Access to Seeds Index

Methodology Report

for the Access to Seeds Index 2015

Draft for Review

November 2014

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Foreword

Forging new global partnerships is the overarching priority of the post-2015 development agenda, according to a report on eradicating extreme poverty and achieving sustainable economic growth, published by the UN High-level Panel in May 2013. The report sees businesses as an essential participant in these partnerships. The question, of course, is how to mobilize the potential of the private sector.

The Access to Medicine Index has illustrated that an industry ranking can be a powerful force in engaging that industry in a global challenge and its solution. Published every two years since 2008, the Index assesses the extent to which pharmaceutical companies contribute to the access to medicine agenda. In so doing, it has helped to increase knowledge, understanding and trust, paving the way for a collaborative road map to eradicate the neglected tropical diseases agreed on in 2012 by governments, the World Health Organization, the pharmaceutical sector and the Bill & Melinda Gates Foundation.

The second industry ranking of this kind was the Access to Nutrition Index, which was published in 2013 and focuses on the contribution of global food and beverage manufacturers to food and nutrition challenges. While this index scores and ranks companies at the end of the food value chain (consumption), the Access to Seeds Index draws attention to the beginning of the food value chain (production), specifically the role the seed industry can play in increasing the agricultural productivity of smallholder farmers in developing countries.

The seed industry can be described as a small group of leaders and a long tail of – smaller – national and regional companies. Both the leaders and smaller companies can play a critical role in making quality seeds available to smallholder farmers and helping them to integrate new technologies into their business. The Access to Seeds Index thus encompasses not only industry leaders in a Global Index, it also considers the activities of smaller players in specific regions in a Regional Index, starting with Eastern Africa.

In creating an industry-wide ranking, each index mentioned here strives to highlight good practice. In the case of the seed industry, however, it might be better to say that the first Access to Seeds Index aims to turn on the lights. The reality is that very little is known about the seed industry, which is at odds with the strong responses it often elicits as well as its strategic position at the beginning of the food value chain.

This report describes the methodology for the Global Index, as agreed upon in broad consultation with stakeholders in and around the industry. The methodology for the Regional Index will follow at the beginning of 2015. The first Access to Seeds Index is scheduled for publication at the end of 2015. Yet however extensive the dialogue on the current methodology has been, the real dialogue with the industry will commence with the findings of the first Index.

Ido Verhagen
Executive Director
Access to Seeds Foundation
November 3, 2014

1. Introducing the Access to Seeds Index

Food security is one of the most pressing challenges of the 21st century. A growing population, predicted to surpass 9 billion by 2050, is increasing the global demand for food. At the same time, competition for resources, climate change and dwindling biodiversity are affecting our ability to meet that demand. The world can produce more by unlocking the potential of the millions of smallholder farmers in developing countries, and in so doing contribute to a sustainable and equitable supply of food for all.

1.1 Feeding the Future

Despite a marked increase in food production in the last 250 years – thanks in large part to the Industrial Revolution and increased understanding of genetics – some two billion people today are malnourished and half of those suffer from chronic hunger. The Access to Seeds Index was born out of the need for greater food and nutrition security and took as its starting point the question: if quality seeds enabled farmers in some parts of the world to triple their yields, could those results be replicated elsewhere?

A possible answer to that question lies with smallholder farmers in developing countries, who represent an untapped opportunity to achieve food and nutrition security. However, their productive potential is currently limited by the availability of quality seed. By improving their access to seeds, coupled with the right agronomic practices, that potential could be unlocked, thereby stimulating sustainable agricultural and economic growth.

Although increased yields in more advanced agricultural systems and the number of people who could thus be fed is no small achievement, it came at a price. The environmental impact of modern agriculture, which is characterized by high-carbon farming methods and loss of agricultural biodiversity, underscored the need to rethink our food production practices. In the search for alternative models, generally referred to as sustainable intensification, quality seeds are indispensable. Seeds are, after all, fundamental to agriculture.

