue arises frequently in U.S. discussions on boosting agricultural productivity, it is worthwhile to examine how African opinions are evolving. This report does not take a position either for or against GM technology. Instead, it seeks to highlight current thinking on GM crops in three sample countries; identify the drivers of these discussions; and offer thoughts on how the debate about GMOs might play out in the future.

Main Observations

A number of common themes emerged from the discussions in all three countries, articulated by both opponents and proponents of GM technology. Most of those individuals and institutions interviewed emphasized the need for

- *An informed debate.* African countries need to conduct a reasoned dialogue on GM food crops and make an informed decision on the issue, free from outside interference. Central to this ef-

4. Johanna Nesseth, *Cultivating Global Food Security: A Strategy for U.S. Leadership on Productivity, Agricultural Research, and Trade*, a report of the CSIS Task Force on Global Food Security (Washington, D.C.: CSIS, April 2010), http://csis.org/publication/cultivating-global-food-security.

fort is an empowered, credible scientific community that ties research priorities to the needs of African farmers and is able to communicate science and risk assessment clearly to policymakers and the public at large.

- *Greater investments in locally relevant research and development capacities.* As science and technology issues become increasingly complex, African countries will need a strong cadre of professionals with a firm footing both in the scientific arena and in the local development realities that confront their nations. In building the next generation of African scientists, African universities should be empowered to play a greater role in applied research and development and to connect more effectively with national development priorities, with farmers, and with local communities. African governments should also maximize the potential of organizations like the Consultative Group on International Agricultural Research (CGIAR) to bring together scholars and scientists on a regional level to share research and pool resources.
- *A sustained, objective public information campaign on GM technology that meets head-on debates over human safety, environmental contamination, and ethics.* This will require independent institutions that enable balanced, informed public policy debates. Further, the African media needs greater capacity in science, health, and risk communication and reporters more able to convey complex scientific debates in an accurate but publicly accessible way.
- *Stronger mechanisms to transfer information and technologies* to smallholder farmers and in turn more fully understand local priorities for agricultural investments.
- *An open and informed political culture.* In taking political decisions on research, development, and commercialization of GM crops, African governments must more fully understand the risks, opportunities, and capacity requirements that such decisions will entail. At the same time, they will need to weigh the opportunity costs of investments in biotechnology capacities against other options for bolstering productivity, market access, and food security.
- *Regional policies and agreements to harmonize national biosafety policies.* Regional groupings such as the East African Community (EAC), COMESA, SADC, and ECOWAS all aspire to bolster intraregional trade and already see considerable cross-border trade in maize and other foods. As individual African countries move to commercialization of GM crops, movement of food within regional economic groupings will become more complex and require greater harmonization of biosafety standards and stronger monitoring and enforcement capacities.
- *A more holistic approach to boosting agricultural productivity.* Genetically modified crops are a potentially important means of promoting food security in Africa, but they are just one tool among many and should not be presented as a "silver bullet." Other, less controversial interventions can be made with relative ease and at a lower cost. Small-scale African farmers would universally benefit from greater access to inputs such as improved seed, fertilizer, mechanized tools, and better irrigation systems.

The Role of the United States

Most of those interviewed agreed that, given its perceived status as a leading proponent of GM technology, the United States should be careful that it does not unduly interfere with Africa's decisionmaking process on GMOs. U.S. advocacy for biotechnology may in fact be counterproductive, given the polarized tenor of previous debates and widespread public suspicion that such advocacy is merely a front for powerful commercial interests. A more appropriate role for the United

States will be to advocate for science and learning in general and to help equip Africans to make informed decisions on scientific matters: not only on GMOs but other technologies as well. This approach means making a generational commitment to improving scientific capacity in Africa through investments in universities and other institutions of learning.

Ultimately, GMOs are just one of many potential methods of increasing African productivity. U.S. interventions should align with the national priorities of individual countries, which may or may not embrace GM technologies.

ZAMBIA

"We need to unravel the mystery and mystique around GMOs, and that has to start with scientific understanding."

—Dr. Stephen Muliokela, director, Golden Valley Agricultural Research Trust

Zambia was the locus of heated domestic and international debates around genetically modified grains in the early 2000s, when, in the face of a mounting regional food crisis, then-president Levy Mwanawasa announced that the country would no longer accept emergency food aid that contained GMOs. Mwanawasa's stance became Zambian national policy, and the controversy surrounding GMOs, though less forcefully debated today, continues to a large extent to shape current attitudes.

Background

Beginning in 2001, Southern Africa faced a massive food crisis, precipitated by successive years of drought, flooding, and poor harvests that left some 10 million people in need of emergency food assistance. Zambia was particularly hard hit, with an estimated 2.7 million—28 percent of the population—at risk of starvation. The crisis was compounded by an adult HIV/AIDS prevalence of 20 percent, a general macroeconomic decline, and major shortfalls in imports of maize, the staple food. In southern Zambia, which suffered the brunt of the crisis, many Zambians were reduced to boiling wild roots for food, and reports circulated of people resorting to eating household pets.

The World Food Program (WFP) launched a major operation in Southern Africa in mid-2002, with significant in-kind contribution of maize from the United States, where 70 percent of maize produced is genetically modified. Zambia, along with Zimbabwe, Mozambique, and Malawi, refused the donated food, and in Zambia, the 18,000 tons of donated maize already in the country was put under guard and eventually shipped back out. After protracted negotiations, Zimbabwe, Mozambique, and Malawi agreed to accept GM maize, but only after it had been milled, to prevent potential commingling with domestic crop varieties. Zambia agreed to allow WFP to provide milled maize to refugee camps that housed some 130,000 Angolan and Congolese refugees, but refused distribution to Zambians, pending further deliberation.

The three leading national research bodies—the Soil and Crop Research Branch, part of the Ministry of Agriculture and Cooperatives, and the National Science and Technology Council and the National Institute of Science and Industrial Research, both of which are under the Ministry of Science, Technology, and Vocational Education—advised the government to refuse the shipment. The United States, surprised and frustrated, invited a team of Zambian scientists on a fact-finding mission to the United States, South Africa, and Europe. On their return to Zambia, to the conster-

nation of the United States, the team argued against acceptance of the GM food. The bottom line, said one Zambian agronomist interviewed for this report, was that "we need to know more, and we can't take chances. If even the Europeans, with all their scientists and research institutions, have doubts, surely there must be good reason to be cautious."[5]

In August 2002, the minister of information announced the government's decision not to accept genetically modified foods, despite the ongoing food crisis:

> We wish to inform the nation that as a government we have taken into consideration the scientific advice about the long-term effects of the [GM products] and all related grains, and we are rejecting it . . . . In light of the uncertainties surrounding the consequences of consuming GM foods, government has decided to take the precautionary principle on this matter.[6]

The minister cited the absence of a biotechnology policy framework; the absence of evidence on the possible risks to human safety and the environment; and the possible threat of contamination of local indigenous and hybrid seed stocks.

