Adoption of GM crops in Africa: why the seed sector matters

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The adoption of genetically modified (GM) crops in Africa has been slow and highly controversial. Most of Africa's 53 countries are at various stages of creating policy and regulatory frameworks that would allow GM crop research and commercialisation, but to date only four – Burkina Faso, Egypt, Sudan and South Africa – have fully commercialised GM crops, and five further countries – Cameroon, Kenya, Malawi, Nigeria and Uganda – are currently conducting field trials, the final step before full approval for commercialisation.[1] At the same time, however, there is growing public opposition to GM crops in Africa, best described as a fear of the unknown. For example, the import of GM foods is currently banned in Angola, Ethiopia, Kenya, Lesotho, Madagascar, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe.

To evaluate the potential of GM crops in Africa, most studies have focused on consumer acceptance and farmers' willingness to pay. The central premise of the current chapter is that decisions made by Africa's seed sector – including private seed companies, government agencies, research institutions and non-governmental organisations (NGOs) involved in the research, production, regulation and dissemination of seeds in Africa – is likely to determine if, when, where and how GM crops are commercialised. With a focus on Africa's

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seed sector, the current chapter summarises research findings on the following three interrelated questions:

1. How developed is the formal seed sector in Africa?
2. How does the level of seed sector development affect the adoption of GM crops?
3. What are the views of seed industry professionals on GM crops?

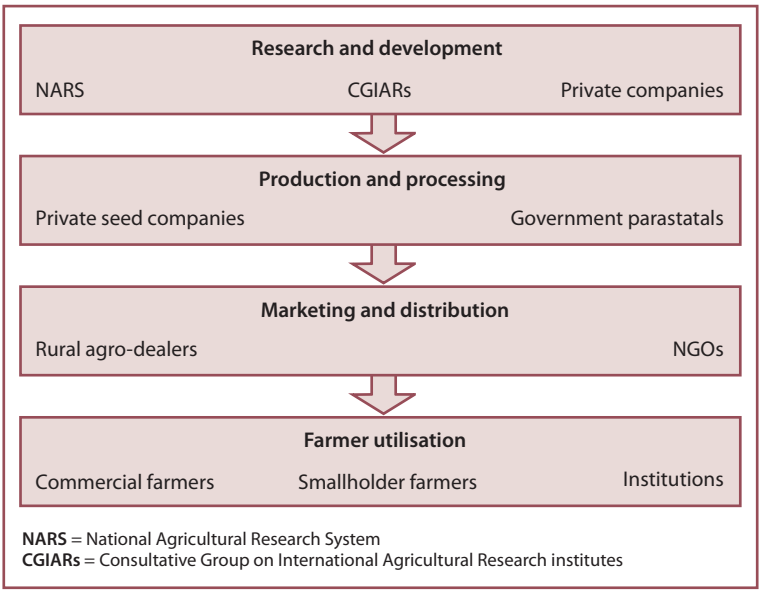
How developed is the formal seed sector in Africa?

Access to affordable, high-quality and locally adapted improved seed has long been recognised as critical to improving agricultural productivity among smallholder farmers in Africa. Yet seed systems in most African countries are still relatively underdeveloped, with improved seed accounting for approximately 20 per cent of planted seeds compared with a worldwide average of 65 per cent.[2,3,4]

A 2013 study on the status of seed systems development in Sub-Saharan Africa paints a complex picture of Africa's seed sector.[4] First, formal seed systems in Sub-Saharan Africa are highly fragmented (Figure 1). Africa's seed sector involves numerous players, sometimes with conflicting interests, operating in a loosely integrated value chain. Compared to other regions of the world where the seed sector is highly vertically integrated, the fragmented structure of the African seed sector slows the speed of technology diffusion, including of hybrid and GM crops. Adding to this complexity is the fact that the industry structure and its participants' conduct are ever-evolving to cope with the dynamic macro-

Access to high-quality, locally adapted, improved seed at affordable prices has long been recognised as critical to improving agricultural productivity

Figure 1. Fragmented structure of Africa's formal seed sector slows technology diffusion



environment, which includes changes in seed policy and regulations, climate change, donor initiatives and advocacy put forward by special interest groups.