Seed companies can play a key role in making quality seeds available to smallholder farmers. However, the large number of farmers to be reached and their diverse needs and demands require market-based approaches. Throughout the industry, seed companies are stepping up their efforts. Yet a challenge of this magnitude can clearly not be solved by the private sector alone. Governments also play a critical role in creating the right conditions for markets to flourish. Other actors, such as NGOs and farmer organizations, can join forces with seed companies to build capacity, enabling farmers to adopt new technologies. Learning from these initiatives and gaining a better understanding, both of the contribution companies are already making and the opportunities for them to do more, is at the heart of what the Access to Seeds Index sets out to do.

The Access to Seeds Index

The Access to Seeds Index reflects growing expectations that companies should play a substantial role in addressing global challenges. In recent decades, companies have increasingly acknowledged these expectations by defining and operationalizing strategies that consider their social and environmental behavior. This response upholds the fundamental idea that corporate social responsibility (CSR) is not solely defined by companies themselves. At the same time, undue social pressure or overzealous government regulation can create an environment of compliance instead of collaboration and innovation. The Access to Seeds Index aims to facilitate constructive dialogue between the industry and its stakeholders on CSR and the possibilities for sustainable value creation.

The Access to Seeds Index draws its inspiration from the Access to Medicine Index, the first Index of its kind to rank pharmaceutical companies according to their efforts to make their products more available, affordable and accessible in developing countries. Recognizing that the challenge of access to medicine cannot be resolved single-handedly, the Access to Medicine Index encourages the pharmaceutical industry to collaborate with other public and private stakeholders.

Following that example, the Access to Seeds Index was established with the aim of enlarging the role the seed industry plays in empowering smallholder farmers to grow their business. Published every two years by the Access to Seeds Foundation, an independent organization supported by the Bill & Melinda Gates Foundation and the Dutch Ministry of Economic Affairs, the Index measures and compares the efforts of the world's leading seed companies to enhance the productivity of smallholder farmers. By creating transparency and identifying leadership in the industry, the Index seeks to benchmark and improve the performance of these companies over time.

Global and Regional Index

The Access to Seeds Index was developed based on input gathered during extensive multi-stakeholder consultations. One of the key insights that emerged from these consultations was the company scope. Since vegetables play an important role in the business model of smallholder farmers, as well as human nutrition needs, both global field crop and vegetable seed companies are included in the Index. Furthermore, stakeholders underlined the contribution of national and regional companies in reaching smallholder farmers, often in remote areas. As a result, a Regional Index is being developed alongside the Global Index. The Regional Index will initially cover Eastern Africa and provide a template to roll out to other regions. The Indices will be published concurrently, as some companies may feature in all three lists and the data collection for each list can take place at the same time.

The Index measures company activity in the seven areas that are considered key for improving access to quality seeds for smallholder farmers in Index regions. In turn, each measurement area is assessed with indicators. These have been carefully compiled to address all aspects of the multi-stakeholder agenda, while offering genuine insights into the performance and behavior of individual companies.

This methodology was reviewed by the Expert Review Committee, composed of representatives from different stakeholder backgrounds and fields of expertise. Their advice, guidance and remarks helped to finalize the methodology. The first Access to Seeds Index, which is scheduled for publication in the fall of 2015, matches stakeholder expectations regarding the role of the industry with the current activities and commitments of individual companies.

1.2 How the Index works

The Access to Seeds Index is an instrument that matches the expectations of stakeholders in and around the seed industry with company performance in addressing global food and nutrition security challenges. It brings transparency to the contribution of individual companies, while providing guidance to companies seeking to assume greater responsibility in this area. The Index is published every two years following a process known as the 'Index cycle'. The approach is based on five components:

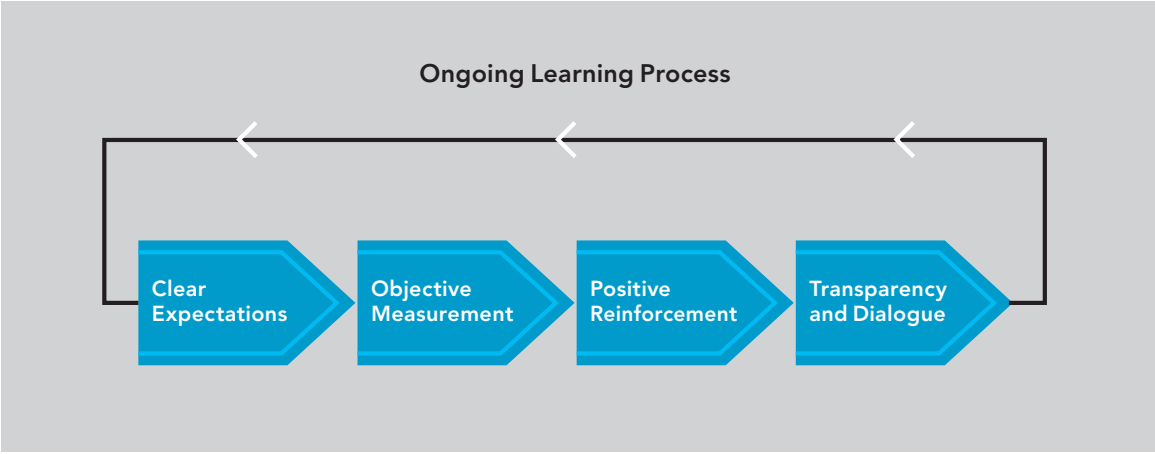
1. **Clear expectations.** To encourage the industry to assume greater responsibility in facilitating access to seeds, expectations need to be stated clearly and collectively. Initial questions are considered, such as: What is expected of the industry? What role could it play? These questions are asked and answered through multi-stakeholder dialogue, resulting in a balanced stakeholder agenda.

2. **Objective measurement and comparison.** The balanced stakeholder agenda is translated into a methodology with indicators that clearly measure the performance of each company included in the Index. For reasons of independence and impartiality, the Index has no personal or financial ties to the companies assessed. The methodology is determined by an independent Expert Review Committee, which includes representatives from relevant stakeholder groups.

3. **Positive reinforcement.** The Index seeks to highlight good practices and recognize leadership in the sector. It rewards companies that take responsibility, develop innovative, inclusive business models and bring knowledge and expertise to a partnership program.

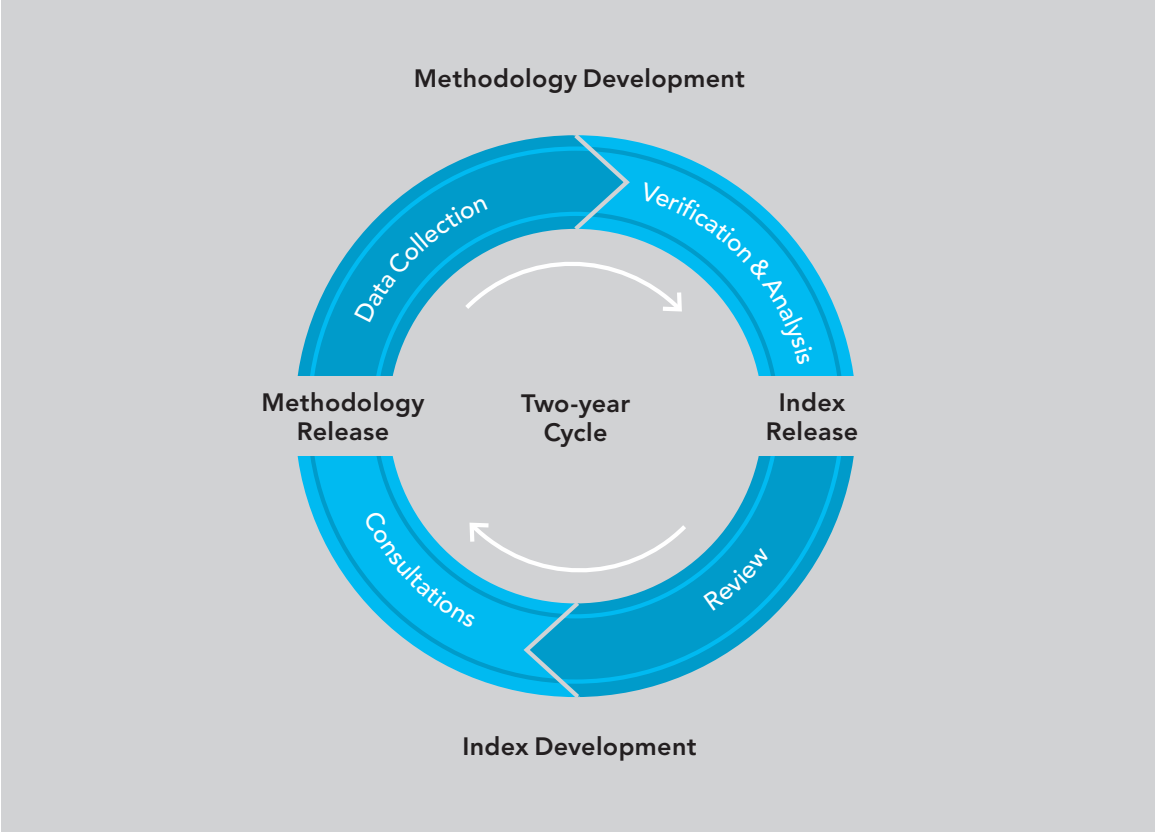
4. **Transparency and dialogue.** The Index creates transparency around the roles individual companies play by identifying good practices such as new products, successful partnerships and innovative, inclusive business models. In doing so, it feeds informed opinion on the role of the private sector, which is essential for a meaningful dialogue about helping smallholder farmers to improve their businesses. As an independent platform, the Index brings unique data to the table while complementing research conducted by global organizations, including the World Bank, on enabling agricultural business and the role of governments. The Index aims to bring those information sources together in the dialogue.