From there, rhetoric surrounding the issue took on political and emotive overtones that remain very fresh in the minds of Zambians today. "Beggars can't be choosers," said an unnamed State Department official, quoted widely in Zambian and African media reports of the time. "People that deny food to their people, that are in fact starving people to death should be held responsible . . . for the highest crimes against humanity in the highest courts in the world," said Tony Hall, then U.S. ambassador to the United Nations Food and Agriculture Organization.[7]

President Mwanawasa responded to critics: "Simply because my people are hungry, that is no justification to give them poison, to give them food that is intrinsically dangerous to their health," he told the Summit on Sustainable Development in Johannesburg in December 2002. "I will not allow Zambians to be turned into guinea pigs, no matter the levels of hunger in the country."[8]

In this polarized atmosphere, in the midst of a food emergency, there was little room for dispassionate debate. Zambia became a *cause célèbre* for biotechnology opponents, and fact, rumor, and ethical, nationalist, and pragmatic trade rationales very quickly created a jumble of negative publicity and fueled public suspicions even further. In the absence of any existing biosafety law or regulatory framework, President Mwanawasa's stance became national policy and permeated all levels of government as well as the public discourse.

Today, much of the heat has gone out of the debates around GMOs. Although the "precautionary principle" still stands, few Zambian researchers or officials will outright dismiss the possibility of eventually adopting GM technologies. There are, in fact, individuals within and outside government, who favor a more proactive approach. However, there is still a strong skepticism of the technology. Pro-GMO voices have not coalesced in a way that might accelerate change, and there is no strong constituency at present pushing for a more facilitative environment or for investment in the kinds of capacities that will be needed to develop and promulgate GM technologies. Even those in favor of moving forward on GMOs acknowledge the many hurdles that will need to be overcome.

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5. Interview by Jennifer Cooke in Lusaka, Zambia, November 9, 2009.
6. Zambian minister of information Newstead Zimba, quoted in *PanAfrica News Agency*, August 17, 2002.
7. "US Calls Food Aid Refusal by Zambia a Crime against Humanity," Reuters, December 5, 2002.
8. Olga Manda, "Controversy rages over 'GM' food aid," *Africa Renewal* 16, no. 4 (February 2003).

Science and Research Establishment

The science and research community is divided on the human health risks and potential environmental impacts of GM crops. "Politicians are risk averse," said one researcher interviewed, "and we scientists need to get our own house in order before we can convince them one way or the other."[9] Few within the research community have been focused on biotechnology issues. Although in 2000 and 2001 the Cotton Development Trust undertook isolated field trials of Bt cotton,[10] the 2002 controversy and subsequent ban put an end to that avenue of research. Aside from occasional brief study tours to South Africa, India, or the United States, the issue has largely been left in abeyance, according to an official in the Ministry of Agriculture, and there is a tendency to rely on external researchers for advice.

There was broad consensus among those interviewed on the need for greater investment in indigenous science and research capacity. Zambia once boasted a relatively robust agricultural research and development infrastructure, but declining state revenues with the fall of copper prices in the 1990s, structural adjustment policies, and a shift in donor focus to poverty alleviation and the private sector have dramatically reduced funding for public research institutions.[11] The voice and credibility of the research establishment has been weakened, and individual institutions compete for external funding most often on a project-by-project basis. Reliance on donor funding often means that priorities shift over time, long-term planning is made more difficult, and an overall agricultural research strategy and agenda are hard to discern.

Responsibility for various aspects of agricultural research falls to three ministries: the Ministry of Science, Technology, and Vocational Education; the Ministry of Agriculture and Cooperatives; and the Ministry of Education. Unfortunately, as described by one university professor, agriculture is not the priority of the Ministry of Science; research is not the top priority of the Ministry of Agriculture; and neither agriculture nor research is a priority for the Ministry of Education.[12] The university has become essentially a "glorified high school" said one professor: "Instruction, not research, is essentially what we do." The research that is possible within the university tends to be largely abstract and not tied to the priorities of the Zambian farmer. University staff worried that Zambia is failing to build the next generation of science and research professionals to tackle future challenges and push for science- and research-based policies. Those interviewed in the university and other research institutions made clear that this is an issue not just for exploring biotechnology applications, but for the whole "buffet of technologies" that Zambia will need to strengthen its agricultural sector. Members of the research community pointed to the need for long-term, sustained research partnerships that may not entail large funding sums, but that build capacity and trust over time. The Collaborative Research Support Program in Sorghum, Millet and Other Grains, a USAID-funded collaboration with the University of Nebraska-Lincoln, was cited by several as the kind of model needed.

9. Interview in Lusaka, November 9, 2009.

10. Bt cotton is engineered to protect the cotton from a common pest, the cotton bollworm.

11. Howard Elliott and Paul Perrault, "Zambia: A Quiet Crisis in African Research and Development," in *Agricultural R&D in the Developing World: Too Little, Too Late?* ed. Philip G. Pardey et al. (Washington, D.C.: International Food Policy Research Institute, 2006).

12. Interview in Lusaka, November 12, 2009.

Policy and Regulatory Framework

Although biosafety legislation is now in place, the regulatory framework and institutional capacity to manage biotechnology issues are in a very nascent stage. The most immediate priority is to build capacity to monitor and block incoming GM seeds or crops, whether from abroad, or more immediately, from neighboring South Africa, where GM maize is prevalent.

The Zambian parliament passed the Biosafety Act in April 2007, calling for the establishment of a National Biosafety Authority to receive and vet applications for research, development, import, transit, contained use, release, and commercialization for genetically modified organisms. The legislation further lays out mechanisms for liability and redress for any harm or damage caused to human and animal health, non-GMO crops, socioeconomic conditions, and biological diversity.

While the bill does not outright ban GMOs, most stakeholders see the legislation as more prohibitive than facilitative of biotechnology research. In fact, in introducing the bill to the parliament, the chair of the drafting committee emphasized that it was "aimed at ensuring that Zambia remains a GMO free country."

