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Indian seeds in Africa

A scoping study of challenges and opportunities

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Preface

This work was carried out by a partnership of research organisations from India, the UK, Kenya and Ethiopia. The project was designed and led by Prof. Ian Scoones of the Institute of Development Studies (IDS, Brighton, UK). The project was devised by Prof. Scoones during a discussion with Dr. Sachin Chaturvedi, Director General of Research and Information System for Developing Countries (RIS, Delhi, India), and Dr. Daniel Bradley of the UK's Department for International Development field office in India (DFID-India, Delhi, India), which provided financial support. The African partners were members of the Future Agricultures Consortium (FAC), an international research alliance based in Africa. Field research was carried out in India by Dr. Amit Kumar of RIS. The research in Kenya was performed by Ms. Maureen Akwara under the supervision of Dr. Hannington Odame at the Centre for African Bio-Entrepreneurship (CABE, Nairobi, Kenya). The research in Ethiopia was carried out by Dr. Dawit Alemu of the Ethiopian Institute of Agricultural Research (EIAR, Addis Ababa, Ethiopia). The work was coordinated by Dr. Dominic Glover of IDS.

A draft version of this report was presented to stakeholders participating in a workshop in Hyderabad, India on 6 October 2015. Based on discussions and feedback during that event, the report was revised and updated for publication. It is intended that the preliminary findings and advice collated in this report will inform and guide policymakers and seed industry actors, principally in India, Africa and the UK, regarding the needs and opportunities for intervention, facilitation or investment to help develop a modern and functional seed sector in Africa.

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List of Acronyms

AATF	African Agricultural Technology Foundation
AFSTA	African Seed Trade Association
AGRA	Alliance for a Green Revolution in Africa
AU	African Union
CGIAR	Consultative Group on International Agricultural Research
CIMMYT	International Centre for Maize and Wheat Improvement (*Centro Internacional de Mejoramiento de Maíz y Trigo*)
COMESA	Common Market for Eastern and Southern Africa
EAGL	East African Growers Ltd.
EIAR	Ethiopian Institute of Agricultural Research (Addis Ababa, ET)
EKL	Elgon Kenya Ltd.
ESGA	Ethiopian Seed Growers' Association
GM	Genetically modified/transgenic; genetic modification
ICT	Information and communication technologies
IPR	Intellectual property rights
ISTA	International Seed Trade Association
KEPHIS	Kenya Plant Health Inspectorate Service
NARI	National agricultural research institute (public sector)
NEPAD	New Partnership for Africa's Development
NGO	non-governmental organisation
OECD	Organisation for Economic Cooperation and Development
R&D	Research and Development
UPOV	International Union for the Protection of New Varieties of Plants
USAID	US Agency for International Development
WTO	World Trade Organisation

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Executive summary

The international emergence of India's generic pharmaceuticals industry is seen as a success for international development and cooperation, bringing affordable drugs to populations not only in India itself but across the developing world, including in Africa. Could India's thriving seed sector play a similar role in delivering affordable, high-quality seeds to African farmers? India shares some of the diverse agro-ecologies and crops found in Africa, so it is plausible that technologies and methods used by Indian farmers might also be relevant to African situations. India's development story, as an emerging economy with millions of its own small-scale cultivators, might indeed provide relevant knowledge, expertise and investments to help develop the seed sector in Africa – and thereby to support economic development, food security and poverty alleviation in that continent. But what is the realistic nature and scope of this potential? India has a vibrant domestic seed market and seed companies with capacity for international expansion, but at present India is a relatively minor player in seed exports to Africa. In 2014 the country occupied only 14th place in the list of nations exporting seeds to Africa, with less than two percent of the trade. What barriers and obstacles might need to be addressed on both sides if India's potential contributions to seed sector development in Africa are to be realised in practice?

It is important to remember that the development of India's own seed industry, as well as India's Green Revolution, were largely directed and supported by public investments and policy frameworks. Even then, the benefits of India's agricultural transformation were not evenly or equitably distributed across the country or among socio-economic groups. If Africa is to enjoy an agricultural transformation that creates broad developmental benefits, then the public sector as well as civil society institutions will need to play crucial roles. It is therefore not only a question of what profit-seeking seed firms from India might accomplish in pursuit of their own commercial interests, but how improving access to modern agricultural technologies might create broad benefits for cultivators and consumers, and for rural and national development.

There will be different opportunities and strategies in different crop markets, regions and countries. The seed sector is not homogeneous but segmented for different crops and seed technologies that have different biological characteristics, and divided into informal as well as formal seed systems with different institutional frameworks and socio-economic functions. The needs, market opportunities, incentives and distributions of risks and benefits that may arise out of interventions in these diverse segments will differ. This makes it important to identify carefully where major problems and key opportunities lie; the potential contributions that might be made by different actors from public, private and informal sectors; and how benefits may be created for poor farmers as well as larger cultivators.

Africa's national and regional seed systems and markets also vary considerably, despite initiatives and proposals to harmonise seed sector policies and regulatory frameworks on regional and continental scales. For example, the seed sectors in Kenya and Ethiopia represent contrasting system types that offer quite different opportunities and challenges for Indian actors to support seed system development. In simple terms, Ethiopia represents a more state-controlled, tightly regulated seeds market whereas Kenya is more liberalised and commercialised. Other African nations have their own distinctive seed sectors. Consequently Indian public and private sector actors seeking to engage in these markets will need to consider distinct opportunities and challenges arising in different national systems and develop specific strategies to address them.

We discuss several different channels or mechanisms by which Indian genetic material, finance, technology and expertise might enter African seed systems. The most obvious is the direct or indirect export of seed from India to African countries. The principal crops and seed technologies flowing from India into Africa are vegetables, along with hybrids of vegetables and some field crops. Ordinary grain crops are less commonly traded because regulatory regimes for these 'food security crops' are generally stricter.

Another channel for Indian influence in the African seed sector is direct investments in African seed companies and seed production facilities, or in non-seed agricultural production. This strategy sometimes involves the acquisition or establishment of an African subsidiary, or the creation of a joint venture with an African firm, enabling the Indian firm to establish a 'domestic' presence within African countries. We document examples of several Indian direct investments in the agricultural sectors in Kenya and Ethiopia that have faced problems and difficulties establishing themselves, leading to soured relationships and reputational damage.

Other channels by which Indian seed sector stakeholders might help to develop African seed sectors include transfers of technology and technical expertise. India may be in a competitive position to offer useful technology to African farmers in the form of hybrids (e.g. of maize and cotton) and transgenic technologies (especially Bt cotton), with the potential for further expansion in the future. Technical expertise sometimes flows from India to Africa in the embodied form of individual managers and executives who carry their experience in India's seed industry into posts with African seed companies. This report documents several such examples. We also give examples of Indian firms that collaborate with regional seed sector development programmes and initiatives with partners from the public, private and philanthropic sectors.

Market forces and the entrepreneurial capacities of Indian seed firms will largely determine whether they are able to open up and exploit new markets in Africa. India's seed industry has an opportunity to expand its operations in Africa, but to do so it needs to raise its game, because it will need to compete hard in challenging markets against rivals from around the world. At present India is a relatively minor player in seed exports to Africa. In 2014 the country occupied only 14th place in the list of nations importing seeds to Africa, with less than two percent of the trade.

Indian seed firms may have particular strengths they could bring to African markets, including locally suitable genetic material and hybrids. India's seed firms are also accustomed to working in a market comprised to a large degree of millions of small-scale and resource-constrained farmers, which arguably positions them to develop similar opportunities in Africa. In East Africa, Indian companies can and do exploit cultural ties through the region's diaspora communities of Indian origin. Alongside these industry and cultural characteristics are the aspirations of the Indian government to play a larger role in bilateral, South—South relations of diplomacy, trade and technical cooperation. Ultimately, the major question for Indian as well as African stakeholders is whether they have the political and strategic will to engage with and learn from one another in horizontal and equal relationships of mutual respect from which both sides can benefit.

Introduction: Indian seeds and African farmers

Crop yields and farm productivity in Africa are generally low by international standards, despite encouraging signs of improvement in some areas (Chauvin et al. 2012; Scoones and Thompson 2011). These low levels of productivity are blamed, among other factors, on low adoption rates of modern farming technologies including better crop varieties. Experts agree that Africa's farmers need quality seeds and improved crop types, but Africa's share in the global seed trade is very low. The international trade in seeds was worth almost US$12bn in 2013[1], and the global commercial seed market is estimated at US$45bn, but in Africa the domestic market is not worth more than about US$20m. The supply of breeder seed is weak and improved crop varieties are introduced at a slow pace. African countries often lack the institutional capacity to support the growth of seed markets in the continent. Foreign expertise and investment could help to build capacity in crop breeding and other aspects of the seed sector, including management, logistics, marketing, and the integration of new technologies (CTA 2014; RIS 2014; Gisselquist et al. 2013).

As an emerging economy with millions of small-scale farmers, there are reasons to think India's experience in developing its own seed sector could indeed provide relevant knowledge, expertise and investments to help develop the seed sector in Africa. India shares some of the diverse agro-ecologies and crops found in Africa, so it is plausible that the technologies and methods used in India might also be relevant to African situations (RIS 2014). This document presents a preliminary analysis of this potential, based on a short scoping study. The study aimed to identify the key issues, opportunities and challenges arising in this area, with a view to understanding how public policy and private initiative might combine to make the most of India's established capacity in crop breeding, seed production, marketing and distribution. Our purpose is to offer guidance to the Government of India, African governments, seed sector organisations and aid donors on the potential to promote and support South—South cooperation and investment in this field. In particular, we addressed the following questions:

1. Is it possible for the Indian seed industry in collaboration with African actors to provide low-cost seed technology and marketing capacity for small-scale farmers that can reduce poverty through improved agricultural production at lower cost, by addressing certain financing, capacity and policy gaps/barriers?

2. What are the barriers and gaps that need to be addressed on both sides?

3. How can these barriers be addressed?

4. Does it make sense for aid donors and governments to invest resources to facilitate this engagement with the overarching goals of food security and poverty alleviation?

Provisional answers to these ambitious questions are offered in the final section of this report.

South—South diplomacy, trade and technical cooperation

Ties of diplomacy, trade and technical cooperation between India and Africa are becoming more intensive and significant. India is recognised alongside China, Brazil, South Africa and Russia as one of the world's rising major powers, while Africa is widely regarded as a frontier zone for economic development. China is often portrayed in the media as a huge rival to India in Africa as well as a role model in some respects, since China's trade with Africa is worth more than twice as much as India's, and Chinese investments are particularly visible in major infrastructure projects such as railway lines, roads and port facilities (Gupta 2015; Kokutse 2015; Naik 2014).

The Government of India is ambitious to develop its own capacity in bilateral aid and development cooperation across a broad range of areas, and is strengthening its relationships with key institutions such as the African Union (AU) and the New Partnership for Africa's Development (NEPAD), as well as individual

African governments. The expansion of relations between India and African countries is reflected in the growth of new platforms and frameworks for 'bilateral' relations, such as the triennial India—Africa Forum Summit meetings (inaugurated in 2008) and the annual India—Africa Business Conclave (launched in 2005). Also in 2005, India joined the African Capacity Building Foundation (ACBF, Harare, Zimbabwe) and accepted observer status in several African regional intergovernmental bodies (Saran, 2012).

The third India—Africa Forum Summit was convened in Delhi in late October 2015, an event that was heralded as India's largest diplomatic venture for three decades and trailed as a key foreign policy initiative by Prime Minister Narendra Modi. Delegations from more than 50 African countries travelled to Delhi to discuss a broad agenda that included climate change, terrorism and maritime security, telecommunications, oil and energy issues, pharmaceuticals, green technologies, education, and diplomatic cooperation in United Nations forums, as well as agricultural trade and cooperation. Officials connected to the Summit argued that Indian agribusiness companies could support African agricultural development through investments in farm mechanisation and technologies for harvest processing and storage, floriculture and horticulture businesses, contract farming operations, and production of crops for local export (within Africa), as well as training and personnel development (IANS 2015; Kokutse 2015; Siddiqui 2015).

One aspect of India's offer of assistance to Africa is in the fields of science, technology and innovation, including technologies for agricultural productivity growth, along with capacity building to support the development of the seed sector in Africa and to promote effective regulation of modern agricultural biotechnologies. For example, a programme was set up to support the development of cotton technologies in African cotton-producing countries, which provided training in biotechnology for African scientists (RIS 2014).

India's pharmaceuticals sector as a model for the seed sector?

Some policymakers wonder if the Indian seed industry – both public and private sectors – might follow the example of the country's pharmaceuticals companies by bringing affordable and high-quality seeds to poor farmers in Africa. Over the last three decades, India has developed a successful international pharmaceuticals industry that produces and exports affordable, high-quality generic (non-proprietary) drugs around the world. Famously, Indian generic drug production has played a vital role in supplying affordable, life-saving HIV/AIDS therapies to patients in the global South, including many in African countries. In the process, some Indian pharmaceutical companies have become recognised global players. Indian drug firms produce around 20–22 percent of the world's generic drugs and India is the fifth largest exporter of drugs and pharmaceuticals (Chidambaram 2013). India also has a thriving domestic seed industry that is bringing improved germplasm within reach of many Indian farmers. Are there lessons from the Indian success in pharmaceuticals that might be relevant to the seed sector as well?

The Indian seed sector: characteristics, strengths and capacities

India's commercial seed sector emerged in the 1950s, benefiting from substantial state support. The public sector was dominant in vital food crops, principally cereals, while the private sector was active in cash crops such as cotton and sunflower. Regulatory and policy reforms during the 1960s stimulated an expansion of private sector involvement in the seed industry. The 1960s also saw the arrival of high-yielding varieties (HYVs) of wheat and rice, as well as hybrid crops. Typically, breeding work on key grains was done by the public sector but the seeds were then made available for the private sector to multiply and market. In the late 1980s and early 1990s, the Indian economy was liberalised and changes in seed policy stimulated an explosion in the number of private seed firms; freer imports of new crop genetic material (especially vegetables and flowers); the arrival of competition and new capacity from multinational seed companies; and the establishment of in-house research and development (R&D) capacities within some Indian seed firms. Stimulated by these changes, the private sector's share in the formal seed market increased during the 1990s and 2000s, overtaking the public sector. The new private players concentrated on the production of crops that could be hybridised, such as sorghum, pearl millet, maize, cotton, rice and vegetables, while proprietary hybrids overtook publicly bred hybrids in the key markets of cereals and oilseeds. Uptake of rice hybrids is low at present but this is growing (Spielman et al. 2014; Manjunatha et al. 2013; Gadwal 2003; Pray et al. 2001).