Another key finding from the same study is that Sub-Saharan Africa's formal seed sector is at different phases of development and structural transformation in different countries.[4] This finding is a key departure from the common narrative that often paints the continent's seed sector with one broad brush. The five phases of seed sector development that characterise most African countries are:

Phase 1: Nascent. Many African countries are still in the nascent or embryonic stages of seed sector development, wherein key policy and institutional frameworks for a formal seed sector are absent. The little seed that is available is imported and used almost exclusively by commercial farmers or relief programmes. Countries in this category include Angola, Democratic Republic of the Congo, Liberia, Sierra Leone, Somalia and South Sudan.

Phase 2: Emerging. Countries with emerging seed sectors often have some breeding programmes and a formalised variety release process supported by a basic policy and regulatory framework. Seed production and distribution is conducted by a handful of seed companies and/or government parastatals (organisations having some political authority and serving the state indirectly). Adoption of improved seed in these countries is limited to innovating farmers. Countries with an emerging seed sector include Botswana, Côte d'Ivoire, Mali, Madagascar, Mozambique, Niger, Rwanda and Senegal.

Phase 3: Early growth. With breeding programmes well established and seed policies still evolving, these countries are in transition to early growth. Start-up seed companies begin to produce and sell a limited range of staple crops to early-adopting farmers. Countries in the early growth stage include Burkina Faso, Ethiopia, Ghana, Nigeria and Tanzania. Both governments and NGOs are still significant players, supported by a growing agro-dealer network.

The formal seed sectors in Sub-Saharan African countries are in different phases of development and structural transformation

Phase 4: Late growth. Spurred by private companies, countries in the late-growth stage have well-established

seed sectors supported by an enabling environment. In this stage, private-sector participation is highly competitive, often with multinational and domestic seed companies producing a wide array of high-quality seeds distributed through a strong agro-dealer network. Only a handful of East and Southern African countries are in this stage, namely Kenya, Malawi, Uganda, Zambia and Zimbabwe.

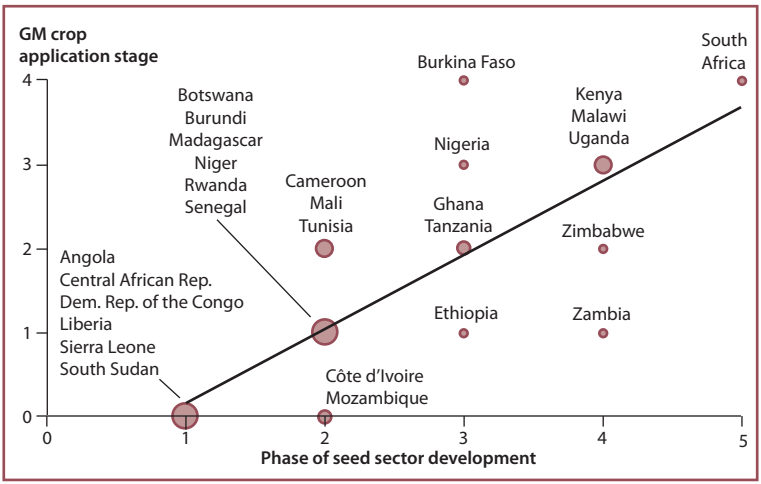
Phase 5: Mature. This final stage of seed sector development is characterised by a self-regulating and fully privatised seed sector that is on a par with that of developed countries. Most participating companies are vertically integrated, with in-house breeding programmes and a tightly managed distribution system. In Sub-Saharan Africa, only South Africa has reached the mature stage. However, it should be noted that South Africa's seed sector has evolved primarily to serve large-scale commercial farmers while the needs of smallholder farmers remain underserved.[5]

How does the level of seed sector development affect GM crop adoption?

Widespread adoption of GM crops requires a well-functioning formal seed sector to efficiently produce and market affordable seeds as well as train smallholder farmers on proper stewardship. This is necessary because GM crops fall within the same operating environment and regulatory frameworks as conventionally bred crops. A study on the factors influencing the adoption of GM crops in Africa identifies the following critical factors: ministerial control of biosafety, peer country influence, stage of seed sector development, advocacy by key political figures, the media, activism, food security and technical capacity.[6]

A vibrant and well-established seed sector can be a key driving force for GM adoption

Figure 2. African countries' seed sector stage compared to GM crop application stage



Mabaya *et al.* use the five-phase classification system discussed above to analyse the impact of seed sector development on GM application and policy presence.[6] For this research, the GM application stage for each country was classified as follows: (0) no activity; (1) developing capacity for research and development (R&D); (2) contained research; (3) contained field trials; and (4) commercial release.