Proponents of GMO technology suggest that while the legislation does envisage the eventual possibility of research, import, and commercialization of GMOs, "there are many ways of saying no."[13] The bar for applications is likely to be set prohibitively high, said some. The National Biosafety Authority is not yet established, and some question how long that process will take. Although a registrar has been named, there appears to be little urgency from the Zambian leadership or from other constituencies to push the process forward.

A National Biosafety Laboratory was completed in 2007, with the help of the Norwegian government, and three staffers are being sponsored for advanced degrees by the Norwegian Institute for Gene Ecology. The priority function of the laboratory, which is managed by the National Institute for Science and Industrial Research, is to detect GMOs in seeds and grains, in keeping with the Cartagena Protocol, which Zambia signed in 2007. Eventually, the laboratory is intended to serve as a national (and perhaps regional) referral center. Currently, there is minimal capacity to monitor food and seeds coming across the national border. And there are no facilities that might eventually begin research on transgenic technologies.

Outreach to the Public and to Smallholder Farmers

The 2002 debates around GM food had broad public resonance, and public opinion toward the technology remains largely hostile. The potential health risks loom large in people's minds, with an array of scary popular narratives on what happens to those who consume GM foods. The argument is made that Americans do not face comparable risks in consumption despite the large quantity of GM food in the United States, since Zambians eat maize three times a day and Americans have a far more varied diet. Americans, it is pointed out, eat a great deal of wheat, and there are no GM varieties of wheat.

13. Interview in Lusaka, November 11, 2009.

The potential effect of crossover to local crops is also a concern, with localized varieties a source of regional pride, taste preference, and farmers concerned that cross-contamination will eliminate local varieties. There is further a general distrust of U.S. intentions in introducing GM food and of private companies perceived to be pushing the technology—either to control the seed market; to edge out European trade ties; or to create long-term dependence on the technology. Fear around "terminator gene"[14] or similar insidious possibilities have not been entirely allayed. And there are ethical concerns around transgenic technologies, particularly when "animal" genes are concerned.

Politicians are sensitive to these popular attitudes, and even supporters of the technology will not push hard publicly on the issue. Current President Rupiah Banda has expressed more openness than his predecessor to the possibilities of GM technologies, and proponents are hopeful that his leadership may begin to alter public perceptions.

According to most people interviewed, GM technology is not on the radar screen for smallholder farmers, who have more pressing immediate priorities and have little room for risk or experimentation. Nor has there been much interest among commercial producers, many of whom worry that adopting the technology will limit their commercial options, essentially eliminating the European market.[15] The cotton industry is one sector that is beginning to push for accelerated research and development on GM technology. Field tests were begun in 2000–2001, and the impacts of Bt cotton production in South Africa and Burkina Faso are being followed with some interest. The advantage too is that cotton is not a food crop ("anything but maize!" said one observer) and will be less prone to public opposition and politicization.

There are some efforts at public education and communication on biotechnology. But because the science community itself is deeply divided, these forums have sometimes had the effect of creating more confusion and reinforcing the tendency to precaution and prohibition. Much greater capacity on communicating science and risk is needed, with greater focus on science education among media and policymakers. Through the food crisis and beyond, the media have tended to concentrate on the more sensational arguments put forward. Instead, said one observer, it could become a powerful tool for helping the public understand the science and the crux of the debates around risk, but only if it can do so through more dispassionate, analytical reporting.

Setting Priorities

A final area raised by the majority of those interviews—on all sides of the debate—is the question of how ultimately useful this technology will be to the Zambian farmer and what opportunity costs are involved to invest in the relatively costly research, regulatory institutions, and public communication strategy around the technology. Said one observer in the private sector, "We need to explore and maximize other inputs first before making the leap to GMOs." High-yield hybrid seeds, developed through traditional breeding techniques, have been around in Zambia for

14. The "terminator gene" is an example of genetic use restriction technology (GURT), a technique that allows genetic traits to be turned off. In this case, the terminator gene, if developed, would render seeds sterile, forcing farmers to buy new seeds each year. The largest developer of GM seeds, Monsanto, promised in 1999 "not to commercialize sterile seed technology in food crops" (http://www.monsanto.com/monsanto_today/for_the_record/monsanto_terminator_seeds.asp).

15. Whether this is in fact true was challenged by a number of researchers interviewed, and this too is an area where a stronger body of credible, independent analysis is needed.

decades, but the adoption rate by small and medium farmers is estimated at 35 percent. Access to fertilizer, appropriate application of inputs and cultivation techniques, conservation farming, access to credit—these are all areas of improvement that are certain to raise productivity and involve little risk. In addition, these are improvements that will be necessary even with the advent of GM crops. Extension services, generally robust in the immediate post-independence period, have been hollowed out over time, and the capacity to understand small farmer priorities, disseminate knowledge and the most basic technologies, and adapt to local environments has been seriously eroded. Even if GM technology were freely available tomorrow, the infrastructure is not there to take full advantage.

The Way Forward

In face of climate change impacts, food insecurity, and expanding commercial opportunities, Zambia may ultimately embrace GM technology. But few see the technology as a panacea, and even its strongest proponents acknowledge the limitations of the technology in Zambia's current situation. GM is one technology among many—albeit one with significant promise—and though building capacities to manage and exploit its potential are important, so too are broader, multipurpose investments that will ultimately create a more enabling environment.

A priority should be research and development capacity (on a broad set of agricultural issues) that is driven by and responds to the most pressing needs of smallholder farmers and can educate on potential opportunities and innovations. Building a cadre of next-generation scientists and researchers able to grapple with biotechnology and other emerging challenges is vital, but this will take long-term, sustained investment, greater donor engagement, and greater political commitment and vision. Extension services and institutions that engage farmers in research, education, and dissemination are critical to that effort. And such efforts may empower smallholder farmers to coalesce as a stronger, more vocal constituency on public policy issues. At the same time, the science and research establishment needs to build a more coherent and organized communication strategy that is able to inform and advise policymakers, the media, and the more general public on risks, trade-offs, and opportunities in a more credible, independent way.