Figure 1 How the Index works



5. **Ongoing learning process.** The Index is published every two years in a so-called 'index cycle'. During the first year, the Index methodology is developed or reviewed based on the conclusions of the preceding Index. This results in the Methodology Report. In the second year, data is collected and verified, resulting in the publication of the Index Report. Companies can improve their ranking in the Index either by increasing their commitment to and performance around access to seeds or improving the transparency of their activities. The results and best practices identified by each Index are evaluated in stakeholder dialogues or roundtable conferences, with the aim of facilitating a learning process for the industry and other relevant actors.

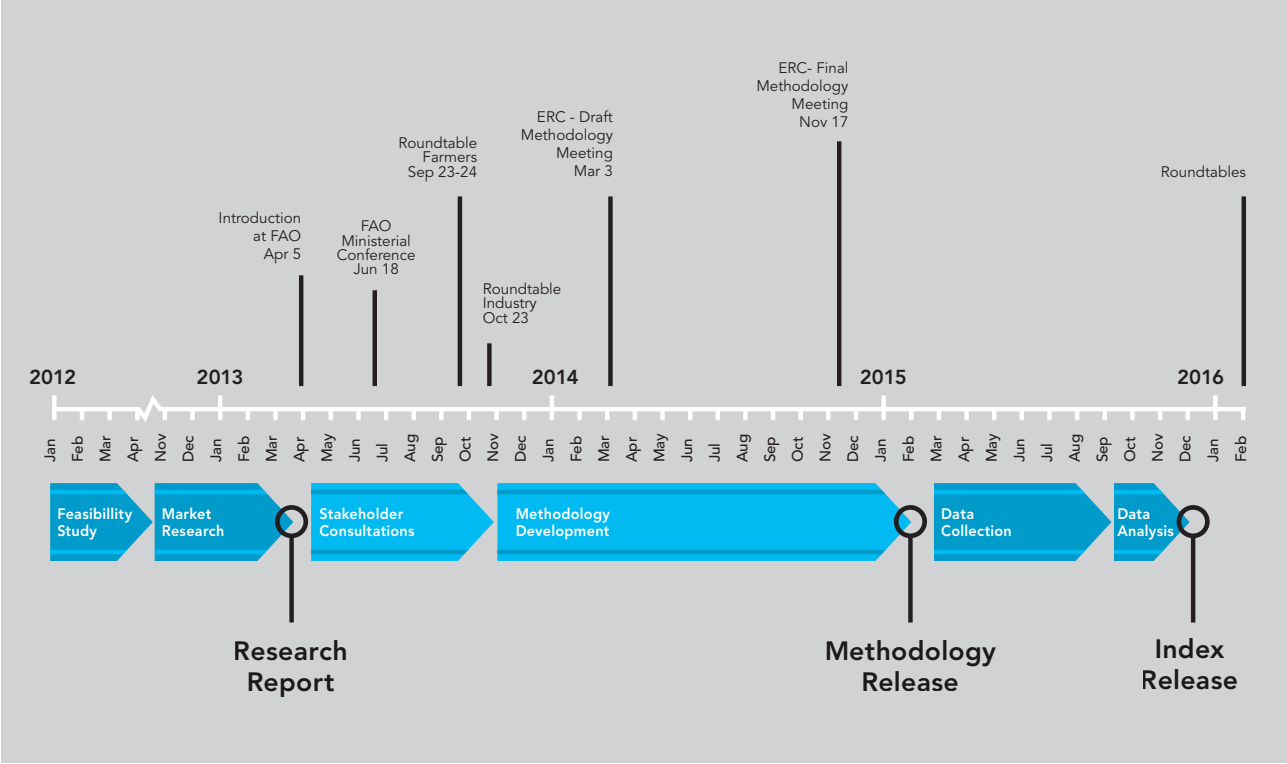
Figure 2 Index Cycle



1.3 Development Process

The methodology of the first Access to Seeds Index was developed in five stages: feasibility study, market research, stakeholder consultations, methodology development and expert review. The review was carried out by the Expert Review Committee, an independent body composed of representatives from different stakeholder backgrounds and fields of expertise.

Figure 3 Development process of the Access to Seeds Index



1. Feasibility study

A feasibility study, for which 25 stakeholders in and around the seed industry were consulted, was conducted in early 2012. The study concluded that the Index could help to bring greater transparency to the role of the seed industry in meeting the needs of smallholder farmers and leverage best practices.

2. Market research

Following the feasibility study, the first outline of the Index was developed based on desk research. The desk research report Food for Thought was published on March 22, 2013. The results were presented to an international audience at FAO's headquarters in Rome on April 5, 2013. The report investigates the challenges facing smallholder farmers in developing countries and describes the possible contribution that the seed industry could make in tackling those challenges. The insights provided input for stakeholder consultations. Part of the market research was a call for case studies and good practices that was sent to the world's 20 leading seed companies.

The initiative was again presented in Rome at the 38th Session of the FAO Ministers' Conference on June 18, 2013. In a meeting hosted by the Dutch Ambassador to the FAO, Ms. Gerda Verburg, a panel made up of Clement Kofi Humado, Minister for Food