India's seed industry received another fillip with the arrival of transgenic Bt cotton in the early 2000s. The new insect-resistant technology was introduced to India by the Indian seed firm Mahyco (Jalna, Maharashtra) in a strategic partnership with the US-based biotechnology transnational company Monsanto (St Louis, MO, USA). Bt cotton was officially approved for commercialisation in 2002 and within a few years the genetically modified trait had been licensed to dozens of cottonseed suppliers. The new technology proved to be a commercial hit and a source of handsome profits for private cottonseed producers, who crowded into the market. Official statistics indicate that more than 90 percent of Indian cotton farmers now plant Bt cotton hybrids, and in such a market there is little room for growth except by eating into rivals' market share (Spielman et al. 2014; Manjunatha et al. 2013; Murugkar et al. 2006; Gadwal 2003).

Driven by these trends, seed production in India increased by about four times between 1991 and 2011 and there was a steady increase in demand for bought

(rather than saved) seed. The formal seed sector in India was worth an estimated US$1.3—1.5 bn in 2008—09, making it the fifth largest seed market in the world, estimated to be growing at 12—13 percent per annum. Nonetheless, at present the formal seed market accounts for only about one quarter of the seed sector, with the remaining three quarters taken up by informal exchanges and saved seed (Spielman et al. 2014; Manjunatha et al. 2013; Gadwal 2003).

After Bt cotton there have been no technological changes of comparable size that would allow the cottonseed companies to maintain their rate of growth. One reason is that, so far, permission has not been granted for commercialisation of transgenic crops other than cotton. Only incremental enhancements of the original Bt cotton trait have been released onto the market. Consequently there are some Indian seed companies equipped with capacity and capital that are seeking new markets for expansion. At present India exports very small volumes of seed, but some Indian seed firms are looking to foreign markets, including emerging markets in Africa (Spielman et al. 2014).

Industry insiders and policymakers suggest that Indian seed firms may have particular strengths they could bring to African markets, including genetic material (e.g. hybrids of maize, cotton and other crops) and transgenic cotton (as and when this technology may be approved in individual African countries). Indian seed firms are also used to working in a market comprised to a large degree of millions of small-scale farmers, which arguably positions them to take advantage of similar opportunities in Africa. In short, a combination of push and pull factors seem to be aligned favourably to encourage the expansion of Indian seed companies into African markets. The capacity of some Indian seed firms and their search for new markets are push factors; the need for high quality and improved seed in African countries acts as a pull factor. Alongside these are the aspirations of the Government of India to play a bigger role in bilateral, South—South relations of diplomacy, trade and technical cooperation.

Methods and cases

To carry out this rapid, exploratory research we used simple methods, beginning with a non-systematic literature review that was followed by semi-structured interviews with seed companies and other seed industry stakeholders in India and two African countries – Kenya and Ethiopia.

The literature review was conducted at country levels in India, Kenya and Ethiopia and included a broad range of materials that shed light on the issues under investigation, including policy frameworks and initiatives, as well as programmes, projects and policy processes influencing agriculture and seed industry development within India and Africa, and relations between the two sides. We also searched for recent and current information relating to the structure, size, growth, evolution and strategic perspectives on agricultural questions and the seed industry in India and Africa. This material established the context for the issues to be examined in this research and helped us to identify key players, stakeholders and policy frameworks that needed to be taken into account.

In order to draw out the views and perspectives of relevant experts and stakeholders we convened a workshop in Hyderabad, India in October 2015. This workshop brought together representatives of the seed industry, government ministries, international development organisations and programmes, technical and regulatory agencies, policy analysts and others from both India (the majority) and Africa (a small delegation). The contributions and observations made by participants during this workshop were captured and used to extend and refine the analysis presented in this document.

Kenya and Ethiopia were selected for academic and practical reasons. First, these two countries are large and important countries in East Africa, which are known to exert significant power and influence regionally. Both Nairobi and Addis Ababa host important international organisations, for example United Nations bodies and African seed industry organisations (e.g. the African Seed Trade Association, AFSTA) in the former; and the headquarters of the AU in the latter. The headquarters or outposts of major international agricultural research institutes are located in both capitals. Ethiopia and Kenya are two countries where Indian investments in seed industry ventures were known to be under way, and also as regional powers with which the Government of India is known to be keen to develop closer bilateral relations. At the same time, Kenya and Ethiopia were known to represent contrasting examples in terms of systems of government, regulatory frameworks, the development and composition of their respective seed sectors, and other dimensions. These contrasts are discussed in more detail below and their implications can be perceived in various parts of this report.

Existing research collaborations also influenced the choice of focal countries. The Centre for African Bio-Entrepreneurship (CABE) in Nairobi and the Ethiopian Institute of Agricultural Research (EIAR) in Addis Ababa were brought into the project on the strength of well-established existing ties with the Institute of Development Studies (IDS, Brighton, UK) – serving as the coordinating hub for this project – through the Future Agricultures Consortium (FAC), a Department for International Development (DFID) [2]-funded platform for agricultural policy research in African countries.[3] By building on these existing research collaborations and relationships we were able to maximise our impact in a short and focused study, and tap into a body of expert knowledge and an established network of relationships on the ground. Nonetheless, while focusing on Kenya and Ethiopia we also drew on information relating to other African countries and regional dynamics, which come to the fore in parts of this report, for example the takeover

of a Zimbabwean cotton company by an Indian seed firm and our discussion of regional initiatives to spread agricultural technologies and develop the seed industry across Africa as a whole (see Appendix 1).

The Indian seed industry: Poised for international expansion?

Development of the Indian seed industry was supported by government action. In 1963 a parastatal National Seed Corporation was established with a mission to produce and distribute foundation and certified seeds. These were supplied directly to farmers but also to private seed companies, which multiplied improved seeds for sale through their own distribution channels. A regulatory and policy framework was created through the Seeds Act 1966, the Seed (Control) Order 1983, the New Policy on Seed Development 1988, the Protection of Plant Varieties and Farmers' Rights Act 2001, the National Seeds Policy 2002 and the National Food Security Mission (NFSM). These established a foundation to encourage the development, commerce and uptake of quality seeds within India and allowed a progressive opening of the Indian seed market and industry to private and foreign investment and technology, underpinning robust growth over several decades (Spielman et al. 2014; Manjunatha et al. 2013; Gadwal 2003; Pray et al. 2001).

Public policy towards India's seed industry has been framed with the explicit purpose of encouraging the development, import and widespread adoption of better crop technologies. During the 1960s India's Green Revolution brought improved crop types to India, including the iconic dwarf varieties of wheat and rice. The Green Revolution, which transformed India's grains deficit into a surplus, was accomplished with the help of substantial international aid and philanthropy, including investments and technology from the Rockefeller and Ford Foundations and public international agricultural research institutions, notably the International Centre for the Improvement of Maize and Wheat (CIMMYT) and the International Rice Research Institute (IRRI) (Cullather 2010; Perkins 1997). Today the public sector remains an important developer of new genetic material, especially for key cereal crops and oilseeds, but the private sector is now an important source of improved crop germplasm, including maize, cotton and rice hybrids and improved varieties of horticultural crops (Spielman et al. 2014; Manjunatha et al. 2013).

In the aftermath of India's liberalisation reforms of the late 1980s and early 1990s, the arrival of large numbers of new seed enterprises caused the seed industry concentration ratio to fall. Since that time, the Indian seed industry has not yet seen the consolidation and concentration that some analysts expected. The contemporary seed industry comprises hundreds of small seed companies that do little more than multiply seed for sale on local or regional markets, as well as a small number of small, medium and large national and regional seed companies with established brands, which have developed their own capacities in research and development (Spielman et al. 2014; Murugkar et al. 2006; Pray et al. 2001). These include Indo-American Hybrid Seeds (IAHS, Bengaluru), JK Seeds (Hyderabad), Mahyco, Namdhari Seeds (Bengaluru), Nath Seeds (Nath Bio-Genes) (Aurangabad), Nuziveedu Seeds (Hyderabad), Rasi Seeds (Coimbatore) and Vibha Seeds (Hyderabad). Some of these have ambitions to extend their sales into international markets (FAC 2014).

Seed systems in Africa: The need and opportunity

Agriculture, especially small-scale farming, remains crucial to the livelihoods and food security of millions of Africans. In recent years African and international experts, policymakers and political leaders have called for a 'Green Revolution for Africa' that should extend or replicate the perceived successes of Asia's Green Revolution onto the African continent. The model widely proposed to achieve this combines technical inputs (including seeds of improved crop varieties and hybrids) with a market orientation epitomised by the figure of the small-scale input dealer or the rural agribusiness entrepreneur. However, commercially oriented seed sector development typically prioritises certain types of crops and technologies (with a bias towards lucrative hybrids, for example). Public—private partnerships (PPPs) are often proposed as a vehicle for delivering agricultural development projects but they are not a panacea and there remains a critical role for public investment backed up by supportive policy frameworks in order to meet the needs of resource-constrained small-scale farmers (Scoones and Thompson 2011; Tansey 2011).

The formal seed sector in Africa accounts for less than two percent of the international seed trade by volume. Most of the African trade is confined to Southern Africa and to a narrow range of crops, principally hybrid maize in addition to small volumes of sunflower, cotton, soybeans, wheat and vegetables (Waithaka et al. 2011). The World Bank characterises Africa's food and agriculture markets as the 'last frontier' for the industry globally, a rapidly growing economic sector that still retains huge untapped potential. The Bank estimates that agriculture in sub-Saharan Africa (including upstream and downstream value chains or 'agribusiness') is the continent's largest economic sector, which is currently worth more than US$300bn per year and has the potential to grow to over one trillion dollars by 2030. According to the World Bank, an important slice of this potential stems from the low productivity of African agriculture compared to other regions of the world, and this may be attributed in part to the continent's low uptake of modern agricultural technologies including quality seeds, improved crop varieties and hybrids. Improved crop varieties were planted on only 27 percent of Africa's food crop area in 2000 (World Bank 2013).

According to the World Bank, the seed industry in Africa faces many obstacles and challenges:

> A recent survey of 89 registered seed companies in Eastern and Southern Africa identified a number of generic constraints, such as access to finance, poor infrastructure, weak extension, and a shortage of skilled technicians. Industry-specific constraints topped the list, however, including lack of access to germplasm, high startup costs, and outdated and rigid seed policies. (Ibid: 73)

Data about the access enjoyed by African farmers to improved seeds is scarce, but two initiatives are now working to improve this situation. The Access to Seeds Foundation (ASF) is compiling baseline information on small-scale farmers' access to seeds in Africa with a view to documenting the present situation, highlighting the performance of different seed companies and encouraging agribusiness to do more to serve smallholder seed markets. A preliminary report on the situation in East Africa has been published and the first Access to Seeds Index is promised in February 2016.[4] The African Seed Access Index (TASAI) is a similar initiative with a similar goal, which has concentrated on the production of country-level reports.[5] Briefings for Kenya and three other pilot countries have been produced, but none has been published for Ethiopia to date.

Policy analysts argue that improvements in African seed systems could reap large benefits in terms of increased production, better productivity and wider availability of affordable, nutritious food (e.g. RIS 2014; World Bank 2013). At present the commercial seed industry is underdeveloped in most parts of Africa, with the use of commercial seed being relatively more common in East and Southern Africa than in West and Central Africa, according to the Bank. In several African countries – including Ethiopia, as discussed in this report – the formal seed sector is still dominated by public sector enterprises and private investment is limited (World Bank 2013).

Regional agreements and frameworks are being established which aim to promote commerce and market development within Africa, including for seeds and other agricultural inputs. An example is the harmonisation of seed regulations under the auspices of the Common Market for East and South Africa (COMESA). The stated goal of this agreement was to enhance the diversity, quality and quantity of seeds available to farmers in the COMESA region while reducing transaction costs for the seed industry, thus expanding markets and attracting private investment. According to a recent analysis, the liberalisation and harmonisation of seed regulations in Eastern and Central Africa (ECA) have played a major role in increasing local seed production from around 43,000t in 2002 to about 122,000t in 2008. Over the same period, seed imports into the ECA region grew from around 9,000t to about 15,000t, while seed exports crept up from fewer than 1,000t to about 3,000t (Waithaka et al. 2011).

Reflecting the ambition to develop and strengthen Africa's agricultural sector, a number of continent-wide and regional programmes, projects and other initiatives have been created to help stimulate agricultural and agribusiness development in Africa (see Appendix 1 for some examples). The Programme for African Seed Systems (PASS) and Integrated Seed System Development (ISSD) are two initiatives to strengthen informal as well as formal seed systems, with the goal of increasing African farmers' access to and uptake of modern crop varieties and hybrids, as well as the other inputs that go with them (AGRA 2014; Louwaars and de Boef 2012). Crop hybrids are viewed by some experts as keys to stimulate agricultural productivity growth and attract investment to expand the emerging seed industry. The World Bank views hybrid maize as particularly effective in this regard, pointing to encouraging examples in Kenya, Zambia and Zimbabwe (World Bank 2013: 75).

Distinguishing seed types

National seed sectors in Africa are diverse and heterogeneous, and the international seeds trade is segmented into distinct systems for different crop types whose market characteristics, policy and regulatory frameworks, logistical systems and key players are distinct. These factors help to determine whether Indian or other seed companies perceive a commercial interest or opportunity in African seed markets, and how readily such opportunities might be exploited. One can distinguish the following broad categories of seeds (which are overlapping and not exhaustive):

- Cereals or grain crops, which generally have small seeds and a high planting rate, and are generally traded in bulk, resulting in a low value-to-weight ratio. These may be termed 'bulk' or 'commodity' crops and their seeds are typically traded in high volumes, yielding small profit margins. These crops may be food staples that are important to household and national food security (see below).

- Horticultural and ornamental crops (fruits, vegetables and flowers), herbs and spices, which generally have a significantly higher market value than bulk grains, and may have large or small seeds but typically a low planting rate, so these seeds are generally traded in relatively small volumes with a high value-to-weight ratio and generous profit margins. These crops may be of marginal importance to basic food security and may be defined as specialist, niche or cash crops (see below). Trade in the seeds of these crops may be subject to minimal regulatory oversight. Cultural and culinary preferences may create segmented markets for distinct vegetable varieties; for instance different shapes, sizes and colours of tomato and eggplant (brinjal,

aubergine) are sought by consumers in India, Eastern Africa and export markets in Europe.

- Subsistence crops that are designated as important for household and national food security. African examples include common staples such as sorghum, cassava and millets. These are typically of acute concern to poor producers and consumers, and of major strategic importance to governments. Seeds of these crops may have low commercial value to seed companies because the potential buyers are often poor, logistics costs may be high (to distribute large volumes of seed in small units to widely spread farming communities), retail prices are necessarily low and the overall market size is small in dollar terms. Crop improvement breeding for these crops is typically dominated by the public sector, and the supply of seeds of these food security crops tends to be tightly supervised and regulated by the state or parastatal bodies.