KENYA

"The horse has left the barn."
—Senior official in Kenya's Ministry of Agriculture

The push to build capacity and an enabling regulatory infrastructure for GM technology in Kenya has gained momentum in recent years in a process initially driven by the science and research establishment and then championed by senior political leadership seized with the potential benefits of the technology. The Kenyan Biosafety Act, signed by President Mwai Kibaki in February 2009, is considered to be among the more forward-leaning and facilitative biotechnology laws in Africa, and Kenyan proponents of the technology see the legislation as a means of accelerating the process of research, development, and deployment of transgenic crops. Public opinion is still divided on the risks and benefits of genetic modification, and competing political priorities may slow full implementation of legislation.

Nonetheless, eventual adoption of agricultural technology for commercial use is considered almost inevitable, and proponents of the technology hope that Kenya's example may persuade more reluctant African governments to follow suit. Secretary of State Hillary Clinton, in a visit to Kenya in August 2009, predicted that "with Kenya's leadership in biotechnology and biosafety, we can not only improve agriculture in Kenya, but Kenya can be a leader for the rest of Africa."[16]

Background

Kenya's embrace of agricultural technologies is not new, and the country has a long history of enduring international research partnerships in agriculture. Large-scale commercial farming interests have been at the center of political and economic power since the British colonial period and have driven public investment in agriculture and agricultural research. The colonial government established a number of powerful research institutes in the early 1900s, including, for example, the Scott Agricultural Laboratories, the Coffee Research Services, and the Veterinary Research Laboratories. At independence, Kenya inherited a strong agricultural research infrastructure, originally established to serve white commercial farmers, and through the 1970s, prior to the collapse of the East African Community (EAC), hosted a number of robust research institutions—in livestock, forestry, agriculture—that served the broader region. With the dissolution of the EAC, the regional organization became the basis for an array of Kenyan public research institutions, including the Kenyan Agricultural Research Institute, or KARI, which later incorporated the research functions of the Kenyan Ministry of Agriculture and Livestock.

16. Phillip Brasher, "Biotech in Africa: High hopes and high stakes," *Des Moines Register*, May 9, 2010.

Research in biotechnology and genetic modification has been ongoing in Kenya for more than a decade, much of it through partnerships between KARI and private, public, and international actors. The longest-running of these—development of a transgenic virus-resistant (VR) sweet potato—was launched in 1991. Initially a partnership between KARI, Monsanto (which donated the VR technology through a royalty-free license), and USAID's Agriculture Biotechnology Support Center, the project has expanded to include other international partners. A project on insect-resistant (Bt) maize was launched in 1999, in conjunction with the International Maize and Wheat Improvement Center (CIMMYT), the Rockefeller Foundation, and the Syngenta Foundation (attached to the major Swiss agro-business company Syngenta). Similar partnerships are ongoing on Bt cotton, virus-resistant cassava and sorghum, biofortified sorghum, and drought-resistant maize. No transgenic crop has moved beyond confined field trials to commercial production.

Senior political leadership has been eager to embrace biotechnology. Agriculture remains the single most important sector in the economy, contributing approximately 25 percent of the GDP and employing 75 percent of the labor force. Since independence, however, the country has seen significant declines, from an average of 4.7 percent growth in the 1960s and early 1970s, to less than 2 percent in the 1990s, to negative growth of -2.4 percent in 2000. The country suffers from persistent food and water crises, and the threat of climate change looms large in policymakers' minds. Kenya was the first country to sign the Cartagena Protocol on Biosafety in May 2000, and shortly thereafter former President Daniel arap Moi wrote to then president Bill Clinton requesting U.S. support in closing the "biotechnology gap":

> In the face of growing population and environmental challenges, current farming methods are proving incapable of meeting our requirements for food security and economic growth. It is therefore imperative that we in Kenya embrace appropriate technologies and policies to transform our agricultural system to become more productive and profitable. It is in this context that we must view the new developments in biotechnology as offering great hope and promise.[17]

In inaugurating a level II biosafety greenhouse (the only such facility in sub-Saharan Africa outside South Africa), President Mwai Kibaki proclaimed: "We must embrace and apply modern science and technology in farming. Indeed, there is evidence that countries that have embraced modern agricultural technologies have improved economic performance, reduced poverty, and ensured greater food security for their people."[18]

In 2006, a National Biotechnology Development Policy was approved, emphasizing the potential opportunities of adoption. The policy states that "the Government's position and commitment to provide an enabling environment for the acquisition and development of the biotechnology industry for fast exploitation of the immense potential in agriculture,environment, bioresources, health, and manufacturing industry is clear."[19]

The relative sophistication of Kenya's research sector, the power of commercial interests, and the acceptance of biotechnology by Kenya's most senior leaders combine to make commercializa-

17. Letter from President Daniel arap Moi to U.S. President Bill Clinton, August 21, 2000, http://www.biotech-info.net/Moi.html.

18. "President Kibaki opens IRMA Green House," in IRMA Updates, December 2004.

19. Government of Kenya, "A National Biotechnology Development Policy, 2006," available at http://www.biosafetykenya.co.ke/documents/BIOTECHNOLOGY%20POLICY%20FOR%20KENYA%20SUMMARY%20nov06.pdf.

tion of GM crops seem inevitable and very likely to happen in the coming few years. Nonetheless, adoption of the technology is not without challenges, as the contentious and protracted debates around the 2009 Biosafety Act made clear. Public concerns over health and environmental safety endure, and some question whether the technology ultimately will benefit the smallholder farmer and those who are most in need.

Science and Research Establishment

Kenya boasts relatively robust research and development capacities and, as noted, has enjoyed long-standing research partnerships with private and international partners. A number of international and regional research institutions are based or have a major presence in Kenya, including the International Livestock Research Institute(ILRI), the International Maize and Wheat Improvement Center, or CIMMYT, the World Agroforestry Center (ICRAF), the International Food Policy Research Institute (IFPRI) , the Alliance for a Green Revolution in Africa (AGRA), Bio-Sciences East and Central Africa, and the African Agricultural Technology Foundation, making it a regional hub of scientific discourse and exchange.

KARI, the most prominent of Kenya's public research institutions, has close to 600 scientists, 170 with PhDs and 230 with advanced degrees; a network of research centers across the country; and a broad array of research programs, from food crops and animal health to regional adaptation and socioeconomic and biometrics research. The institution's Biotechnology Research Program is staffed by some 15 scientists and has been the lead partner in biotechnology research partnerships, from tissue-culture to marker-assisted selection to transgenic technology.