and Agriculture in Ghana, John Atkin, Chief Operational Officer of Syngenta, and Clayton Campanhola for the FAO reflected on the initiative. Representing the Dutch government, Roald Lapperre, Deputy DG Agro of the Ministry of Economic Affairs, explained the motivation to launch the initiative. Ido Verhagen, Access to Seeds' Executive Director, outlined the project.

3. Stakeholder consultations

Stakeholder consultations took place from April to November 2013. Forty experts from different backgrounds were consulted on an individual basis, either in person or via teleconferencing.

In the spring and summer, a series of field trips were organized to Ghana, Rwanda, Uganda, Kenya and Ethiopia to consult various stakeholders on the ground. Experts on the situation in South and Southeast Asia were consulted via video conferencing.

In September and October, two stakeholder roundtables for farmers and the industry respectively took place. Eleven representatives of farmer organizations from Latin America, Africa and Asia and 12 representatives from NGOs, research institutes and the seed industry participated in the farmers' roundtable in Addis Ababa on September 23 and 24, 2013. A total of 14 participants from eight companies and two seed trade associations participated in the industry roundtable in Washington DC on October 23, 2013.

4. Methodology development

Based on the insights gathered from the stakeholder consultations, development of the high-level methodology started in November 2013. Experts from the research firm Sustainalytics supported the Access to Seeds team in this process.
Two technical advisory meetings were held in February 2014. The meeting on February 6 focused on the areas of the Index that assess seed company activities in Index countries. The meeting on February 13 focused on genetic resources, intellectual property and research and development.

5. Expert review

The Expert Review Committee (ERC), which is made up of individuals from a variety of stakeholder groups, is a key component in the stakeholder engagement process. The ERC evaluated the methodology on March 10, 2014 and their advice and remarks were used to refine the methodology further. The ERC convened for a second time on November 17, 2014 for a final review of the methodology prior to publication.