- Cash crops, which are grown for sale rather than consumption. This category might include grains (e.g. rice) on some farms or in some regions, but typically refers to food crops that are not vital for food security (e.g. vegetables, fruits), ornamentals, spices and fibres (notably cotton). Classically, cash crop production primarily concerns larger and commercially oriented farmers, including small-scale family farmers who have sufficient resources to meet their own families' food security requirements while also producing some crops for the market. State authorities are less likely to deem the seeds of crops in this category as requiring tight regulation. Supplying seeds in this category may be attractive to commercial seed companies because the growers are market oriented and have both the incentive and the financial capacity to purchase good quality seed, including improved cultivars. However, some crops are produced for (local) markets by poor and small-scale farmers, who might choose to sell some produce in case of financial need or if they happen to produce a surplus in a given season. For this purpose small-scale growers may cultivate 'dual purpose' crops that can be consumed, sold or stored, allowing for some flexibility in engaging with the market; however, they might not purchase improved seeds for this purpose.

- Hybrids are crop cultivars that have been improved using special breeding methods that involve crossing two parent plants of different varieties. The first generation of offspring (labelled F_1) combines characteristics of the two parents and often grows better than either parent, but the performance of subsequent generations declines sharply. Hybrids are now widespread in some major crop species, including maize and – especially in India but not commonly elsewhere – cotton. Hybrids are attractive to seed companies because they offer farmers a distinct performance advantage that can only be exploited for one generation, and this encourages farmers to purchase fresh seeds every season. Many African governments are keen to promote hybrid crops because of their performance advantages (especially higher yields); however, the hybrid seed trade may attract regulation to eliminate frauds such as fake hybrids or mislabelled seeds (known as spurious seeds). The superior performance of hybrid crops typically places increased demands on soil nutrients and water supplies, and requires additional investments in external inputs such as mineral fertilisers and crop protection chemicals. These costs may be beyond the capacity of poorer farmers, making hybrids inappropriate for them.

- Open pollinated varieties (OPVs) and vegetatively propagated crops are cultivars that can be freely multiplied and reproduced by farmers. The development and marketing of improved crops in this category is less attractive to seed firms because the seeds/planting material can be reproduced freely by farmers. In addition, planting material consisting of roots and tubers, which propagate vegetatively, may be bulky and heavy to transport and may be more prone to deterioration in transit than the seeds of many grains and vegetable crops. Cassava and sweet potato are examples of vegetatively propagated root crops that are also important staples for many rural households.

- Transgenic crops (often termed 'genetically modified' or GM) are crop cultivars that have been improved using advanced molecular breeding techniques. They incorporate genes taken from unrelated (or very distantly related) organisms in order to improve their performance or express particular traits, such as better resistance to viral disease or a higher tolerance of drought. At present the two most widely commercialised transgenic traits in crop plants worldwide are insect resistance and herbicide tolerance. Transgenic crops are attractive to seed companies because they can use legal mechanisms (such as patents and contracts) and market power to exercise a high degree of proprietary control, determining who may have access to the technology and on what terms. The sale of

transgenic seeds is a very lucrative business for the major transnational companies that dominate the sector. However, the cultivation and trade of transgenic crops is restricted by national and international regulations, and attracts considerable controversy and opposition. Among crops of interest to African farmers, transgenic types of maize and cotton are available in some countries. Transgenic, insect-resistant, hybrid cotton has been commercially available in India since 2002[6] and is now planted in Burkina Faso and Sudan as well. Transgenic, insect-resistant maize has been planted in South Africa since 1998 (yellow grain maize) and 2001 (white maize for human consumption). Some observers believe that transgenic cotton hybrids represent a key opportunity that could be exploited by Indian seed companies in emerging African markets. Indian seed firms also have capacity in the maize sector, including hybrids.

Distinguishing seed systems

Another important distinction is between formal and informal seed systems. Formal seed systems encompass public crop breeding and seed distribution systems as well as the activities of the commercial seed sector. It is in this arena where scientific crop improvement programmes operate, either with public funding and direction, within private seed firms, or through development partnerships between public and private (including philanthropic) actors. Historically, important advances in plant breeding have been accomplished in the public sector, and publicly developed germplasm was in the vanguard of the Green Revolution in India and other parts of Asia. In more recent times seed companies have become more prominent in crop improvement, particularly in commercially attractive hybrid crops and transgenic seed technologies.

Historically, improved seed developed within the formal sector has often failed to reach the poorest farmers and remote areas, for commercial and logistical reasons. In these areas, informal seed systems remain vitally important for agriculture, food security and rural livelihoods. The informal sector encompasses farmers' own practices of seed selection, seed saving and simple on-farm breeding, as well as community-level systems of seed sharing and (largely non-commercial) seed exchanges among farmers. Some analysts distinguish an intermediate or transitional third sector between formal and informal seed systems, where small local seed businesses operate on a commercial basis. Each country has its own particular mixture of formal, informal and intermediate seed systems. Seed sector policies and interventions need to appreciate the characteristics, roles and contributions of these systems in an integrated way (Scoones and Thompson 2011).[7]

This implies that the scope for Indian germplasm and expertise to support the development of African seed systems extends beyond the role of Indian commercial seed firms that want to exploit new market opportunities in African markets. The opportunity also exists for publicly developed germplasm, public sector expertise and official development assistance from India to support the development of the informal and intermediate seed sectors in African countries, for the benefit of resource-poor farmers and rural communities.

The seed sectors in Kenya and Ethiopia

The seed sectors in Kenya and Ethiopia represent contrasting cases that offer quite different opportunities and challenges for India to support seed system development. In simple terms, the difference can be summarised as follows. Ethiopia represents a more state-controlled, tightly regulated seed market whereas Kenya is more liberalised and commercialised. However, both countries have tighter regulations for food security crops than for vegetables and cash crops; both are gradually opening up to the international trade in seeds and agricultural products; and both have large communities of poor small-scale farmers. The state largely determines what private enterprise may do in Ethiopia, although this means that an unknown volume of entrepreneurial activity is driven underground. In Kenya there are networks of agricultural input dealers but they are distributed unevenly around the country, with concentrations in high-potential areas, and there are concerns that seed diversity is declining and that farmers in poor regions are being neglected (Alemu 2011; Odame and Muange 2010; Scoones and Thompson 2011).

Kenya

Agriculture contributes 24 percent of Kenya's gross domestic product (GDP) and indirectly underpins a further 27 percent of GDP from related sectors. Agriculture supports approximately 80 percent of the rural population, most of whom are small-scale farmers (GoK 2009). The development of Kenya's seed industry began in the early twentieth century with the creation of the Kenya Seed Company (KSC), which was established initially to produce seed for pasture but later diversified to produce other field crops (Sikinyi 2010). Today Kenya's seed sector is diversified and even small-scale farmers use seeds from the formal as well as the informal sectors. Both small private companies and multinational firms are important suppliers of seed for horticultural and cereal crops. About 70—80 percent of hybrid seeds produced in Kenya are maize, and hybrids are now planted by the majority of maize growers. However, an estimated 70—80 percent of all seeds used in Kenya are from the informal seed system, yet seed policy in the country is predominantly concerned with the 20—30 percent that come from the formal system (Sikinyi 2010; Ayieko and Tschirley 2006).

Kenya's seed industry has grown through a period of liberalisation and declining public investment in the seed system. Market liberalisation policies were introduced from the 1980s onwards, removing price controls on agricultural commodities, liberalising fertiliser imports, removing obstacles in marketing and distribution systems, and other steps to reduce government interventions and encourage private investments. A substantial private seed sector emerged which promotes modern agricultural technologies to small-scale farmers. Private operators prioritised horticultural seed, while the public sector continues to dominate in the cereal seed segment. Today about 27 Kenyan companies import horticultural seeds, with about half of these sourcing seeds from India. National agricultural research institutes (NARIs) and non-governmental organisations (NGOs) provide basic seeds of cereal crops to the private sector for multiplication and marketing; the exceptions are the multinational firms Pannar (South Africa), DuPont Pioneer (USA) and Monsanto (USA), which produce their own supplies. The effects of liberalisation were mixed; for example, there was a positive impact on maize yields and farm-gate prices, but macro-economic instability and a sinking exchange rate led to the country becoming a net importer of maize seed, while export markets declined a little (Odame and Muange 2010; Sikinyi 2010; Argwings-Kodhek and Jayne 1996; Nyangito and Okello 1998; GoK 1986).

Today, large multinational seed companies are prominent in Kenya's seed sector. They have been involved in donating technologies and contributing technical expertise to high-profile international projects to develop 'water efficient maize for Africa' (WEMA) and 'drought tolerant maize for Africa' (DTMA). The latter project involved transgenes donated by the private sector and, in line with this work, multinational agribusiness firms are also prominent in policy discussions to convince the Kenyan government to allow transgenic crop cultivation in Kenya.

More than 80 percent of agricultural R&D in Kenya is performed by public research institutes (i.e. NARIs) and universities. The rest is conducted by international agricultural research centres of the Consultative Group on International Agricultural Research (CGIAR), two prominent non-governmental organisations – the Alliance for a Green Revolution in Africa (AGRA) and the African Agricultural Technology Foundation (AATF) – and some private seed companies. According to our informants, Kenya's research institutes are increasingly sourcing seed technologies from India for research purposes. Most private sector organisations are only involved in seed multiplication using foundation seeds from public sector sources or by importing seeds from foreign seed companies, including Indian firms. Demand for high yielding seed technologies has motivated some Kenyan seed merchants to import vegetable seeds from India. Today, out of 78 seed companies in Kenya, 35 percent are supplying hybrid vegetable seeds of Indian origin. Another trend is that Kenyan seed merchants are sourcing seed from South Africa and China, exemplifying an increasing role for South—South cooperation (Ayieko and Tschirley 2006; Lenné et al. 2005). However, many new seed varieties are poorly disseminated, which some analysts blame for the domestic seed industry's slow growth rate and persistent poverty in the country (Nyoro and Ariga 2004).

Kenya is a signatory to various global and regional agreements and frameworks that govern the seed trade, such as the seed certification scheme of the Organisation for Economic Cooperation and Development (OECD); the International Seed Trade Association (ISTA); intellectual property rights (IPR) organisations such as the International Union for the Protection of New Varieties of Plants (UPOV), the World Intellectual Property Organisation (WIPO) and the World Trade Organisation (WTO); and AFSTA, an industry body whose mission is to promote the seed trade.

Kenya has a well-established regulatory framework governing the seed industry and trade in seeds. Seed enterprises must be registered by the Kenya Plant Health Inspectorate Service (KEPHIS) and have to comply with various operational standards and guidelines. In 2012, 89 organisations submitted applications to operate seeds businesses in Kenya, two thirds of them foreign breeders. Seed varieties have to be tested in performance or varietal trials and registered before they may be sold. Seed consignments are withdrawn from the market if they are found to be contaminated with diseases or otherwise fall short of internationally recognised standards.

Seed certification in Kenya is another responsibility of KEPHIS. Applications for certification of imported seeds may only be submitted by registered seed companies. Certification requirements depend on seed categories, which are grouped into four schedules. Crops under the first schedule may be imported relatively easily and are mostly vegetables. For this class, KEPHIS relies on declarations by the exporting companies and internationally recognised seed certificates. Second schedule crops are subject to compulsory certification and comprise crops that are considered vital for national food security, including all cereal crops as well as staples such as sweet potatoes. Planting material for these crops is subject to stringent testing before release as well as periodic retesting to check germination rates (every six months for vegetable seeds and annually for grain crops). The third and fourth schedules allow certification of seeds for use in breeding programmes and performance trials.

Seed produced within Kenya is subject to rules governing field inspections, seed processing, seed testing, labelling, sealing and post-certification surveillance. Seed lots are tested to ascertain purity and germination capacity. KEPHIS also conducts a post-certification survey throughout the country, taking and testing seed samples from agro-dealer distribution channels. Each year some locally produced seeds are rejected or withdrawn from the market because they fail to meet minimum requirements.

Ethiopia

The Ethiopian seed system is characterised by a dominant informal seed sector, making up about 90 percent of the system. The use of hybrid varieties is limited to maize. In the formal sector, private actors play a very limited role in terms of both scope and size, with the larger role played by public seed enterprises. The involvement of multinational seed companies is very limited (Alemu 2011).

Agricultural growth has been identified as a driver of economic development in Ethiopia, highlighted in strategic policy documents over the last two decades. The formal seed system in Ethiopia has played a critical role in boosting productivity. The overarching national development plan, the Growth and Transformation Plan (GTP) for 2010—2015, targeted a doubling of agricultural production over its implementation period, which ended in June 2015. This target was expected to be achieved mainly by increasing productivity through the application of improved agricultural technologies including improved seeds and associated agronomic practices. Official trend data indicates that agricultural growth in Ethiopia over the last few decades was achieved through both increased productivity and agricultural land expansion. Accordingly, the Government of Ethiopia has been investing in agricultural R&D while also enhancing private sector development.

The draft version of GTP II (2015–2020) indicates a target of a further doubling of agricultural production through considerable public investment in agricultural R&D and also strengthening capacity to adapt technologies introduced from abroad, plus considerable investment in small-, medium- and large-scale agricultural irrigation and additional emphasis on high-value agricultural commodities (vegetables, fruits, spices and industrial agricultural commodities).

There are four public seed enterprises: the Ethiopian Seed Enterprise (ESE), which is a federal entity, and three regional companies – Amhara Seed Enterprise (ASE), Oromia Seed Enterprise (OSE) and South Seed Enterprise (SSE). These public seed companies are concerned mainly with important food security crops, principally wheat and maize. There are about 30 private seed companies that are involved in hybrid maize seed production. Of these, two multinational seed companies have their own registered varieties but the remainder depend on public hybrid maize varieties.

Almost all of the vegetable seed marketed locally is imported. Many of the companies that market vegetable seed are merely trading companies without any agricultural background. They serve as agents of seed producers abroad. To be marketed locally, the variety has to be registered and these trading companies play a role in getting the varieties registered in the country. For vegetable imports, the variety type and phytosanitary certifications provided by the country of origin are recognised.

Both public and private seed companies produce seed on their own farms and also through contract farming, either with commercial farm enterprises or small-scale growers. Much of the foreign seed companies' business is based on the export of seeds of vegetables and hybrid cotton. There have been no applications to release hybrid varieties of cotton or rice.

Agricultural research in Ethiopia is primarily public. The recent achievements of agricultural research are attributable largely to a strategy of adapting agricultural technologies from elsewhere in the world. Strong collaborations between the NARIs and international agricultural research centres of the CGIAR have played a crucial role in this (Teklewold et al. 2012). The contributions of R&D by multinational companies are increasingly recognised by the Ethiopian government, especially their role in making available advanced crop technologies such as hybrids of vegetables and industrial crops like cotton.

Ethiopia has a well-developed regulatory framework that covers company licensing and registration; variety release and registration; seed certification; and seed distribution. Companies wishing to operate a seed business in Ethiopia are required to have suitably qualified personnel, necessary farm equipment and land and internal quality control systems. New varieties must be shown to be distinct, uniform and stable (DUS) and to perform better than existing ones in terms of yield and other parameters, such as disease resistance. Completely novel genetic material must be tested for two to three years, but varieties that have already been approved in other countries may be tested for just one year in Ethiopian conditions. The regulator has the discretion to release a variety that does not outperform existing varieties if it considers that the performance is acceptable and there is a shortage of released cultivars for that crop.