As illustrated in Figure 2, there is a strong positive correlation between a country's progress towards adopting GM crops and the stage of seed sector development. None of the countries with nascent seed sectors have made any progress towards GM crop adoption. In contrast, countries with the most advanced sectors (phases 4 and 5) all have biotechnology policies in place.

Those in the early phases (2 and 3) have the highest rates of GM policy in draft form. It is evident from this trend that a vibrant and well-established seed sector can be a key driving force for GM adoption. The study concludes that adoption of improved seed varieties, as manifested in a country's stage of seed sector development, results in an increase in demand for productivity-enhancing technologies and thereby drives support for GM crops.[6] There are, however, a few exceptions to this pattern, such as Burkina Faso and Sudan, which have commercialised *Bt* (insect-resistant) cotton even though they have less developed seed sectors.

What do African seed sector representatives think of GM crops?

Another study by Mabaya and Fulton explored attitudes towards GM crops among the leaders of the continent's seed sector, including private seed companies, government agencies, research institutions and NGOs involved in the research, production, regulation and dissemination of seeds in Africa.[7] Based on an industry survey of more than 320 respondents across Africa conducted in 2012 and 2013, the Mabaya and Fulton study reveals a strong acceptance of biotechnology among seed sector experts across the continent. Table 1 shows the distribution of responses to some key statements on GM crops, with the most frequent responses highlighted in bold.

Unless and until the formal seed sector develops to a level that can deliver conventional hybrid seed to most smallholder farmers, the GM debate will remain just that

While participants in the survey generally had an informed and positive view about GM crops, there were some notable differences of opinion. Some of these were based on the home country's level of seed sector development and the stated

Table 1. Survey results

Statement	Reaction to statement, %				
	Strongly agree	Agree	Neither	Disagree	Strongly disagree
1. GM crops have the potential to improve Africans' food security	36.4	**44.5**	8.1	7.2	3.7
2. African governments should enact stricter regulations on GM crops	15.0	**37.7**	18.4	21.5	7.5
3. Products containing GM crop ingredients should be labelled as "Containing Genetically Engineered Ingredients"	38.3	**38.9**	10.3	7.8	4.7
4. I would buy food that I know contains GM crop ingredients	20.6	**46.6**	17.2	10.6	5.0
5. Smallholder farmers in Africa will benefit from planting GM crops	26.8	**41.4**	16.5	9.7	5.6
6. Food containing GM crops will cause harm to those who consume them	1.6	6.0	30.4	**37.9**	24.1
7. The potential benefits of GM crops outweigh the risks	21.5	**41.1**	26.9	8.5	1.9

knowledge of GM crops: the more developed a respondent's country's seed sector, the more beneficially GM crops were perceived. An undeveloped seed sector appears to limit the knowledge and awareness of GM crops and thus they are seen less as a tool to improve food security. In addition, those with a knowledge of GM crops were more positive about the technology. However, there was not much difference between the responses of those

who worked in the private sector and those from the public sector. Overall, those experts involved in the seed sector who were surveyed were strong proponents of GM technology. The support for modern biotechnology was even stronger for non-food crops such as *Bt* cotton and tobacco.

Conclusion

Africa has been slow in adopting GM crops. In most countries, both political debate and public opinion have been shaped by a fear of the unknown fuelled by social media. However, the potential of GM crops to improve food security on the African continent will depend, to a large extent, on the role of the seed sector. Unfortunately, the formal seed sector in most countries is in the very early phases of development. Farmers and policy makers need to appreciate the value of improved seed before they can appreciate GM crops. It is encouraging that seed sector professionals in Africa see the potential for GM crops to improve the continent's food security. In the right enabling environment, the seed sector can trigger a domino effect among other stakeholders in favour of GM crop commercialisation.

Lest we forget, GM crops can only get to farmers through the seed system. Unless and until the formal seed sector develops to a level that can deliver conventional hybrid seed to most smallholder farmers, the GM debate will remain just that. If GM crops become an essential tool for improving food security in Africa, the seed sector will be the vehicle that delivers the tool to smallholder farmers.

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