Members of the Expert Review Committee

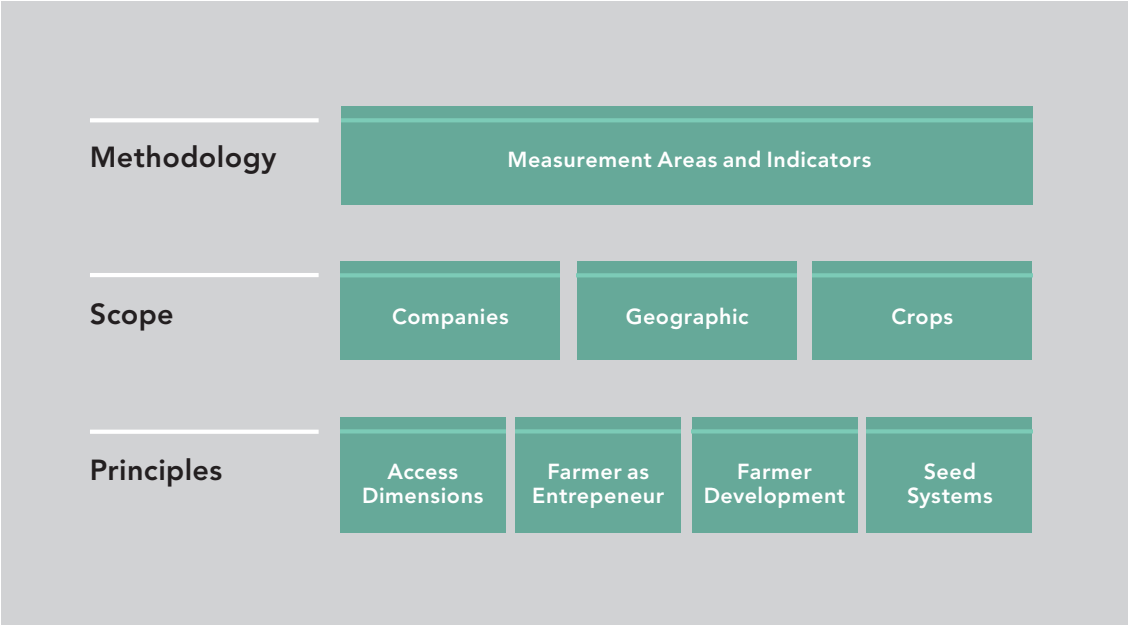
1. Paula Bramel, Assistant Executive Director of the Global Crop Diversity Trust
2. Heleen van den Hombergh, Senior Advisor at IUCN
3. Gigi Manicad, Senior Program Manager at Oxfam
4. Christoph Amberger, former board member of KWS SAAT AG
5. Michael Halewood, Head of Policy Research at Bioversity International
6. Ram Kaundinya, former CEO and Managing Director of Advanta
7. Philip Kiriro, President of the East African Farmers Federation
8. Thomas Osborn, former Senior Agricultural Officer at the FAO
9. David Spielman, Senior Research Fellow at IFPRI

2. Index Framework

The Index framework provides a visual overview of the different components that make up the methodology of the Access to Seeds Index: the principles, the scope and the measurement areas with indicators.

The Index consists of a three-tiered framework. At its base are the four principles that have guided the development of the Index and methodology. The tier above it addresses the scope of the Index (companies, crops and geographic areas), while the top tier covers the measurement areas and indicators of the methodology itself.

Figure 4 Index framework



2.1 Principles

Seeds are fundamental to agriculture. Yet it is clear that empowering smallholder farmers in developing countries entails more than simply making better seeds available to them. This is acknowledged in the four guiding principles of the Index and reflected in the indicators.

'Access dimensions' addresses what 'access to seeds' means to smallholder farmers. Stakeholder dialogue identified six dimensions: availability, affordability, suitability, capability, profitability and autonomy.

'Farmer as entrepreneur' underscores the notion of smallholders who view their farms as a business. The focus of the Access to Seeds Index is on building sustainable business models, not on charity or donations.

'Farmer development' acknowledges that access to seeds is only one of a number of factors affecting farmer development, including access to finance and output markets. Although this is not the core business of the seed industry, seed companies can nevertheless play an important role in furthering this approach.