KARI has received strong private sector and international support. If commercial concerns initially drove the biotechnology agenda, Kenya's multiple food crises have generated greater national government support as well. The 2008 crisis, which hit the middle class as well as the country's poorest populations, was a wake-up call for the leadership, according to a senior KARI official. Water shortages, population growth, competition over land, and the existence of 10 million Kenyans who face food insecurity have underscored for policymakers the need to embrace new approaches and technologies.

Plant pathogens—including wheat stem rust, potato blight, cassava mosaic virus—emerge rapidly and can wipe out in one season varieties that have been developed through traditional breeding for decades. The UG99 stem rust strain swept through Kenya, Ethiopia, and Yemen in 1999, reducing wheat production by 60 percent. The impact and immediacy of these challenges, which must in the first instance be addressed through science and research, have elevated the profile and perceived value of the research establishment.

As a result, the Kenyan science and research community, writ large, had credibility and heft in encouraging the political leadership to establish a facilitative, enabling environment for GM research and development.

Challenges nonetheless remain. Nongovernmental observers express a concern that because many of the research partnerships are externally funded, either by Western donor governments or private interests, research priorities may be skewed toward external or commercial interests and not coordinated in a way that meets Kenyan national needs or the needs of the smallholder farmer.

Sustained investment in building the next generation of Kenyan scientists is needed as well. Public institutions lose a significant number of personnel to better-paying jobs in the private sector or to nongovernmental organizations. Kenyan universities hold some promise and are rebuilding capacities after several decades of decline. The Jomo Kenyatta University of Agriculture and Technology has had an Institute for Biotechnology Research since 1991; Moi University has a School of Agriculture and Biotechnology; and the University of Nairobi established in 2005 a Center for Biotechnology and Bioinformatics, an interdisciplinary center staffed by a range of departments including the College of Agriculture and Veterinary Sciences. Although the universities undertake a number of research projects, the focus is primarily on training. According to several researchers, there tends to be a huge gap between students' theses and the priorities of farmers in field, and research tends to be abstract. U.S. land grant universities, which support more sustained, regular interaction between farmers, students, and researchers, are considered a strong, positive model.

Legal and Regulatory Framework

In contrast to Zambia, where research in GM technology was halted pending the establishment of legislation and regulatory authorities, in Kenya the legal framework is being set up, according to one observer, "after the horse has left the barn." Said one official in the Ministry of Agriculture, "Researchers did a lot on their own, thinking they would just inform everyone later. Now we have to go back, communicating with the public and setting the rules." Prior to the passage of the 2009 Biosafety Act, applications for research were vetted by the National Council for Science and Technology through a National Biosafety Committee, but, as one nongovernmental observer noted, there were little coordination, strategic vision, direction, or enforcement on research and development under that arrangement. Only in the issuance of import permits, through the Kenyan Plant Health Inspectorate Services (KEPHIS) was there real enforcement capacity.

The Kenyan science and research community was eager to have greater clarity and legal backing for research and development in biotechnology, particularly as a number of GM projects moved to advanced stages of development. But equally essential in the eventual passage of the Biosafety Bill was a host of nongovernmental organizations engaged in a robust and focused campaign of advocacy, outreach, and education of media, policymakers, and the broader public. Among these were the African Biotechnology Stakeholders Forum, established in 2001; the International Service for the Acquisition of Agri-biotech Applications (ISAAA), through its Nairobi-based AfriCenter; the Agricultural Biotechnology Network in Africa; and Africa Harvest Biotech Foundation International. Central to the advocacy campaign, which began to gain momentum in 2001, was educating and targeting Kenyan members of Parliament. A series of workshops for legislators was launched in 2003; tours of Kenyan research facilities in 2004; travel to South Africa in 2006, to meet with low-income, small-scale farmers engaged in Bt cotton production; and focus groups with reluctant parliamentarians as the bill neared passage.

Opposition to the biosafety bill began to coalesce in 2004, with the establishment of the umbrella organization the Kenya GMO Concern Group (KEGCO), which included the Greenbelt Movement, Action AID International Kenya, Ecoterra, and others. Opposition was based on a range of concerns, from health risks of consumption, environmental impacts and risk of contamination, a generalized distrust of commercial interests, and advocacy for organic products. KEGCO and other groups were able to get some public traction, organizing demonstrations, getting sym-

pathetic media play, mounting a law suit to halt the legislation, and advocating for a much more restrictive alternative bill, introduced by MP Silas Ruteere. Ultimately, these challenges were not enough to overcome parliamentary momentum, and the intervention in support of the bill by two powerful political figures—Sally Kosgei, then minister of higher education, science, and technology, and William Ruto, then minister of agriculture—were considered instrumental in final passage of the bill.

The 2009 Biosafety Act puts in place comprehensive legislation that governs biotechnology from research and field testing to commercialization and imports of bioengineered crops. The act empowers the minister of science and technology to set in place regulations for contained use of GM organisms, release, import and export, handling, packaging, and labeling, transport and transit, and applications requirements. A Biosafety Authority, which reports to the minister, will receive applications, identify manpower and capacity requirements, and liaise with other countries; collect and disseminate relevant information; maintain a database of experts and projects engaged in biotechnology research; and undertake education and public outreach on biosafety.

The authority is to be managed by a multidisciplinary board, comprising scientists, permanent secretaries from key ministries, directors of biosafety regulatory agencies, and representatives of farmers, consumers, and the private sector. Implementation of the act may take some time—the Biosafety Authority is not yet in place—and some observers expressed concern that the Ministry of Science and Technology, for which food security is not a top priority, may not be acting with the necessary speed. Composition of the authority's board is also of concern, to both opponents and proponents of the technology, who want to see adequate balance within the governing body.

Public Opinion and Farmer Perspectives

The passage of the Biosafety Act has not entirely allayed public suspicions of GM technology or of the government's willingness and capacity to regulate them. A shipment of GM maize coming from South Africa was blocked by protesters at the Kenyan port of Mombasa in April 2010, with protestors claiming that the Kenyan government failed to inform consumers that the maize was genetically modified or to perform the relevant safety checks.

Overall, however, organized opposition to GM technology seems to be diminishing, and though there is still considerable public concern, the coalition that formed in opposition to the Biosafety Act, seems largely to have disbanded. Those organizations that favor GM technology and whose mission is to educate farmers and the public and to disseminate biotechnology applications (whether transgenic or not) appear better organized, better resourced, and more sophisticated in their outreach techniques.