Regulatory regimes and policy frameworks

A conventional view holds that one of the most important obstacles to seed system development in Africa is the weight of bureaucracy and burdensome regulations. In the words of the World Bank:

> A top priority is to reform seed policies and regulations. Policy and regulatory barriers — including import restrictions and rigid, lengthy processes for releasing new varieties — are slowing the adoption of agricultural inputs. Priorities are to reform seed policies, ensure a level playing field for the private sector, and liberalize varietal release procedures. As emphasized time and again by investors, these reforms must be accompanied by policies to allow free exchange of varieties and seeds within a region to create markets of sufficient size. Despite general agreement on the value of such reforms, their implementation has been

> painfully slow. The vested interests of government agencies responsible for certifying, producing, and distributing improved varieties and seed are hard to overcome. (World Bank, 2013: xxiii)

For all these reasons, says the World Bank, it takes too long to get new seed to farmers – even after the new varieties have been approved for release (Ibid: 73). Not surprisingly, many seed companies echo these complaints. However, other stakeholders defend the regulatory frameworks, arguing that they are necessary and effective for protecting the interests of vulnerable farmers and national food security. Here we briefly consider some regulatory issues pertaining to seed imports and varietal releases in Kenya and Ethiopia, putting the issues into context and discussing some positive and negative dimensions of seed regulation.

In Kenya, seed industry analysts and stakeholders complain that over-regulation of the industry creates high transaction costs and non-tariff barriers to trade, particularly for Schedule 2 crops (food security grains and staples), which slow down the adoption of new technologies. They argue that regional harmonisation around less restrictive rules would give farmers greater access to improved crop varieties and encourage private investment in seed businesses (Waithaka et al. 2011). However, KEPHIS defends the testing procedures, arguing that they are justified by past experiences with poor quality seeds, including open-pollinated varieties (OPVs) supplied by European seed companies and seeds bearing certificates issued by the reputable ISTA. Officials insist that the regulations are necessary and proportional to protect farmers and the interest of national food security (Lenné et al. 2005; Mutuku Muendo and Tschirley 2004). Kenyan government policy appears to discourage seed imports; for example, new legislation in 2013 subjected seed imports to value added tax (VAT) of 16 percent for vegetable seeds and 25 percent for cereals. At the same time, however, Kenya's efforts to adopt international standards appear to pay off in that seed from Kenya may be traded easily throughout East Africa because the country complies with ISTA and OECD norms.

Kenyan regulators complained about problems coming from the Indian side. For example, the Indian authorities generally issue a single phytosanitary certificate for all seed lots exported to Kenyan importers, whereas the Kenyan authorities require a certificate for each consignment. According to KEPHIS, this creates bottlenecks in the import clearance process, adversely affecting shipments from India compared to other countries. During key informant interviews, KEPHIS staff also related that they had encountered problems with the quality of seeds coming from India, giving an example of some tomato seeds from India that were rejected due to a germination rate of less than 90 percent. Subsequent imports by the same company were subjected to compulsory tests.

Ethiopia imposes a number of regulations and procedures that control the supply and pricing of seed in Ethiopia. The import, wholesaling and retailing of seed may only be carried out by Ethiopian nationals, so foreign firms need to have an Ethiopian partner. Access to basic seeds is controlled; seed companies must apply for an allocation and the central Ministry of Agriculture and regional Bureaux of Agriculture distribute appropriations among the applicants. In cases of shortages, public seed enterprises receive priority. Private companies that wish to import basic seeds of approved varieties require an import permit, which in turn requires certification from the country of origin. This is the procedure followed for hybrid maize seeds by two multinational seed companies that are currently operational in the country. Importation of seeds for direct marketing also requires an official release and an import permit which is based on certification by the country of origin, plus local phytosanitary tests. Due to the high cost of this process, to date it has applied only to vegetable seeds.

Ethiopia also operates a system of price controls. The prices of seeds produced by public seed enterprises in Ethiopia is fixed by government, while the prices of seeds produced by private seed enterprises which use public basic seeds is set based on negotiation. Private seed companies that use their own basic seeds are required to report their prices to the Ministry of Agriculture. Once these several prices are known, an official price setting mechanism is used to determine the retail price at which the seeds will be sold to farmers in each location. These price controls do not apply to imported vegetable seeds, however, which nonetheless have to be marketed through licensed retailers.

During our research we learned about difficulties faced by two Indian firms getting approval for their genetic material to be released in Ethiopia. In one of these cases, Vibha Seed has evidently responded to delays and rising costs by withdrawing from the Ethiopian market (see case studies 3 and 4 in Appendix 3). A key challenge for Indian seed companies wishing to import seed to Ethiopia is the difficulty of repatriating revenue in the currency of the importing company (i.e. Indian rupees). This is a problem when the importing entity in Ethiopia is not in a position to pay the whole cost at the time of importation, and in practice importing companies often pay in local currency (Ethiopian birr) after they have sold the seed. Foreign seed firms in Ethiopia also grumbled about difficulties in getting land suitable for seed cultivation.

Advocates calling for the introduction of transgenic crop technologies to African countries argue that excessively stringent biosafety regulations are preventing the deployment of a safe and beneficial technology. For example, an ongoing delay in approving Bt cotton for commercial release is blamed by some stakeholders for preventing a revival of Kenya's depressed cotton production sector. The historical collapse of Kenya's cotton sector was caused principally by the liberalisation of international trade in cotton fibre and textiles rather than a lack of cotton production technologies; nevertheless, supporters of Bt cotton argue that the technology could make Kenyan cotton competitive again

by increasing yields and reducing production costs. But some analysts believe that the structural weakness of Kenya's agricultural extension system and difficulties in accessing financial services and input and output markets would make it quite difficult for Kenya's farmers to reap the potential benefits of Bt cotton. Commercialisation of the technology without these structures in place could create risks for poor cotton growers due to the likely higher cost of Bt cottonseed compared to conventional cottonseed.

Commercial developers of transgenic crop technologies are also keen for countries to adopt regulations that recognise and protect their claims of IPRs over genetically modified plant varieties. They argue that this gives them the confidence they need to release their transgenic varieties onto the market, otherwise they will have little incentive to bring their modern technologies to farmers in the countries concerned. Companies want governments to adopt the IPR rules of the WTO's trade-related intellectual property agreement (TRIPS) or the 1991 version of the UPOV treaty, which confer strong protection over plant varieties. Some analysts and campaigners argue that African countries should resist this pressure in order to protect their farmers' and breeders' freedom to exploit useful crop germplasm with more freedom.

Channels of influence: trade, investment, technology and know-how

In this section we discuss several different channels through which Indian material, resources and expertise might help to upgrade and improve African seed systems. We examine how seeds and other crop germplasm, investment, technology, technical expertise and knowledge already flow, or in the future might flow from India into the African seed sector.

While India's seed companies may be significant actors in this regard, and their strategies of export and investment may be of key importance, our focus extends beyond Indian companies to include African companies that are engaging with Indian seed and expertise, and various other actors that may contribute to or be implicated in the strengthening of India—Africa ties of trade, technical cooperation and development, such as technically skilled individuals, government agencies and investors.

Nonetheless, for obvious reasons seed companies are key players. We discuss particular strategies and channels by which Indian seeds and seed companies are entering Africa. Note that these strategies are not mutually exclusive and may be combined in different ways or pursued simultaneously as part of an integrated business strategy. We concentrate on examples from Kenya and Ethiopia but draw on examples from a few other countries whenever appropriate.

Examples from four companies are prominent in the following text, two from Kenya and two from Ethiopia. These are Elgon Kenya Ltd. (EKL), a Kenyan seed company that imports seed and hires staff from India; Safari Seeds, a Kenyan subsidiary of an Indian firm, which imports seed from India and other countries; Nirmal Seeds, an Indian firm from Pachora, Maharashtra that has commenced operations in Ethiopia; and Vibha Seeds Ethiopia PLC, the Ethiopian subsidiary of an Indian company, which has attempted to establish operations in Ethiopia but subsequently withdrew, complaining about problems getting key crop varieties approved. Brief descriptions of these companies' operations, strategies and experiences are provided in Appendix 4.

Channels and strategies

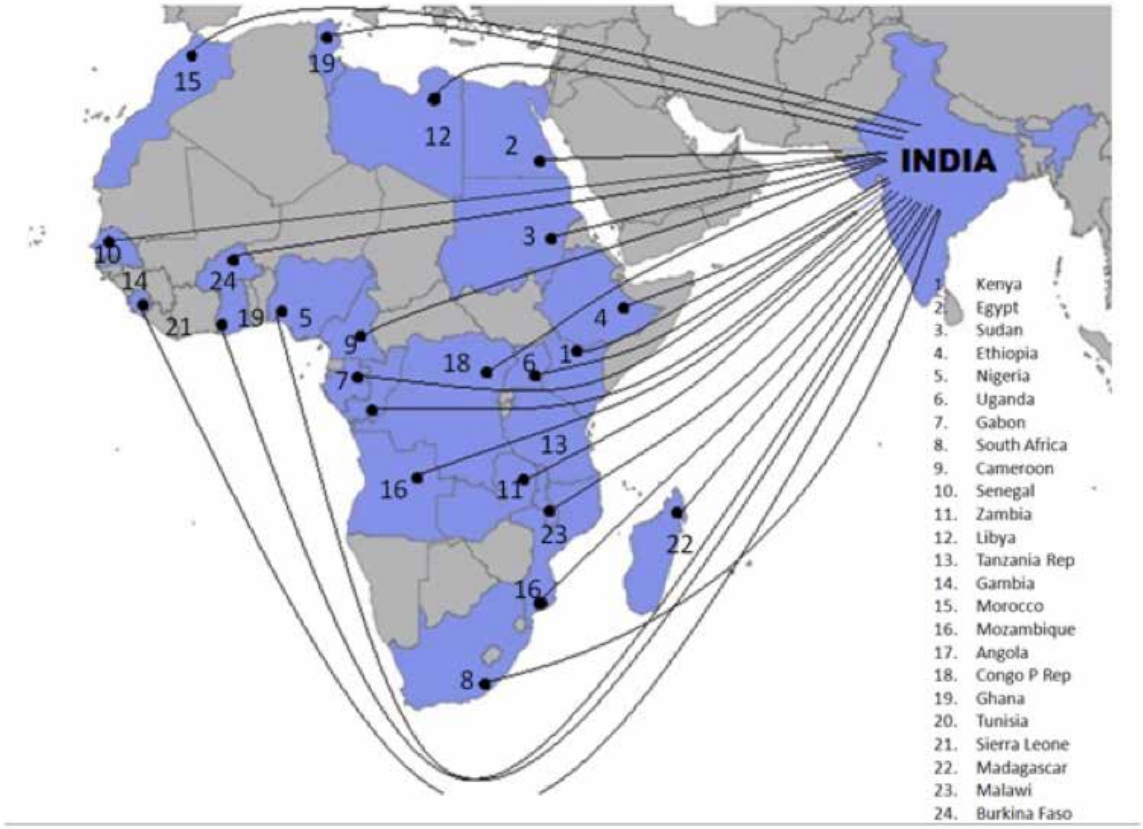
1. Export of seeds from India to Africa

In a sense the simplest and most obvious means by which Indian germplasm and expertise enter African seed systems is via the export of seeds from India to Africa. The principal crops and technologies flowing from India into Africa are vegetables, along with hybrids of vegetables and some field crops, while ordinary grain crops are less commonly traded because regulatory regimes for these crops are generally stricter. In 2014 India occupied only 14th place in the list of countries exporting seeds to Africa, with a 1.46 percent share of the trade.[8]

Data from India's Agricultural and Processed Food Products Export Development Authority (APEDA) indicate that seed is exported from India to 24 African countries, with Kenya occupying first place and Ethiopia fourth in the list (Figure 1). Fruit and vegetable seeds are most prominent in this trade. Within this total, Kenya was the destination for 57.12t of Indian fruit and vegetable seeds in 2013-14, while 15.25t were exported to Ethiopia (see Tables 1 and 2). However, though first in Africa, Kenya is only the tenth largest international importer of fruit and vegetable seeds from India in terms of value (US$1.72m in 2013/14). Ethiopia occupies only the 27th rank, with US$0.28m in 2013/14.

Though Kenya is India's largest export market for seed in the African continent, India's share of seed imports into Kenya is very small at only about one percent (Figure 2). India has a larger slice of the smaller Ethiopian import market at about 18 percent, in fourth place behind Ukraine, Romania and the USA (Figure 3). Beneath these headline figures, however, India's market share varies by crop. For example, India is the largest exporter of wheat seed to Ethiopia with a 59 percent share of that trade; by contrast, India exports negligible quantities of wheat seed to Kenya. With respect to vegetable seed, India is the third largest exporter to Kenya, with an 11 percent share,[9] and fifth largest (by volume) to Ethiopia (Table 3).

Figure 1: Seed exports from India to African countries



Source: Compiled by Amit Kumar using data from APEDA for the year 2015. Countries ranking indicates descending order of seed export intensity from India in terms of value.

Table 1: Export of fruits and vegetable seeds from India to Africa, region-wise, 2013/14

Region	Quantity (tonnes)	Value (million US$)
East Africa	87.28	2.19
North Africa	1046.44	1.32
West Africa	24.07	0.71
Central Africa	20.69	0.23
South African Customs Union	46.13	0.21
Other Southern African Countries	2.59	0.09

Source: APEDA Agri Exchange.

Table 2: Indian export of fruits and vegetables seeds to Africa: Top 10 countries						
Year	**2011/12**		**2012/13**		**2013/14**	
Country	**Qty**	**Value**	**Qty**	**Value**	**Qty**	**Value**
Kenya	101.65	1.29	86.74	1.34	57.12	1.72
Egypt	159.38	1.1	279.51	0.58	232.75	0.65
Sudan	8.09	0.06	2.76	0.04	796.85	0.59
Ethiopia	4.94	0.03	3.07	0.06	15.25	0.28
Nigeria	0.62	0.01	0.86	0.03	4.13	0.24
Uganda	19.14	0.19	9.04	0.16	20.61	0.22
Gabon	0	0	0	0	12	0.21
South Africa	162.74	0.29	91	0.25	46.13	0.21
Cameroon	0.19	0.02	1.1	0.11	1.82	0.13
Senegal	0.55	0.05	0.8	0.09	0.62	0.09

Source: APEDA Agri Exchange (2015). Note: Qty in tonnes, Value in US$ millions.