Opinion is divided among those interviewed on how smallholder farmers view the technology. One view is that Kenyan farmers have seen and benefitted from new technologies in the past—from traditional hybrid seeds to tissue-culture—and have a long history of going back to seed sellers for new technologies. On the other hand, it was pointed out, farmers are consumers as well as producers and, like many Kenyans, are wary of health and environmental impacts of GM foods.

Perhaps the larger challenge to farmer uptake of GM technologies is adapting varieties to meet localized climate, soil, water, and disease conditions, which are extremely varied within Kenya. And in Kenya, as elsewhere in Africa, biotechnology may hold long-term promise, but for farmers who have little room for experimentation or risk, is not a pressing priority. "We have so many

technologies already that haven't been exploited to their full potential," said a senior representative of the Kenya National Federation of Agricultural Producers.[20] Fertilizer and irrigation are high on that list, not to mention structural and policy challenges that must be overcome. The challenge will be to balance investments that will benefit farmers only in the long term with the need to meet immediate needs. There was universal agreement among those interviewed on the need for much greater communication between farmers, researchers, and policymakers.

The Way Forward

While research is advancing and political leadership is largely on board, Kenya will still face challenges in persuading a public as yet unconvinced of the safety of GM food and often skeptical of government motives, capacity, transparency, and willingness to put the needs of average citizens first. Regulations on labeling and consumer information will be potentially contentious. Equally important will be ensuring that investments in technology benefit Kenya's small-scale farmers and do not crowd out other essential investments in yield-boosting technologies that may be of more immediate benefit to the average producer.

Finally, though GM proponents praised the Biosafety Act, some worry that implementation may not be fully funded and that competing political priorities—a constitutional referendum in August 2010, potential indictment of senior leaders by the International Criminal Court, and political jockeying within a fragile coalition government—may slow the process of building the regulatory structures required. "Passage of the bill was exhausting," said one nongovernmental representative involved in the pro-GM information campaign. "So the regulations passed, but then everyone went to sleep."

20. Interview in Nairobi, November 17, 2009.

SOUTH AFRICA

"I really don't like the idea of having genes in my food."

—South African MP

"You ask people if they want labeling of GM foods and they say 'yes.' Then you ask them if they know what GM foods are and they say 'no.'"

—Senior official in the South African Department of Health

South Africa stands apart from the rest of Africa in having a long-established and relatively well-resourced scientific community. This distinguishing feature to a large extent explains the country's early embrace of GM crop production, which was given strong encouragement by scientists. South Africa has grown GM crops since 1997, when Bt cotton was first approved for commercial release. It is now the eighth-largest producer of biotech crops in the world, growing 2.1 million hectares of genetically modified maize, cotton, and soya in 2009.[21] More than 90 percent of the cotton grown in South Africa is genetically modified; the figures for soya and maize are 80 percent and 62 percent respectively.[22] South Africa has therefore grown far more GM crops, and for far longer, than any country in Africa. South Africa is also unusual in that it produces and exports both GM and non-GM food products, maintaining parallel production lines for them both.

Laws and Policies

South Africa has developed a detailed policy and legal framework covering biotechnology generally and genetically modified organisms specifically. Lawmakers have tended to struggle to keep pace with the scientists, who have advanced the technology at a rapid rate, then led demands for regulations to go with it. The main piece of legislation governing the production and use of GMOs in South Africa is the Genetically Modified Organisms Act, passed in 1997 and amended in 2006. Under the act, which is administered by the Department of Agriculture, all applications to develop GMOs or release them into the environment must be approved by the Executive Council. The council consists of officials from six (soon to be eight) government departments, including agriculture, health, environmental affairs, and science and technology. The council reaches its decisions by consensus, based on the recommendations of an advisory council of scientists. If an application is approved, a permit is issued by the registrar of the GMO act.

21. Clive James, "Global Status of Commercialized Biotech/GM Crops: 2009," Brief No. 41, International Service for the Acquisition of Agri-Biotech Applications, 2009.

22. Wynand J. van der Walt, "An Outlook on the Next Generation of Biotech Crops," presentation made on behalf of Agri SA at the XVII Eurofins International Seminar, 2009.

The task of limiting the environmental impact of GMOs lies with the Department of Environmental Affairs. It operates the National Environmental Management: Biodiversity Act of 2004, which aims to guard against habitat destruction and prevent GMOs from upsetting the ecosystem and threatening plants and wildlife.

The Department of Health looks after issues pertaining to food safety, through the Foodstuffs, Cosmetics and Disinfectants Act of 1972. Under a 2004 act, products containing GMOs need only be labeled as such if they substantially differ from their non-GMO equivalents in terms of composition, nutritional value, mode of storage, preparation, or cooking. This does not apply to any products currently on the market in South Africa. Some companies choose to label their produce as "GM-free," though a 2006 study found that many of them did in fact contain GM ingredients.[23] A bill recently introduced by the Department of Trade and Industry has the potential to radically shake up this system, leading to much tougher labeling laws. The Consumer Protection Act would introduce mandatory labeling of all products containing GMOs. Discussions about how to implement this law are unresolved, and campaigners on both sides of the ideological divide doubt the government's capacity to enforce it.

South Africa is also a signatory to international agreements governing the transfer of living modified organisms across borders. It ratified the Cartagena Protocol on Biosafety in 2003 and since that date has adopted much stricter controls on the importation of GM products from abroad, more on protectionist grounds than on concerns about safety. South Africa has a moratorium in place on imports of new GM varieties. Trade issues have come to play a central role in decisions about GMOs. The Cartagena Protocol allows countries to consider the potential socioeconomic impact of approving a GM application, and this position is mirrored in South Africa's amended GMO Act, which empowers the Executive Council to take these factors into account.

The South African government takes a pro-biotech stance and in 2007 published a ten-year plan to transform the country into one of the world's leading commercial markets for biotechnology. This policy seeks to build on the 2001 National Biotechnology Strategy, which focused on improving scientific and research capacity through the establishment of four regional biotechnology innovation centers.

A program called Public Understanding of Biotechnology (PUB), established by an agency of the National Research Foundation, aims to raise awareness of the issues behind biotechnology and challenges some of the common misconceptions that surround it.

Main Stakeholders

GM technology has long been used to develop medicines and vaccines without controversy in South Africa, but its use in agriculture remains contentious. There is no common ground between the rival parties in the debate. A small but vocal and well-organized group of campaigners continues to oppose GMOs, borrowing many of the arguments used by European NGOs such as Greenpeace and the Gaia Foundation. They tend to cluster around the legislative capital, Cape Town, from where they lobby parliament intensely. They are backed by elements of the media, although the tone of reporting on GMOs has become more neutral as time has passed. They are pitted against the scientific community, the main commercial farmers' group, Agri SA, and the

23. C.D. Viljoen, B.K. Dajee, and G.M. Botha, "Detection of GMO in food products in South Africa: Implications of GMO Labeling," *African Journal of Biotechnology* 5 (2006): 73–82.

government, which is officially supportive of GMOs. Within the government, a more complex picture emerges. The departments of Agriculture and Science and Technology are perceived to be the leading proponents of GMOs, while other departments such as Environmental Affairs and Trade and Industry are seen as more cautious. Outside of these constituencies, anecdotal evidence suggests that public awareness of the complex issues surrounding GMOs is low.

Proponents of GMOs accuse their opponents of peddling scare stories and tend to dismiss them as an out-of-touch elite trying to apply first world arguments to a third world setting. They argue that poor South Africans want cheap food above all else and do not appreciate being preached to about the benefits of traditional farming by middle-class city dwellers. The opponents of GMOs, on the other hand, accuse their rivals of intellectual elitism for thinking they have the right to foist technology on people without adequate debate and without absolute proof that it is safe. They view the scientific community as a front for corporate interests and accuse it of operating in a secretive and unaccountable manner. Distrust between the two groups is high, and their debates are often rancorous, but there is little sense that their arguments resonate with the wider public.

Main Issues of Debate

In many ways, the debate in South Africa reflects the reality that GMOs are a fact of life and have been for some time. Although opponents continue to question the safety of genetically modified crops and advocate the adoption of the precautionary principle, which argues for a "when in doubt, don't" approach to GM food, most of them understand such crops are here to stay. Therefore, their efforts center on tightening the regulatory system and preventing the entry of new GMO products into the South African market. Proponents of genetically modified crops claim that the anti-GMO lobby engages in a "dead debate" over food safety and tries to retrospectively change laws they were not well-organized enough to oppose in the first place. They share concerns about the regulatory system but argue that it should be relaxed, not tightened.

Both sides direct their attacks toward the Executive Council, the regulatory body that has become the lightning rod of the GMO debate in South Africa. It faces several challenges. The members of both the Executive Council and the advisory committee that supports it are volunteers, taking on the work in addition to their full-time jobs. Many complain that their workload is becoming unsustainable. Absenteeism from meetings is a problem. For these reasons, the decisionmaking process is often slow, causing great frustration for applicants. The council's consensus-based decisionmaking process is also problematic and can draw out discussions. Each department has its own interests to protect, even though their decisions should theoretically be dictated by the national policy framework, laid out in the National Biotechnology Strategy.

A clash of cultures is evident in the various claims and counterclaims made by the scientific community, the anti-GMO lobby, and the Executive Council members themselves. The scientists get exasperated by what they see as the nonprofessional approach of the Executive Council. Although the council has an advisory committee of scientists to rely upon, some scientists express their concern that it is ill-informed, unscientific, overly cautious in approach, and too easily swayed by political considerations. They argue that the PUB campaign would be better directed at educating the regulators, policymakers, and politicians than the general public.

The anti-GMO campaigners accuse the Executive Council of being in the pocket of the scientists, of passing a disproportionate number of applications, and of being slow to provide informa-

tion about applications that should be in the public domain, or failing to provide it at all. For their part, the Executive Council accuses the scientists of being detached from the real world, of only complaining about the system when their applications are unsuccessful, and of not appreciating the fact that they have to be held accountable to the public for their decisions. They accuse opponents of GMOs of obstructing all applications on principle and reeling out the same stock arguments for each one, rather than raising legitimate concerns selectively.

The most contentious arguments revolve around applications for GM crops not previously grown in South Africa. The recent decision by the Executive Council to reject an application for GM potatoes was the subject of heated debate and, depending on one's standpoint, demonstrates either the excessive difficulties of winning approvals for new GM crops or the robustness of the regulatory system. It also illustrates the increasing importance of trade and economic considerations in the decisionmaking process. The *SpuntaG2* application, which was undoubtedly controversial, sought permission to grow potatoes modified with a gene to protect against the Potato Tuber moth, a pest that affects most areas of South Africa but is currently controlled fairly effectively by many farmers. The research project had been funded by USAID and developed by an international consortium led by the South African Agricultural Research Council. It had been moved to South Africa after the original host country, Egypt, pulled out following eight years of field trials. GM potatoes had already been rejected in the United States because of consumer unease. If approved, South Africa would have been the first country in the world to grow GM potatoes commercially. The application rang alarm bells within the potato industry, which feared jeopardizing its trade with countries taking an anti-GM stance. Angola and Zambia are the two main markets for South African potatoes and potato seeds. The former has no biosafety law while the latter has taken a strong public stance against GMOs. Suppliers also voiced their doubts. One of South Africa's leading supermarket chains said it would not stock GM potatoes, and the leading food processor in the country, McCain, said it too would refrain from using GM potatoes in any of its products. Opponents of the application claimed South Africans would be used as guinea pigs for an untested product that would risk African biodiversity and public health. Supporters said it offered a golden opportunity for South Africa to place itself at the forefront of cutting-edge scientific research.

The Executive Council rejected the application in July 2009, citing economic rather than safety concerns. It expressed doubt that *SpuntaG2* would help potato farmers, claiming that concerns over pest control were of secondary importance compared with other issues such as lack of water and seed availability. It also expressed "particular concern" about the potential impact of GM potatoes on the non-GM potato trade, noting that it would require an Identity Preservation System to separate them throughout the entire production and supply chain which is currently not in place.[24]

This episode indicates the hurdles that new biotech applications face in South Africa. The Executive Council is mandated to consider the socioeconomic implications of any application, and these can be interpreted as widely or narrowly as individual council members choose. Economic considerations weigh heavily on any decision to introduce new GMO products because South Africa's largest trading partner is the European Union, which takes a tough stance against GMOs. Although it is clear that there were legitimate concerns about *SpuntaG2,* scientists in South Africa worry that the rejection of this application sends a negative message to other researchers in the field of agricultural biotechnology. Experts currently working on drought-resistant maize or GM

24. Minutes of the meeting of the Executive Council under GMO Act, 1997, Pretoria, July 21, 2009.

sorghum cast an anxious glance at the Executive Council and wonder whether their expensive and time-consuming work will be in vain. Ultimately, the argument goes, scientists will decide to take their research elsewhere.