Figure 2: Kenya's imports of all seeds from top 10 countries, 2004-2013
Source: UN Comtrade

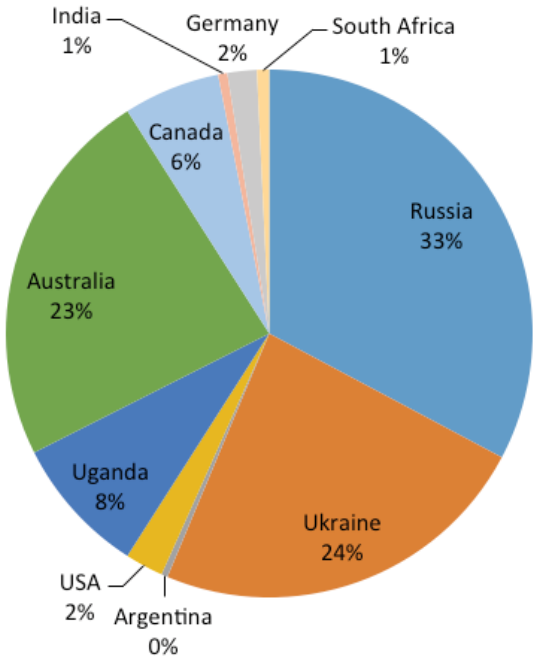


Figure 3: Ethiopia's imports of all seeds from top 10 countries, 2004-2014
Source: UN Comtrade

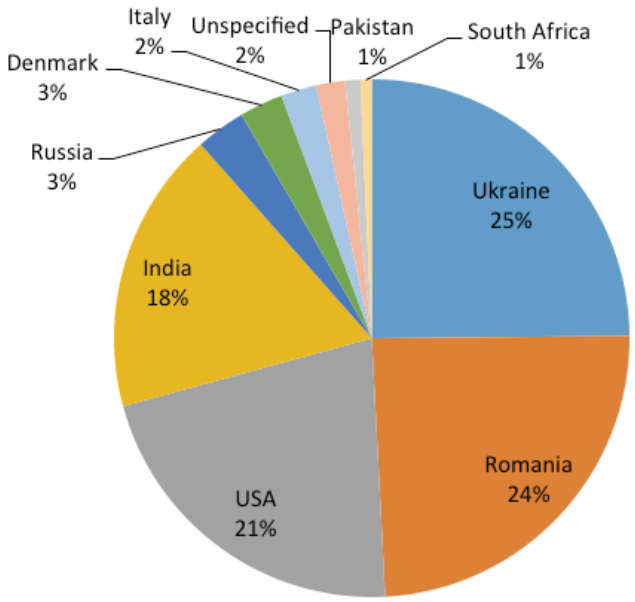


Table 3: Trends in vegetable seed imports into Ethiopia, by country (2012—2014)

Country of Consignment	2012		2013		2014	
	Amount (tonnes)	CIF Value (1,000 US$)	Amount (tonnes)	CIF Value (1,000 US$)	Amount (tonnes)	CIF Value (1,000 US$)
Netherlands	1,580.14	2,301.53	2,095.24	2,799.69	2,021.91	2,621.37
Italy	156.36	245.56	128.63	227.50	665.82	880.21
Germany	58.24	74.03	0.95	7.36	354.20	523.31
France	49.85	64.68	70.95	122.09	186.50	236.67
India	49.40	24.24	59.84	60.88	24.96	26.49
Israel	11.97	780.55	13.58	1,147.47	37.81	1,531.69
Zimbabwe	2.50	1.96	12.00	9.78	3.96	3.66
Kenya	0.14	14.44	0.27	14.43	9.24	177.09
Others	95.96	229.12	163.21	252.49	262.13	258.96
Total	2,004.58	3,736.11	2,544.67	4,641.69	3,566.52	6,259.44

Source: Ethiopian Revenues and Customs Authority, 2015. Note: 'Others' category – 2012: Belgium, Niger, Spain, Thailand; 2013: Australia, Belgium, China, Denmark, Jordan, Malaysia, Turkey, United States; 2014: China, Denmark, Iceland, New Zealand, South Africa, Thailand, UAE, Tanzania, United States.

Onion and gram seed exports from India are regulated and therefore we have good data on the volumes being exported to African countries; this data also includes foundation seeds of hybrid rice (see Appendix 2). The data indicates that 18 Indian seed companies applied for clearance to export onion or gram seeds to African countries between 2010 and 2014. The majority of these export licences were sought by East West Seeds India Ltd (Aurangabad), Safal Seeds, Mahyco and Nirmal Seeds. The seeds were exported to 12 African nations, with the great majority of shipments going to Kenya and Ethiopia. The total volume of annual shipments of seeds of these crops fluctuated over the period from a low of 87t (2011) to a high of 359.5t (2012). Sixty-eight out of 74 consignments were onion seeds with the remainder made up of red, green and black gram seeds. Two small shipments of foundation seeds of hybrid rice were sent to Mozambique by Nirmal Seeds. The majority of all shipments were 10t or less, with the largest single

shipment being 100t of onion seeds sent by a Delhi-based firm to Kenya.

Technologies entering the Kenyan seed sector from India include hybrids of various crops, greenhouses and germplasm sought by research institutions in the country. Hybrid maize is viewed as an expanding market in Africa and both it and hybrid cotton are seen as an area where India has competitive strengths. India has developed internationally significant expertise in hybrid cotton technology through more than 15 years of experience with transgenic Bt cotton hybrids. Transgenic cotton is only approved for cultivation in a few African nations but industry executives are hopeful that the technology will be adopted more widely in coming years, in which case Indian firms may be able to position themselves to take advantage. This might take the form of simple export of cottonseed from India but may involve more deeply engaged strategies, such as direct investments in seed production, marketing and distribution in Africa. Mahyco's purchase of the Zimbabwean seed company Quton is one manifestation of this preparatory positioning strategy (see below).

Some of the seed travelling from India to Africa moves indirectly via intermediaries in third countries, for example transnational companies that grow seed in India for sale in international markets, or via trading companies based in places such as Dubai, which source seed from Indian suppliers for sale in African countries. A representative from the Indian seed firm Sakata Seeds explained that his company sees three advantages in exporting seeds indirectly from India to Africa via the Middle East (West Asia), Europe or Australia. First, he argued that seed imports from these locations are subject to less stringent regulations than seed coming directly from India. Second, according to him African buyers have a more positive perception of seed coming from these places compared to seed coming from India. Third, for these reasons, Sakata can charge higher prices and make bigger profits when its seeds are perceived as coming from developed countries rather than India.

Seed trading companies may be of different types and capacities, ranging from non-specialist trading companies that lack substantial expertise in seeds or agricultural markets to more specialised distributors and marketers of seeds and other agricultural inputs. Naturally, seed imports to Africa may also be organised as spot contracts between Indian seed growers and African seed companies. Over time, or as part of a deliberate strategy, trading relationships between Indian seed producers and African seed companies might strengthen into a more substantial relationship; for example, most of the seeds exported by the Indian seed firm Advanta Ltd (Hyderabad) to East Africa are distributed through a partnership with just one company, EKL. A more pro-active strategy is for an Indian firm to create a local subsidiary to import seeds from India or other countries. In Kenya, the Indian seed firm Safal Seeds followed this strategy and created a local subsidiary, Safari Seeds, in partnership with a local drinking water enterprise. As a trading company, Safari Seeds does not grow seeds in Kenya but imports seeds from India and other countries (see case study 2 in Appendix 3). These relationships often depend on cultural ties formed within the Indian diaspora community in East Africa.

2. Indian investments in African seed production and agribusiness

Some Indian firms are making direct investments in seed production in African countries. This approach might involve registering as a seed company in the target country, establishing a subsidiary there, or forging a joint venture with an existing local firm. Another alternative is to acquire an existing local seed company. In November 2014 Mahyco acquired a majority stake in the Zimbabwean seed company Quton. Quton specialises in cotton and the apparent motive for this move is to secure a channel into African markets for Mahyco's cotton hybrids, and potentially for transgenic cotton containing Monsanto proprietary traits in future. Other Indian seed firms are reported to be contemplating similar moves, including JK Seeds, Kaveri Seeds and Nuziveedu Seeds. The acquisition route is considered to offer the advantages of a recognised local brand and local knowledge of regulations and policy frameworks.

The Ethiopian government is keen to attract foreign investment and has made it easier to receive an investment licence, which gives companies a right to apply for residence permits and bank loans. Nirmal Seeds and Vibha Seeds have established subsidiaries in Ethiopia with the intention of using their own genetic material to produce seeds in the country for both domestic and export markets, including India itself. However, both companies have struggled to secure regulatory approval for the release of key seed varieties, leading them to question their focus on the Ethiopian market (see case studies 3 and 4 in Appendix 3).

Another potential avenue for Indian investment is in non-seed agribusiness production in African countries. This industry has indirect implications for Indian seed exports, to the extent that Indian-owned and operated farms may be somewhat more likely to source their seeds from India, although this is not a necessary implication. The seed (variety) choice may depend more on the product characteristics demanded in the target market for the farm products than on the nationality of the farm ownership. For example, Indian, African and European consumers may favour different varieties of tomato and eggplant.

Some Indian companies have taken licences for non-seed agricultural production in Ethiopia. The Government of Ethiopia has identified priority areas for foreign direct investment, including edible oils, cotton, other agro-industrial commodities and agricultural commodities for export. Data from the Ethiopian Investment Agency indicates that 93 Indian investments in agricultural enterprises were licensed from 1995 to 2014. Of these, 28 were reported to be operational by the end of 2014, 19 starting up and the rest still in a pre-implementation phase (Table 4).

Table 4: The extent of agricultural investment of Indian origin (1995–2014)

Status of investment (end 2014)	Total no. of investments	Type of investment	Number of investments by type
Operation	28	Flower farming	16
		Cotton farming	3
		Oil seed farming/plantation	4
		Horticulture	4
		Coffee plantation	1
Implementation	19	Cotton farming	2
		Coffee plantation	2
		Flower farming	3
		Seed production	3
		Grain production (rice, wheat and soybeans)	5
		Livestock fattening, meat	1
		Palm oil plantation	2
		Tea plantation	1
Pre-implementation	46	Livestock production	3
		Grain production (cereals and pulses)	10
		Seed production	4
		Horticulture	6
		Coffee plantation	4
		Cotton farming	3
		Oil seed farming	4
		Flower farming	9
		Sugarcane plantation	3
Total			93

Source: Ethiopian Investment Agency, January 2015.

Karuturi Global Ltd, Shapoorji Pallonji & Co. and Ruchi Agrifresh Plc are three Indian firms reported to have established farming operations using leased land in Ethiopia. Karuturi is a prominent and somewhat controversial example among these. The company started operating two flower farms in Oromia Region in 2005. In 2007 Karuturi was granted three separate licences to set up, respectively, sugar cane cultivation and processing; oil palm plantation and processing; and cultivation of cereals, legumes, cotton, oilseeds and vegetables. The local subsidiary, Karuturi Agro Products PLC, was granted a lease on 300,000ha of land. This arrangement has been depicted controversially as an example of 'land grabbing' and has also been criticised because Karuturi lacks a strong track record in successfully executing investments of this kind outside India. By 2010 the company had still not started operations and the land allocation was reduced to 100,000ha. In mid-2015 its operations were still classified as 'pre-implementation', although it was reported that it had planted just 120ha with sesame and haricot beans. According to recent information, Karuturi is currently involved in bankruptcy negotiations and other legal disputes with the Commercial Bank of Ethiopia. The government is reported to be very unhappy with the outcome of the Karuturi deal and wants to reclaim the 100,000ha tract allocated to Karuturi; however, they are unable to intervene until these legal disputes have been resolved. Sources within the Agricultural Investment and Land Administration Agency indicated that if the case was not settled by December 2015 the Agency would take steps to transfer the land to another developer.

Karuturi has also operated flower farms in Kenya since 2008. In 2014 Karuturi lost control of its flower farm in Naivasha to creditors after reporting serious cashflow difficulties that led to unpaid bills and salaries, which triggered disputes with the workforce. Along with other multinational floriculture firms, Karuturi has been accused of evading taxes in Kenya. The company, which denies wrongdoing, is reported to have restructured its finances with a view to reclaiming its Kenyan operations (Michira 2015; Van den Houdt 2013; Lawrence 2011). Publicity surrounding the Karuturi cases has raised concerns in India about negative effects on the reputation of Indian companies and investors. Sources we spoke to in Ethiopia reported that experiences with this and other foreign agricultural investments have created great

mistrust among officials, which casts doubt on the future prospects for this strategy of seed sector development.

3. Flows of technology from India to Africa

We have already noted that the Indian public and private sectors may have relevant expertise in the development and commercialisation of modern crop production technologies that are sought in Africa, such as hybrids (especially maize but also cotton) and transgenics (particularly cotton). Of these, hybrid maize is seen by various African governments, policymakers and technical experts as a priority for African development and the regulatory hurdles are few. Consequently Indian companies seeking to bring in these technologies may find they are pushing at an open door.

Transgenic technologies are another matter. Bt cotton and Bt maize are the only transgenic crops currently approved for commercial planting in the African continent, but only in South Africa, Burkina Faso and Sudan. Several other African nations have been conducting confined field trials of transgenic crops without reaching the point of commercialisation. As we noted above, the Indian seed firm Mahyco, Monsanto's strategic partner and licensee of Monsanto's Bt cotton technologies in India, has acquired a majority stake in the Zimbabwean cottonseed company Quton. This deal has the apparent long-term goal of positioning Mahyco and Monsanto to bring transgenic cotton technologies to more African countries. One senior Monsanto executive expressed the view that Bt cotton is the vehicle through which India can make the biggest difference to Africa's seed systems.

Potentially India can also offer other agricultural technologies alongside seeds and varieties, such as affordable drip irrigation systems and small farm machinery. However, in these areas Indian technologies would face stiff competition from well-established international rivals, such as Israeli micro-irrigation. These technologies were not the primary focus of our study.

A different type of agribusiness technology that might be transferable between Indian and African contexts (in either direction) could be devices, software or services in the area of information and communications technologies (ICTs), such as mobile telephones and apps for smartphones and tablet computers that deliver financial services, logistics coordination, market information and so on. Businesses from India and various African countries have relevant expertise and technology in these areas, so lessons and business models might be exchanged between partners on either side, through commercial ventures or non-commercial channels.

4. Circulation of technical experts and their know-how

Another mechanism that can carry Indian technology and knowledge into African seed systems is the migration of individual skilled professionals from India to Africa. During the course of this exploratory research we encountered several examples of this type. Three individuals illustrate three different routes by which this mechanism of influence may operate. Mr. Senthil Kumaran is a long-term Indian expatriate who lived in Ethiopia and worked in agricultural businesses there for nearly two decades before bringing his family back to India. Mr. Manish Tyagi is a veteran of the Indian seed business who was head-hunted from India by the Kenyan company EKL to serve as a senior operations manager. Mr. Gyanendra Shukla is an Indian national and former managing director of Monsanto India who was transferred by his company in 2014 to assume the new role of managing director for Monsanto Africa, based in Nairobi. The influence of cultural ties (the Indian diaspora community in East Africa) can be seen here, especially in the former two cases. Mr. Shukla's case reflects the increasing internationalisation of the seeds industry and highlights Monsanto's belief that lessons may be transferred from its Indian business to its African operations.

Another potential channel of influence could be at the level of diplomatic negotiations and capacity building efforts. During our research interviews, some Indian seed industry and policy stakeholders expressed concern that India's foreign rivals were more active and successful than India in building trade relationships and shaping African regulatory and policy frameworks that suit their strategic interests.

5. Partnerships and collaborations

Another general route by which Indian seeds, technologies and expertise may flow into African seed systems is through partnerships and collaborations with local and regional initiatives for agricultural development and technology uptake. Alongside the contributions such companies might make to the philanthropic and developmental goals of these initiatives, the firms also benefit from gaining access to African markets and promoting their brands. Some examples of this type of engagement include the Indian seed firm Advanta's involvement in the Grow Africa initiative, while Nirmal Seeds, Ganga Kaveri Seeds (Hyderabad), Ankur Seeds (Nagpur), Rasi Seeds (Coimbatore) and Nuziveedu Seeds have joined Syngenta's Seeds2B project as a way to facilitate their access to African markets and permission for field trials of their genetic material in African countries. Rasi Seeds is test marketing seeds in some African countries through Syngenta's Seeds2B platform and is now confident of a huge market potential and market acceptance of its vegetable seeds.

As an illustration of a different type of partnership, the Indian seed companies Indo-American Hybrid Seeds, Nuziveedu Seeds, Safal Seeds & Biotech Ltd. and Vibha Seeds have agreed to collaborate with AFSTA to market their seeds. However, in Ethiopia we learned that at present no Indian firm has joined the Ethiopian Seed

Growers' Association (ESGA). The ESGA expects that Indian companies may join the Association as they become established in the country. The ESGA leadership is keen to explore possible collaborations with Indian seed companies and has sent representatives of eight Ethiopian seed companies to India from both the public and private sectors. Though the visit was considered useful and informative, no concrete agreement was made and some of the participants reflected that there had been a mismatch between the Indian seed companies, which were more interested in vegetable seeds, and the Ethiopian companies, which were interested in hybrid maize and cotton.

Some issues and challenges

Indian seed companies and public sector agencies face a number of issues and challenges if they seek to contribute to the upgrading and improvement of African seed systems.

Upgrading technology, infrastructure and R&D capacity

The seed industry is technically complex and demanding, requiring firms to purchase and/or import sophisticated machinery; set up complex logistics networks and warehouses; and acquire some capacity in local adaptation breeding, breeding for improved traits and production of hybrids. Seed companies in Africa are obliged to serve a distributed rural market and to be prepared to cope with peaks and troughs in demand that vary with the seasons. To manage all these operations, seed companies need to recruit or train skilled and qualified staff who can perform field trials and seed multiplication and manage seed processing operations, warehouses and distribution networks (World Bank 2013).

It is to help address technical challenges of this kind that African seed companies such as EKL and East African Seed Co. have recruited Indian nationals with seed industry expertise to work for their business. However, some problems are more structural. For example, our informants in Kenya complained that the country lacks storage facilities of sufficient size and quality to store seeds, which obliges seed companies to import multiple shipments of small quantities of seeds in order to be able to store them before distribution and sale. This increases transaction costs. According to EKL, the overall cost of seed production in Kenya is 25 percent higher than in India. The company attributes this uncompetitive cost of production partly to the limited availability of suitable land near to water bodies in Kenya and the cost of irrigation in other areas. To avoid these problems, the company has resorted to producing hybrid seeds in Zambia and importing them into Kenya. This could be a market opportunity for cost-competitive hybrid seed production in India. During our interviews in Kenya, some key informants suggested Indian seed companies should focus on technologies where they may have a competitive advantage, such as Bt cotton and hybrid maize.

Reputational issues

During our interviews, informants distinguished between reputable and competent Indian seed companies and a few irresponsible Indian firms. Some informants expressed frustration at the impression that companies of the latter type were somehow more prominent in Africa to date, while responsible Indian seed companies with capacity were slower to enter African markets. In both Kenya and Ethiopia we heard accounts of Indian firms having created poor impressions of Indian business competence and ethics (see the Karuturi case above and case study 2 in Appendix 3).

In Ethiopia some Indian farming operations were perceived to have performed poorly. The Ethiopian government has reviewed its policy of attracting foreign investment in the sugar sector. After having provided investment incentives including land, credit, infrastructure, etc. the government was disappointed by the performance of the foreign investors and decided to establish a publicly owned Sugar Corporation, which has now invested successfully and allowed the country to become a net exporter of sugar within a five-year period. This experience has resulted in strong scrutiny of the costs and benefits of potential foreign direct investments in agriculture, including seed production.

Stiff competition

Indian seed companies face stiff competition in African markets. For example, several multinational seed companies have already begun to engage in the Ethiopian seed industry including Syngenta, DuPont Pioneer, the Dutch company HZPC Holland, Bejo Seeds (USA) and the Israeli firm Hazera Genetics Ltd. These firms have been attracted by the commercial potential of Ethiopia's agricultural sector, tax incentives for investment, land provision and also cheap labour.

Cultural ties and diaspora networks

Indian companies may be able to exploit the advantage of cultural ties with the Indian diaspora community in East Africa. For example, some Kenyan seed companies owned by Kenyans of Indian descent have recruited experienced managers and executives from India to help develop and expand their seed production and marketing businesses in Kenya. We interviewed one such recruit who is now working for East African Seeds Limited in Nairobi. Having access to these diaspora networks can give access to relationships with different companies across the seed sector, through cross-ownerships etc. Bringing in expertise from the Indian seed business is not restricted to local firms, however. As discussed above,

the US-based transnational agribusiness firm, Monsanto, has appointed an Indian national, the former managing director of Monsanto India, to be the regional lead for Monsanto in Africa, also based in Nairobi.

Cultural differences can also create problems. For example, few Indian nationals speak French, which creates an obstacle to seed firms wishing to operate in francophone African countries. Consumers in India and African countries also sometimes have preferences for different varieties of the same crops, for example types of tomato (plum, cherry, etc.), or for different crops, for example classic 'Asian vegetables' such as okra, which have only a small market in Africa.

Sharing Indian experience, learning from African experience

During our project workshop in Hyderabad, one Indian company executive observed that the learning to be gained from engaging with Africa should not be regarded as a one-way street, and that Africa might learn from studying India's mistakes as well as its successes. He noted that India's Green Revolution has been remarkably successful in increasing production of major crops, yet the country is also suffering the effects of depleted and salinated soils, declining water tables and contaminated groundwater due to excessive irrigation and over-use of fertiliser. Whereas African farmers may use too little fertiliser for efficient production, in parts of India the farmers certainly use too much fertiliser to be ecologically and economically sustainable.

Summary findings and recommendations for next steps

Looking ahead, we address some key questions. We present here our summary findings on each of these points with some suggestions about steps for follow-up action.

1. *Is it possible for the Indian seed industry in collaboration with African actors to provide low-cost seed technology and marketing capacity for small-scale farmers that can reduce poverty through improved agricultural production at lower cost, by addressing certain financing, capacity and policy gaps/barriers?*

Market forces and the entrepreneurial capacities of Indian seed firms will largely determine whether they are able to open up and exploit new markets in Africa. India's seed industry has an opportunity to expand its operations in Africa, but to do so it needs to raise its game, because it will need to compete hard in challenging markets against rivals from around the world. A key issue is that Africa's seed markets are highly segmented between different crops and technologies, distinct agro-ecological regions and cropping zones, fragmented national and regional markets, and so on. In this regard, an important division is between high value/low volume seeds businesses (vegetables and spices, for example), where most profits are to be found, and other seed markets, including for various cash crops such as cotton as well as cereals, where premium prices are rarer and competition from local players is more intense. At present, regulatory issues around transgenic crops constrain the expansion of these potentially lucrative niche markets.

African farmers stand to gain a lot from an expanded and diversified supply of high-quality improved crop seeds, which a strengthened and competitive formal seed system could provide. However, a disaggregated assessment is required in order to define how benefits of such a seed system will be distributed. Some seed markets, including many hybrid crops, are geared to well-resourced elite farmers, who can pay premium prices. These crops cannot be linked to a 'pro-poor' agenda even though they contribute to growth of the agricultural sector as a whole. The profits to be made from non-hybrid varieties of food or cash crops, which have a wide but much poorer market base, are less attractive for Indian seed companies. Our data confirms that Indian seed companies are prioritising higher-value markets for vegetable seed and hybrid maize, and positioning themselves to exploit potential new opportunities in hybrid cotton and transgenics. This is despite the availability of germplasm and marketing expertise in India that could enable Indian firms to bring better crop varieties to resource-poor African farmers.

Our research, however, has looked at only the very early stages of market expansion by Indian players into Africa. In time, Indian germplasm and expertise could certainly play a useful role here and in some niches there may be Indian companies or varieties that can offer something distinct, with a competitive edge. A key challenge for the industry will be to identify these niches, understand them and work out how to exploit them. This will require an investment in careful and painstaking research as well as efforts to build mutual understanding and relationships of trust and confidence with African businesses and other stakeholders. Indian firms have no reason to expect other organisations to do their research or build their new business relationships for them.

In our research, we identified several mechanisms and channels of transfer and exchange between Indian seed companies and the African market. These involve direct exports, indirect exports via intermediaries in third countries, creating satellite companies, forming joint ventures, and establishing local operations in Africa, either for seed cultivation or growing crops for sale on African domestic or export markets. Each of these has pros and cons. To some extent these may be interpreted as different stages in the engagement between Indian and African agriculture, in which the lowest cost and least risky arrangements involve direct or indirect exports with minimal engagement of Indian businesses in Africa. This is a common, early stage linkage, but in the longer

term ambitious Indian companies may want or need to forge closer ties. This will require stronger commitments and bigger investments on several levels, including legal and regulatory arrangements, adaptive breeding, market research, marketing and extension, and others. Joint ventures based on trust and mutual benefits take time and effort to build and we see this as an important route for India–Africa exchanges into the future, through which a broader portfolio of products can be offered that are tailored to local markets, combining African and Indian expertise and ownership. In this way, India's engagement in African agriculture can help to upgrade the capacity of local seeds systems, producing widespread benefits.

If Indian seeds, seed technologies and know-how are to help upgrade and improve African seed systems, a particular challenge is to support the numerous small-scale and resource-poor African farmers who could benefit from new seed technologies and better-functioning seed systems. As we discussed at the beginning of this report, theoretically India has relevant technologies and expertise to help serve seed markets at the 'bottom of the pyramid' and to help improve the operation of informal seed systems in Africa. The challenge is whether Indian support could help to reduce the price and improve the distribution and accessibility of good quality and improved seed.

Some seed sector executives argue that governments – whether in India or Africa – should encourage investment in African seed markets, for example by underwriting market risks and by working towards the regional harmonisation of seed laws, which would multiply the size of potential 'bottom of the pyramid' markets and make them more economically attractive to serve. Another area where public investment or policy might be necessary is to meet the needs of poor farmers or to encourage private sector involvement where there are market failures. For example, the public sector probably needs to take the lead in the supply of improved and climate resilient varieties of crops that are important for food security and subsistence, although the private sector may have much to offer as a distributor and even as a breeder of improved varieties of these seeds.

To support the functioning of informal seed systems, alternative approaches are likely to be suitable. To target these systems, Indian and African governments and seed firms might work with NGOs and public—private partnerships. For example, Farm Africa is an NGO that focuses specifically on agricultural improvement in five East African nations and might be an effective partner for Indian organisations from the public or private sectors.

Of course, India is not the only player that could contribute in these areas. To offer something distinct, Indian firms will have to compete hard against their international rivals, while the Government of India will need to target its diplomatic, policy and development initiatives towards their country's particular strengths, in order to offer something distinctive.

2. What are the barriers and gaps that need to be addressed on both sides?

Seed companies complain that the process for getting new crop genetics tested and approved is too slow, costly and uncertain. Also, while seed markets are defined by agro-ecology and span multiple countries across regions in Africa, most regulatory systems are national. Seed companies call for regional harmonisation and standardisation. Moves in this direction have been under way in various forums over an extended period but are unfolding quite slowly. Because of these issues, according to the seed industry, crop varieties that have been successful in similar agro-ecologies elsewhere are denied to farmers in Africa who might want or benefit from them. The seed companies call for a smooth, rapid, streamlined, clear and transparent clearance system for seed importation, funded by modest fees to cover necessary costs. This requires regulatory systems that have sufficient technical capacity, independence and integrity to carry out honest and competent trials. Seed companies and regulators in African nations and India alike could benefit from greater knowledge and understanding of one another's operations, practices and procedures, and there is scope for international cooperation to streamline steps in the import—export process, such as certification and the obtaining of import clearances.

Crop field trial outcomes are inherently variable due to the uncertainties of weather, pests and diseases. The performance of any crop variety, even a good one, might be positively or negatively affected by the specific conditions of the production season in which it is tested and this may lead, for instance, to a good variety being denied clearance. This problem can be mitigated in several ways, for example by comparing the variety under test with a suitable check variety grown under the same conditions; by running trials in several locations reflecting different growing conditions (which is commonly done); and running the trials in a manner so as to avoid inadvertent damage or infection to the crop. Long experience from India in the conduct of field crop trials across multiple locations may be usefully exchanged with African NARIs, towards the development of a regional approach to crop trials.

Countries including Kenya and Ethiopia commonly distinguish between crops that are judged to be particularly vital for food security, typically grains and some other staples such as sweet potato, for which stringent regulations are considered essential, and other crops for which a more permissive regime is appropriate, such as vegetables. Poor and marginal farmers in Africa are intrinsically vulnerable to spurious seeds, mislabelling and other types of fraud. For these farmers a softening of stringent seed testing rules for staple crops would increase risks and therefore would be imprudent and irresponsible. However, other safeguards can also provide some measure of protection, such as the brand name of reputable and legally accountable seed firms, effective compensation schemes and technical support to help farmers when things go wrong. An effective regulatory

system should encompass all these aspects and require public agencies and private companies to cooperate in transparent and accountable ways.

Other kinds of challenges include building mutual understanding, trust and confidence between actors in the seed system. This is especially important for new entrants from abroad, including India. Trust can only be built when actors on both sides engage one another and build ongoing relationships. To facilitate this, Indian seed firms need to invest in learning about African markets, while African seed system stakeholders should also invest effort in learning about the strengths of the Indian seed business and what it may have to offer to African farmers.

The cultural hurdles are not uniformly high, however. For example, in some East African countries there are cultural ties and diaspora connections of culture and language (including cuisine and food traditions) which could be made to work to the advantage of Indian players compared to their foreign rivals. On the other hand, French is not widely spoken in India, which represents an obstacle for Indian seed firms aspiring to operate in francophone Africa.