Away from the Executive Council, the other main flashpoint between the pro- and anti-GMO lobby is over changes to the labeling laws. The recently passed Consumer Protection Act, hailed as a great victory by opponents of GMOs, would force mandatory labeling of all GM products. The government claims that the cost of implementing such a policy would raise food prices by an average of 10 percent. Officials point out that in a country where many people struggle to put food on the table, the desire for affordable food far outweighs any concern over GMOs. Opponents of GMOs argue that this is a false argument and that any increased costs should be borne by the producer rather than the consumer. The government also claims that implementing such a law would be virtually impossible when so much of South Africa's produce is traded informally in markets. Without the necessary levels of public awareness about GMOs in place, there are also concerns that labeling a product with the words "Contains GMOs" may alarm people. In addition, officials point to the reality that trace elements of GMOs are present in every product and that setting a threshold level establishing the point at which a product becomes genetically modified is therefore an arbitrary exercise.

Role of Research Institutions and the Enabling Environment for Scientists

South Africa has an active scientific community engaged in biotechnology and a number of firms working on commercial applications. A 2006 audit produced by the Department of Science and Technology found that there were 78 home-grown biotech companies in South Africa involved in 1,500 products, more than half of them related to agriculture.[25] Official policy is supportive, and one of the main objectives of the government-funded Council for Scientific and Industrial Research (CSIR) is to help scientists commercially exploit their work. However, serious problems impede efforts to harness science and technology for the public good in South Africa. There is a lack of trained scientists, a shortage of equipment and laboratories, and little private funding available for research. In terms of public funding, the government currently invests 1 percent of its budget into research and development, and the Department of Science and Technology is pushing for that percentage to be doubled by 2018.

Many South African scientists complain that these capacity issues prevent them from exploiting the commercial opportunities presented by GMOs. Many find that their applications to the Executive Council are passed over in favor of those submitted by the large commercial companies like Monsanto and Syngenta, which are able to put more time and resources into their submissions. The council follows a policy of judging each application strictly on its merits, which leads to a natural bias towards the larger, foreign-owned biotech companies. Their greatest concern, however, is that the regulatory system in South Africa is too cumbersome, that it is contracting, and that, as a result, scientists are being discouraged from conducting research in South Africa.

25. Republic of South Africa, Department of Science and Technology, *National Biotechnology Audit 2007*: *Biotechnology Use and Development in South Africa,* Pretoria, 2007, http://www.dst.gov.za/publications-policies/strategies-reports/National%20Biotech%20Audit.

Regional Developments

South Africa's experience in dealing with GMOs would suggest that it has a natural leadership role to play in helping other countries in the region as they develop policies and regulations on biotechnology. This is not the case in practice. While in the past, other African countries sent delegations of government officials and farmers' groups on fact-finding missions to South Africa, these visits have dried up more recently. Many returned home with a negative view of GMOs following meetings with opponents of the technology. These forcefully argued messages were not countered by South African officials, who believed it was inconsistent with their role as public servants to champion a position on GMOs. As a result, there is a perception by experts in South Africa that other countries view their biotechnology policy as lax and skewed in favor of big business; a model to be avoided rather than followed.

Despite the relative inaction at an official level, South African experts believe other countries could learn from South Africa's experience. They stress the importance of putting in place a coherent system of laws and regulations to govern GMOs at the earliest possible opportunity. They also point to the importance of investing heavily in public information campaigns on biotechnology, so that misinformation does not creep into the public domain and gain traction.

There has been much talk in Africa about the need to harmonize GMO legislation on a continent-wide level. Anti-GMO campaigners in South Africa view these discussions with suspicion, suspecting a plot by the biotechnology industry to foist what they perceive as the lax regulatory system in South Africa on the rest of the continent. They view the AU's African Model Law on Safety in Biotechnology as the best framework for regional harmonization because it is adopts the precautionary principle. Scientists favor a more harmonized regional approach to GMOs as well, citing the absence of uniform regulations as an impediment to their work. However, they reject the AU model law as unworkable and unnecessarily stringent. The prevailing view is that integrated regulations on GMOs are unlikely, despite the efforts of the New Partnership for Africa's Development (NEPAD) and the more proactive regional economic communities such as the Common Market for Eastern and Southern Africa (COMESA). Many experts, both on the pro and anti-GM side, are skeptical about the idea that nations can establish national laws and then somehow work together to harmonize them. This, they argue, is a back-to-front approach.

The Way Forward

The trend lines suggest that South Africa will continue to expand production of the GM crops it already produces—maize, cotton, and soya. But introducing new varieties will prove difficult, given the tightening regulatory regime and the determined efforts of a small but vociferous group of opponents who remain focused on preventing new GM products reaching the market and promoting strict labeling requirements for those that do. Most important of all, persistent concerns that investing in new GM crop varieties will lead to lost trade with Europe mean that economic calculations will continue to cloud decisions about biotechnology.

Scientists in South Africa also face day-to-day impediments that hold back their research into GM crops. They point to funding shortages, regulatory hurdles, and a lack of political will as the largest barriers to biotech crop expansion. The low level of public knowledge about GMOs means there is no pressure to support the wider use of biotechnology as a possible tool to address food

insecurity and boost agricultural productivity. While South Africa led the way in introducing GM crops in Africa, there is little apparent political will to maintain a leadership role on the issue.

Having said all this, proponents of biotechnology in South Africa remain upbeat, confident that their argument will ultimately win the day. Scientists express a strong sense that Europe is standing on the wrong side of history and that when it finally drops its opposition to GMOs, the market will free up and their research into agricultural biotechnology will be given a decisive boost. The big question is how long this process will take.

The final point to be made is that the argument over GMOs in South Africa is one that must be fought at home without the advocacy of outsiders like the United States. Opponents of GMOs strike a chord with many South Africans when they use the debate to make a wider point about the intrusion of Western interests into the African way of life. American businesses, they argue, are trying to commoditize nature and deprive Africans of their freedom to farm in the traditional way. They use terms like "rampant capitalism" and "neocolonialism" to place the biotechnology issue within a wider debate about foreign interference. For this reason, it is important for the United States to realize that interventions in favor of GMOs are likely to be self-defeating. American proponents of biotechnology would be advised to sit back and allow the debate in South Africa to run its course.

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