3. *How can these barriers be addressed? And 4. Does it make sense for aid donors and governments to invest resources to facilitate this engagement with the overarching goals of food security and poverty alleviation?*

Based on our scoping studies, which were limited to two countries in Africa and interviews with only a subset of Indian seed industry stakeholders, we recommend a multi-stage process to enhance engagement. This can usefully be facilitated by third parties, which might work closely with other programmes and platforms such as NEPAD's Comprehensive Africa Agriculture Development Programme (CAADP) and the AU, as well as Regional Economic Communities in Africa. Attempts at public–private sector brokerage have been implemented before through such organisations as AATF, AGRA and the Syngenta Foundation, which we have discussed in this report. However, some stakeholders may regard these actors as too closely associated with particular commercial or national (mostly US) interests to be perceived as credible in the role of independent broker, and therefore we consider African inter-governmental organisations as potentially better platforms for governments and aid donors to engage with.

A possible way forward for policy research would be to explore and evaluate regulatory barriers from a social perspective. This would encompass regulation in its widest sense, including sanitary and phytosanitary clearance; varietal and performance trials; seed certification; corporate registration rules; taxation and customs arrangements; and biosafety. These components of regulation are regarded by most stakeholders as key issues, but they have different perspectives on them. The concern of governments should be to mobilise seed system investments not only for economic growth but also for widespread social benefits. In other words, to augment technical and economic analyses of regulatory obstacles and burdens, a broader social analysis (including of the goals and benefits of regulation) is required.

Such an assessment should have a 'development' lens that systematically assesses the costs, benefits and risks of seed system regulations for different groups of people. This should be combined with an analysis of environmental issues (e.g. a shift to inorganic fertiliser, biodiversity impacts, etc.), as well as a wider appraisal of the consequences of such changes for the 'seed system' (e.g. the balance in supply of hybrid and open pollinated varieties, and the consequences of shifts in crop choices between food and cash crops, and so on). The particular issues for different crop types, and for different types of India–Africa relationships (from direct import to joint ventures, for example) need to be assessed and evaluated across national and regional scales within Africa. This should be connected to ongoing negotiations relating to regional harmonisation of seed laws, which is already happening to some extent but is often narrowly focused on particular aspects of regulation, such as biosafety.

Typically recommendations call for liberalising, harmonising, simplifying and integrating regulation. Sometimes this call is quite radical; for example, some policy analysts argue that private firms should be permitted to introduce new technologies without government approval as long as there are no major problems or externalities, allowing market forces to operate and determine the success or failure of commercial products (Gisselquist et al. 2013). But while such moves might benefit some desirable Indian companies, they could also open up opportunities for others, including less reputable Indian operators as well as rivals from China, Europe, the USA and elsewhere. This might have knock-on effects for local seed industry operators in Africa, who are probably the best placed to understand and serve local needs. Therefore a wider 'market system' appraisal is desirable, which should be nationally and regionally focused.

A political feasibility analysis could address the underlying political economy issues that have been highlighted in this report. Some 'ideal type' seed regulatory systems have been designed for Africa over many years, though none has been realised, not because of failures in technical design but because of political realities. Political incentives to cede sovereignty over regulation in favour of harmonised or regional approaches or common standards may be higher or lower, depending on different political calculations. Therefore this should be an important part of any assessment, which would require a comparative national and regional political economy analysis.

Finally, African and Indian governments, companies, industry and professional bodies could create and organise opportunities for exchanges and engagements between stakeholders on both sides. This might take the

form of professional training programmes, workshops, site visits, exchanges, professional placements and other spaces and arenas for professional training, mutual learning, relationship-building and so on. Both sides stand to gain from this two-way engagement, which could improve cultural understanding, forge new partnerships and build a foundation for long-term cooperation.

APPENDICES

Appendix 1: Organisations, programmes and initiatives aiming to develop agriculture in Africa

The African Agricultural Technology Foundation (AATF) is a not-for-profit organisation supported by public, private and philanthropic funders, which facilitates and promotes public–private partnerships to enable access and delivery of appropriate agricultural technologies for sustainable use by smallholder farmers in sub-Saharan Africa. It is based in Kenya.

The Alliance for Green Revolution in Africa (AGRA) is an organisation with a mission to help millions of African small-scale farmers and their families lift themselves out of poverty and hunger. It receives funding from numerous public and philanthropic sources. The Program for Africa's Seed Systems (PASS) is an AGRA programme, which works to improve the availability and variety of high-yielding crop varieties. AGRA is based in Kenya.

The African Seed and Biotechnology Programme (ASBP) was established by the AU in 2007 with a mission to promote the development of the seed sector in Africa. The ASBP is being driven by an implementing agency, AfricaSeeds.

The One Acre Fund offers a bundle of farming inputs and services to small-scale farmers in Kenya, Rwanda, Burundi and Tanzania. It was founded in 2006 and is based in Kenya.

The Grow Africa Partnership ('Grow Africa') was established in 2011 by the African Union, NEPAD (see below) and the World Economic Forum as a 'partnership platform' to attract and facilitate investments in African agriculture.

The African Seed Trade Association (AFSTA) is an industry body whose mission is to promote trade in quality seed and other agricultural technologies for the benefit of its members. It is based in Kenya.

The Comprehensive Africa Agriculture Development Programme (CAADP) is an intergovernmental 'policy framework for agricultural transformation, wealth creation, food security and nutrition, economic growth and prosperity for all'. It was established in 2003, under the aegis of the AU, as 'an integral part of the New Partnership for Africa's Development'.[10]

Feed the Future is a global programme of the US Agency for International Development (USAID) that has regional programmes in East, West and Southern Africa as well as individual African states. Feed the Future has a number of focal areas that are linked with seed, including inclusive agricultural growth, encouraging private sector engagement in agribusiness, and improved nutrition.

The India—Africa Seed Bridge is an initiative supported by the USAID Feed the Future Programme and run by the Syngenta Foundation for Sustainable Agriculture, supported by the National Seed Association of India (NSAI) and Indian advisors, in collaboration with prominent African agricultural organisations such as the AATF and AFSTA. The Seed Bridge aims to carry out performance trials on Indian planting material in African conditions and then have the seeds approved for commercial release on a regional rather than national scale, under a harmonisation agreement brokered by the West African economic community, ECOWAS.

Seeds2B is a project of the Syngenta Foundation for Sustainable Agriculture, a philanthropic organisation linked to the transnational agribusiness company, Syngenta. Seeds2B was established as a way to promote the role of the private sector as a channel for delivering quality seed and financial services, such as credit and insurance, to small-scale farmers. Seeds2B also seeks to influence seed sector policies and regulations to facilitate private sector engagement in these markets.

Integrated Seed System Development (ISSD) is a project that aims to support the development of a 'pluralistic' and 'market-oriented' seed sector in Africa, involving both public and private actors and encompassing both formal and informal seed systems. The project's goal is to increase access for both men and women to high-quality, improved and locally valued germplasm.

Appendix 2: Applications for export of onion, gram and hybrid rice foundation seeds to African countries submitted by Indian companies (2010-2014).

#	Year	Seed type	Quantity (MT)	Indian exporting company	African importing country
1	2014	Onion	5	Durga Seed Farm (Chandigarh)	Ethiopia
2	2014	Onion	50	Samar Agro Overseas (Amravati)	Kenya
3	2014	Onion	12	Safal Seeds & Biotech (Jalna)	Kenya
4	2014	Onion	10	Safal Seeds & Biotech (Jalna)	Kenya
5	2014	Red gram	10	Nirmal Seeds (Jalgaon)	Ethiopia
6	2014	Green gram	10	Nirmal Seeds (Jalgaon)	Ethiopia
7	2014	Black gram	10	Nirmal Seeds (Jalgaon)	Ethiopia
8	2014	Onion	5	Mahyco	Kenya
9	2014	Onion	12.5	Jindal Crop Sciences (Jalna)	Kenya
10	2014 (proposal)	Red gram	10	Nirmal Seeds (Jalgaon)	Ethiopia
11	2014 (proposal)	Green gram	10	Nirmal Seeds (Jalgaon)	Ethiopia
12	2014 (proposal)	Black gram	10	Nirmal Seeds (Jalgaon)	Ethiopia
13	2013	Onion	2.5	Mahyco	Kenya
14	2013	Onion	18	Crystal Crop Sciences (Delhi)	Kenya
15	2013	Onion	6	East West Seeds India (Aurangabad)	Sudan
16	2013	Onion	6	East West Seeds India (Aurangabad)	Senegal
17	2013	Onion	6	East West Seeds India (Aurangabad)	Kenya
18	2013	Onion	10	Karanja Hybrid Seeds (Hyderabad)	Kenya
19	2013	Onion	0.1	Indo-American Hybrid Seeds (Bangalore)	Kenya
20	2013	Onion	2.5	Mahyco	Kenya
21	2013	Onion	0.1	Karanja Hybrid Seeds (Hyderabad)	Kenya
22	2013	Hybrid rice (foundation seed)	12	Nirmal Seeds (Jalgaon)	Mozambique
23	2013	Onion	25	Safal Seeds & Biotech (Jalna)	Kenya
24	2013	Onion	1.5	East West Seeds India (Aurangabad)	Senegal
25	2013	Onion	1	East West Seeds India (Aurangabad)	Benin
26	2013	Onion	1	East West Seeds India (Aurangabad)	Ghana
27	2013	Onion	2	East West Seeds India (Aurangabad)	Sierra Leone
28	2013	Onion	2	East West Seeds India (Aurangabad)	Mali
29	2013	Onion	2	East West Seeds India (Aurangabad)	Burkina Faso
30	2013	Onion	19	Malav Seeds (Ratlam)	Kenya
31	2013	Onion	3	Mahyco	Kenya
32	2013	Hybrid rice (foundation seed)	12	Nirmal Seeds (Jalgaon)	Mozambique

33	2012	Onion	10	Mahyco	Kenya
34	2012	Onion	1	Krishidhan Vegetable Seeds (Pune)	Kenya
35	2012	Onion	20	Durga Seed Farm (Chandigarh)	Ethiopia
36	2012	Onion	8	Biocarve Seeds (Patiala)	Ethiopia
37	2012	Onion	11	Jindal Crop Sciences (Jalna)	Kenya
38	2012	Onion	7	East West Seeds India (Aurangabad)	Kenya
39	2012	Onion	5	East West Seeds India (Aurangabad)	Sudan
40	2012	Onion	5	East West Seeds India (Aurangabad)	Senegal
41	2012	Onion	2	East West Seeds India (Aurangabad)	Mali
42	2012	Onion	2	East West Seeds India (Aurangabad)	Burkina Faso
43	2012	Onion	6	East West Seeds India (Aurangabad)	Kenya
44	2012	Onion	9	East West Seeds India (Aurangabad)	Sudan
45	2012	Onion	6	East West Seeds India (Aurangabad)	Senegal
46	2012	Onion	3	East West Seeds India (Aurangabad)	Mali
47	2012	Onion	6	Nuziveedu Seeds (Secunderabad)	Kenya
48	2012	Onion	3	East West Seeds India (Aurangabad)	Senegal
49	2012	Onion	37	Safal Seeds & Biotech (Jalna)	Kenya
50	2012	Onion	100	Proline Overseas (Delhi)	Kenya
51	2012	Onion	5	Durga Seed Farm (Chandigarh)	Kenya
52	2012	Onion	37	Safal Seeds & Biotech (Jalna)	Kenya
53	2012	Onion	10	Rasar Agrotech (Secunderabad)	Kenya
54	2012	Onion	5	Rasar Agrotech (Secunderabad)	Ethiopia
55	2012	Onion	10	Nuziveedu Seeds (Secunderabad)	Kenya
56	2012	Onion	15	Global Seeds (Delhi)	South Africa
57	2012	Onion	10	Rasar Agrotech (Secunderabad)	Kenya
58	2012	Onion	0.5	Rasar Agrotech (Secunderabad)	Ethiopia
59	2012	Onion	10	Mahyco	Kenya
60	2012	Onion	16	Safal Seeds & Biotech (Jalna)	Kenya
61	2011	Onion	14	Malav Seeds (Ratlam)	Kenya
62	2011	Onion	20	Advanced Biogenetics International (Indore)	Kenya
63	2011	Onion	3	East West Seeds India (Aurangabad)	Senegal
64	2011	Onion	15	Safal Seeds & Biotech (Jalna)	Kenya
65	2011	Onion	10	Biocarve Seeds (Patiala)	Ethiopia
66	2011	Onion	25	Mahyco	Kenya
67	2010	Onion	27	Malav Seeds (Ratlam)	Kenya
68	2010	Onion	2	Mahyco	Kenya
69	2010	Onion	3	East West Seeds India (Aurangabad)	Sudan
70	2010	Onion	2	East West Seeds India (Aurangabad)	Mali
71	2010	Onion	2	East West Seeds India (Aurangabad)	Burkina Faso
72	2010	Onion	22	Safal Seeds & Biotech (Jalna)	Kenya
73	2010	Onion	5	Safal Seeds & Biotech (Jalna)	Uganda
74	2010	Onion	27	Malav Seeds (Ratlam)	Kenya
75	2010	Onion	14	Safal Seeds & Biotech (Jalna)	Kenya
76	2010	Onion	4	East West Seeds India (Aurangabad)	South Africa

Source: *EXIM Committee Reports 2010-2014*

Appendix 3: Case studies

Case study 1. Elgon Kenya Ltd. – A Kenyan company using Indian seeds

Elgon Kenya Ltd. (EKL) is an agribusiness company owned by Kenyan citizens of Indian origin. The firm started life in 1980 as an agro-chemicals company and only entered the seed industry in 2012. EKL now deals in hybrid seeds of vegetable and cereal crops. The company has operations in Kenya (head office), Uganda, Tanzania, Ethiopia and Zambia. In order to engage in the seeds sector, EKL recruited an experienced manager from India and at the time of our interviews the company had nine departments headed by Indian managers while the seed division included nine experts recruited from India. EKL imports all its vegetable seeds in bulk from India and repackages them for retail sale in Kenya. The company cooperates directly with Indian seed companies to get new varieties registered in the Kenya National Plant Catalogue. Indian firms currently supplying EKL with seeds include Advanta, Kaveri Seeds (Hyderabad), Rasi Seeds, Namdhari and IAHS. EKL sells Indian seeds of okra, onion, coriander, tomato, broccoli, spinach, watermelon and cauliflower. Advanta and IAHS have recently tested ten varieties with EKL, three of which have been released by the National Variety Release Committee (NVRC). EKL sources its cereal germplasm from NARIs, especially the Kenya Agricultural and Livestock Research Organisation (KALRO), public universities and international agricultural research centres (e.g. CIMMYT).

Alongside its strictly commercial operations, EKL is working with the Government of Kenya, public extension services and various NGOs to promote modern agricultural technologies to small-scale farmers, including Syngenta's Seeds2B project, the AATF through the WEMA project, the One Acre Fund and AGRA. The company continues to offer agro-chemicals and now offers input credits as well.

EKL exemplifies a number of the strategies discussed in the main body of this report, for example:

- *Direct imports.* EKL is currently procuring watermelon, coriander, tomato and cabbage seed from Namdharia Seeds in India.
- *Informal linkages via diaspora communities*. The owners of EKL are Kenyans of Indian descent and have hired Indian experts to establish the company's seeds business in Kenya.
- *Partnerships with Indian firms.* EKL has invited Indian seed firms to collaborate, for example by using EKL's status as a Kenyan company to register Indian varieties for release in Kenya. For example, Advanta and EKL have worked together to release new onion and tomato varieties for the Kenyan market.
- *Supplying Indian seed to other African firms.* EKL collaborates with other local companies (also led by Kenyan Indians) to jointly source Indian germplasm through bulk imports for local retail distribution. For example, EKL is importing Indian seed and supplying it to Wilham Kenya Ltd., a subsidiary of East African Growers Limited (EAGL). This relationship also demonstrates the kinship ties mentioned above.

As a Kenyan firm, EKL also illustrates strategies from which Indian seed companies might learn. For example, EKL promotes its seed varieties – including those sourced from India – by working with government extension agencies and development schemes. The company has also forged relationships with African and regional initiatives such as Grow Africa, the One Acre Fund and AGRA (see Appendix 1). EKL also promotes contract seed production with local seed growers to expand local seed production capacity.

Case study 2. Safari Seeds Ltd. – Kenyan subsidiary of an Indian firm

Safari Seeds Ltd. is a subsidiary of Safal Seeds & Biotech Ltd. of Jalna, Maharashtra, India. Safari Seeds started operations in Kenya about seven years ago (2008). It was incorporated by an existing firm, Alpine Coolers, which packages and distributes drinking water and is owned by a Kenyan of Indian descent. Another Kenyan Indian citizen was recruited from the Kenyan company East African Seed Co. Ltd. (EASEED) to run the new business. Safari Seeds has operations in several African countries including Uganda, Tanzania, Burundi and South Sudan, with its head office in Nairobi, Kenya.

Safari Seeds imports and markets seed from India and other countries. In the past three years the company has reduced its business with Indian seed companies and placed more orders with Chinese seed growers. According to our informant, this is because Chinese seed companies are offering lower seed prices and better technical support and customer service. For example, the Chinese firms use ICTs (e.g. video and photo messaging) to keep Safari Seeds informed about the progress of its seeds during the growing season; have paid for Safari Seeds staff to visit the farms in China where their seed is being grown; and made after-care visits to Kenya. Where problems have arisen, such as poor seed germination rates, the Chinese firms have readily replaced the seeds. The director of Safari Seeds now regularly attends congresses of the Asian Pacific Seed Association (APSA) in China to learn about new seed varieties and make business deals.

Safari Seeds has sourced vegetable seed from several Indian firms, including its parent company Safal Seeds & Biotech Ltd., namely okra, capsicum, watermelon, tomato, onion (red and white), eggplant, French bean, beetroot, cucumber and radish. Safari Seeds has had mixed experiences with Indian seed growers. Our informant aired complaints that some Indian firms charged high prices but provided poor quality seed. Safari also experienced problems with reliability of supply from some Indian firms. In one case Safari Seeds shipped tomato seed to India for multiplication but the Indian company returned seed of an entirely different, cherry tomato variety, for which there is no demand in East Africa. As a consequence of this mix-up, Safari Seeds had to compensate its customers and got into trouble with the seed regulatory agency in Kenya. On top of these issues, the main concern was that Indian seed exports were provided with only one phytosanitary certificate for multiple seed varieties in a shipment, so the seed had to be tested by KEPHIS. It was due to this issue that Safari started importing red creole onion seeds from South Africa instead of Bombay red onion seeds from India.

Safari Seeds has adopted several of the strategies discussed in the main body of this report, including:

- *Direct imports of Indian seeds*. Safari Seeds has procured watermelon, okra, pepper and Bombay red onion seeds from Bejo Sheetal (Jalna, Maharashtra), and French bean, okra, beetroot, cucumber, tomato and radish seeds from Sakura Seed Corporation (Bengaluru, Karnataka).

- *Cultural ties and kinship.* The owners of Safari Seeds are Kenyans of Indian descent. The company directors routinely visit India to source seed. The company recruited an Indian national with several years' experience of working with both Kenyan and Indian seed companies.

- *Collaborating to register Indian varieties in Kenya.* Safari Seeds invited Indian breeders to submit seed varieties for testing and release in Kenya under the company's name.

- *Supplying Indian seed to other Kenyan seed companies.* Safari supplies imported seed to EAGL, Seminis East Africa (a Monsanto subsidiary) and Vegpro Kenya Ltd.

Case study 3. Nirmal Seeds – An Indian firm in Ethiopia

Nirmal Seeds (Pachora, Maharashtra) was established in 1988 and is engaged in the supply of agricultural inputs including quality seeds. The company has been exploring international markets in Africa and Asia. Initially, Nirmal began exporting seeds from India to Kenya, Mozambique, South Africa, Mauritius, Sudan, and Zimbabwe through local agents in these countries. The company later began to explore the possibility of producing seeds of improved varieties locally in Africa. The company's first such attempt was in Sudan but subsequently its attention shifted to Ethiopia. Nirmal perceives that the key opportunities in Ethiopia are in the production and marketing of vegetable seeds (tomato, capsicum, watermelon, radish, carrot, coriander and cabbage), hybrid crops (cotton, maize, rice, etc.) and spices. This assessment is based on the observation that the country is currently either importing or not using seeds of these commodities. The company also sees an opportunity to produce seeds in Ethiopia that can be exported to other countries in Africa. Nirmal believes it has the technical and investment capacity to undertake testing and release of adapted varieties of these crops and establish its business in Ethiopia.

In 2011 and 2012 Nirmal Seeds received official investment licenses to produce seeds on sites in Benishangul-Gumuz, Oromia and Amhara regions. However, the firm has only started to exercise its licence in Oromia, where it received an allocation of 150ha of land near Ginchi, about 115km west of Addis Ababa and opposite the Chinese Agricultural Technology Demonstration Centre. Nirmal Seeds now has seven permanent staff in Ethiopia including two Indian managers. However, to date none of Nirmal's varieties have been registered in the country. To make use of its land, in 2015 Nirmal planned to multiply seeds of public varieties. The target crops are tomato, pepper, coriander and okra.

Nirmal Seeds applied for official release of two hybrid cotton varieties in 2012 but both applications were rejected in 2013. Rejection usually implies that the rejected varieties will not be further considered for release. The company regards the rejection as a serious blow to its plans for seed production and marketing in Ethiopia and the corporate managers have alleged that the rejection of good germplasm was due to the poor design and management of the field trials carried out by the Ethiopian Institute of Agricultural Research (EIAR).

Strategies employed by Nirmal Seeds in Ethiopia included the following:

- *Launching seed production operations in Ethiopia.* This long-term strategy involves laying foundations for operations in Ethiopia, such as establishing a local office with Indian and local staff; securing land from the government on a 25 year lease; making investments in learning about local conditions, policy issues and regulatory frameworks in seed production and marketing systems; and applying for release and registration of its own varieties of diverse vegetables, cotton and hybrids. Nirmal also intends to establish local seed production through contract farming to boost production for local and export markets.

- *Internationalising the Indian business.* With encouragement from the Government of Ethiopia, Nirmal Seeds aspires to use Ethiopia as a hub from which to export seed to other African countries and even to India and other Asian countries; and also to source seed from other countries besides India, as demand and market opportunities dictate, potentially through joint ventures with other firms.

- *Promoting a partnership with the NARI*. Nirmal has sent five Ethiopian plant breeders from the EIAR to India for a 15-day study visit, focusing on cotton.

Case study 4. Vibha Seeds Ethiopia PLC – An Ethiopian subsidiary of an Indian firm

Vibha Seeds Ethiopia PLC is a subsidiary of Vibha Seeds. The company received an investment license to operate in Ethiopia in 2010. An Ethiopian national, who was a former manager of the Indian-owned firm J. J. Kothari &Co. (Ethiopia) Ltd., was appointed as a liaison officer to help set up Vibha's operations in Ethiopia. The same year, Vibha submitted applications for the release of six hybrid sorghum varieties. According to company officers, despite signing a memorandum of understanding with the EIAR to conduct the necessary trials, the trials were not carried out during the production season that year, leading to a delay until the following season. Company officers complained that in the second year the trial was ruined by bird attack and the sorghum hybrids were designated as failures. As noted above, this usually means that the varieties will not be reconsidered for release.

An application for the release of some tomato, rice and maize varieties in 2011 was relatively successful. In 2012 Vibha applied for release of 24 different seed varieties, of which only eight were approved in 2013, including one of okra, two of watermelon, three of rice and two hybrid cotton varieties. A further ten were recommended for repeat trials for one more year while the remaining six varieties were rejected (see Table 1). In spite of this modest progress, in early 2014 the company decided to cease its operations in Ethiopia, blaming the difficulties they faced in getting varieties released and the spiralling costs of repeated trials. Meanwhile, Vibha has begun field trails with its seeds in Mozambique and Senegal and is targeting the Kenyan and Tanzanian markets with cotton hybrids.

Vibha's engagement in Ethiopia illustrates the use of the following strategies:

- *Establishing seed production operations in Ethiopia through a subsidiary.* This plan included working with 5,000 small-scale contract farmers, based on Vibha's experience of contract seed production in India.

- *Supplying seed to Indian farms within Ethiopia*. Vibha planned to take advantage of the expansion of Indian-origin agricultural investments in Ethiopia by producing seed for these farms. However, the company has become less confident in this strategy because of the failure of several such investments to implement their investment plans effectively.

- *Targeting domestic markets by competing on price and quality.* Vibha aimed to get as many varieties released as possible in order to capture potential domestic markets. In particular Vibha hoped to undercut the only existing supplier of hybrid cotton in Ethiopia, an Israeli firm, with a cheaper and equally good or better performing hybrid of its own.

Appendix 4: Brief Profile of Select Indian Seed Companies doing Seed Business with Africa

	Name	Size	Estb. Year	Place	Business Arrangement	Crop Focus	Technology Focus	Country Focus
1	Advanta Ltd.	Large	2003	Hyderabad	(i), (ii), (v)	Maize (white and yellow), sorghum (grain and forage), sunflower, hybrid rice, canola, vegetables	Hybrids	South Africa, Malawi, Mozambique, Ethiopia, Tanzania, Uganda, Kenya, Egypt, Sudan, South Sudan, Nigeria, Mali, Chad and Ghana
2	Indo-American Hybrid Seeds	Large	1965	Bangalore	(i)	Vegetables (onion, tomato, capsicum, okra, eggplant, bitter gourd, radish), field crops (cotton, rice, maize, sunflower), flowers	Hybrids	Kenya, Sudan, East and South Africa
3	Nuziveedu Seeds	Large	1973	Ranga Reddy Dist.	(i), (ii)	Maize, sunflower, vegetables, cotton	Hybrids and GM (Bt Cotton)	Sudan, Ethiopia, Tanzania, Ghana and Kenya
4	Mahyco	Large	1964	Jalna	(i), (iii)	Cotton, rice, wheat, maize, oil seeds, castor, soybean, eggplant, okra, tomato, onion	Hybrids and GM (Bt Cotton)	Kenya, West Africa
5	Safal Seeds and Biotech Ltd	Large	-	Jalna	(i), (ii)	Vegetables, fruits, onion, cotton, hybrid maize, hybrid rice, millet, mustard, sorghum, sunflower, watermelon	Hybrids	Kenya, Uganda
6	Vibha Seeds	Large	-	Hyderabad	(i), (ii)	Cotton, sunflower, rice, pearl millet, mustard, wheat, sorghum, pulses, castor, capsicum, tomato, okra, watermelon, maize	Hybrids and GM	Ethiopia, Ghana, Tanzania, Uganda, Mozambique
7	Nirmal Seeds	Large	1988	Jalgaon	(i), (ii), (iv), (v)	Cotton, sorghum, wheat, maize, rice, sunflower, soybean, gram, okra, eggplant, tomato	Hybrids	Ethiopia, Mozambique
8	JK Seeds	Large	1989	Hyderabad	(i)	Cotton, maize, rice, pearl millet, sorghum, sunflower, mustard, tomato, okra, other vegetables	Hybrids and GM technology in cotton, rice and maize	Kenya, Egypt, Ghana, Mali, Sudan
9	Rasi Seeds	Large	1973	Coimbatore	(i), (ii)	Cotton, maize, hybrid rice, mustard, sunflower, wheat, okra, tomato, cabbage, eggplant, watermelon	Hybrids	Sub-Saharan Africa
10	Ganga Kaveri Seeds	Large	1983	Hyderabad	(i), (ii)	Cotton, maize, rice, sunflower, sorghum, wheat, mustard, pearl millet	Hybrids	Sub-Saharan Africa
11	Namdhari Seeds	Large	1985	Bangalore	(i), (ii)	Rice, maize, eggplant, tomato, okra, cotton	Hybrids	Egypt, Kenya
12	Bejo Sheetal Seeds	Large	-	Jalna	(i)	onion, chilli pepper, tomato, eggplant, okra, cucumber, melons, gourds, other vegetables and exotic crops	Hybrids	Kenya
13	Proline Seeds	Large	1995	Delhi	(i)	Maize, sorghum, pearl millet, wheat, rice, onion, tomato, watermelon, coriander, cucumber, okra, carrot, sweet corn, baby corn	Hybrids, OPVs	Kenya
14	Malav Seeds	Medium	-	Ratlam	(i)	Okra, onion, cabbage, tomato, watermelon, cotton	Hybrids	Kenya
15	Ankur Seeds	Medium	1976	Nagpur	(i), (ii)	Cotton, sunflower, eggplant, cabbage, okra, onion, tomato, rice, sorghum, maize	Hybrids	Sub-Saharan Africa

Compiled by Amit Kumar based on interviews and secondary sources. Note: Business arrangement designated as follows: (i) Export of hybrid seeds from India; (ii) Partnering with local African partner/regional initiatives/ NGOs; (iii) Acquisitions; (iv) Leasing; (v) Registering as local company/subsidiary in African countries.

Endnotes

1 International Seed Federation statistics. Available from http://www.worldseed.org/isf/seed_statistics.htmlhttp://www.worldseed.org/isf/seed_statistics.html (accessed 9 September 2015).

2 DFID is the UK government department responsible for British aid and development cooperation.

3 See www.future-agricultures.org.

4 See www.accesstoseeds.org.

5 See www.tasai.org.

6 Bt cotton is known to have been cultivated without authorisation in India prior to the official regulatory approval of the technology in 2002. It is not possible to determine the scale of this unauthorised cultivation, although local observers estimated at the time the practice was detected that the Bt varieties may have been planted for several seasons and over several thousands of hectares.

7 See the Integrated Seed Sector Development Project, www.issdseed.org.

8 UN Comtrade Database. Available at www.comtrade.un.org [accessed 10 September 2015].

9 UN Comtrade.

10 See www.caadp.net/about-us [accessed 29 September 2015].

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