'Seed systems' reflects the Index's focus on the role of the formal seed sector, but also looks at its interaction with other seed systems such as informal or public seed systems.

2.2 Scope

The scope of the Index is defined in terms of (1) the companies included, (2) geographic focus and (3) crop selection. The scope is not fixed and can be adjusted for each consecutive Index.

Company scope: The Index assesses the efforts of the world's leading seed companies (based on seed revenue) with an integrated business model to improve smallholder farmers' access to seeds. As the business models of field crop and vegetable seed companies differ, two separate lists have been drawn up for the seven leading field crop companies and the ten leading vegetable seed companies. Additionally, a regional spotlight Index is being developed for Eastern Africa. This will encompass global companies with substantial activities in this region as well as leading regional and national companies.

Geographic scope: Four geographic areas were identified by matching the challenge of food insecurity and yield gap with agricultural potential. The four areas are (1) Western Africa, (2) Eastern Africa (3), South and Southeast Asia and (4) Latin America.

Crop scope: Determined primarily by the needs and business models of smallholder farmers, the crop scope encompasses both field and vegetable crops. A list of nine major field crops and fifteen major vegetable crops was drawn up based on area harvested in the target regions (the Index calls these 'global crops'). The Index also assesses seed company activities in so-called local crops, sometimes referred to as 'neglected and underutilized species' or 'orphan crops'.

2.3 Measurement Areas

The Index measures company activity in the seven areas that are considered key for increasing access to quality seeds of improved varieties for smallholder farmers in Index regions.

The first two measurement areas focus on (1) the commitment companies display to global food and nutrition security in general and access to quality seeds for smallholder farmers in particular, and (2) their participation in public and stakeholder engagement and policy debates that contribute to that end. The next two measurement areas assess the development of products suitable for smallholder farmers in Index regions, specifically (3) the handling of genetic resources and intellectual property, and (4) R&D efforts by the company itself or in collaboration with partners. The last three areas, which evaluate company activities in Index regions, cover (5) marketing and sales efforts, (6) capacity building for smallholder farmers and (7) attempts to advance local seed sectors.

Figure 5 Seven measurement areas

2.4 Indicators

The Index is a relative ranking, which compares companies with each other rather than against an absolute, ideal state. The highest attainable scores for each indicator do not reflect an optimal characteristic of industry behavior, but the degree to which a company meets predetermined stakeholder expectations. Additionally, companies do not receive negative scores in indicators, meaning that they can never score below zero.

Each measurement area is assessed with indicators classified along four lines: Commitment, Performance, Transparency and Innovation. Commitment is the first step to actualizing practice as it defines what a company values and aims to achieve, for example through a code of conduct, policy or as a signatory to international agreements. Performance measures what companies actually do, which has the greatest impact on access to seeds. Transparency surrounding policies and practices shows the company's intent and allows it to be held accountable for its actions and values. Finally, Innovation captures how companies create or employ new means to advance and lead industry practice to promote access to seeds.

Commitment

This classification measures company values, strategies, policies and codes of conduct for improving performance related to access to seeds. Companies receive more credit for commitments that are publicly available in reports, statements or other verifiable sources. The Index uses information collected on these indicators to track the extent to which companies follow through on their commitments.

Performance

This classification focuses on what companies are actually doing to promote access to seeds through the implementation of initiatives within the seven measurement areas. It shows where companies put policies and priorities into action to achieve what they committed to do.

Transparency

This classification focuses on the extent to which companies disclose information regarding their access to seeds initiatives. They receive credit for disclosing information, either publicly or to the Index through one-on-one engagement, regardless of whether the content has a positive impact on access to seeds. This is to encourage companies to be transparent about and accountable for their policies and activities. Public transparency is given more weight because it promotes accountability to a wider audience.

Innovation

As the seed industry as a whole looks for ways to enter new markets and address current industry challenges, companies can develop innovative strategies and models that make access to seeds more sustainable. This classification measures what companies do to shape their core competencies to improve access to seeds. It identifies the industry as an important driver of change, recognizing that it operates within an environment where multiple actors may influence the access to seeds landscape.

3. Principles

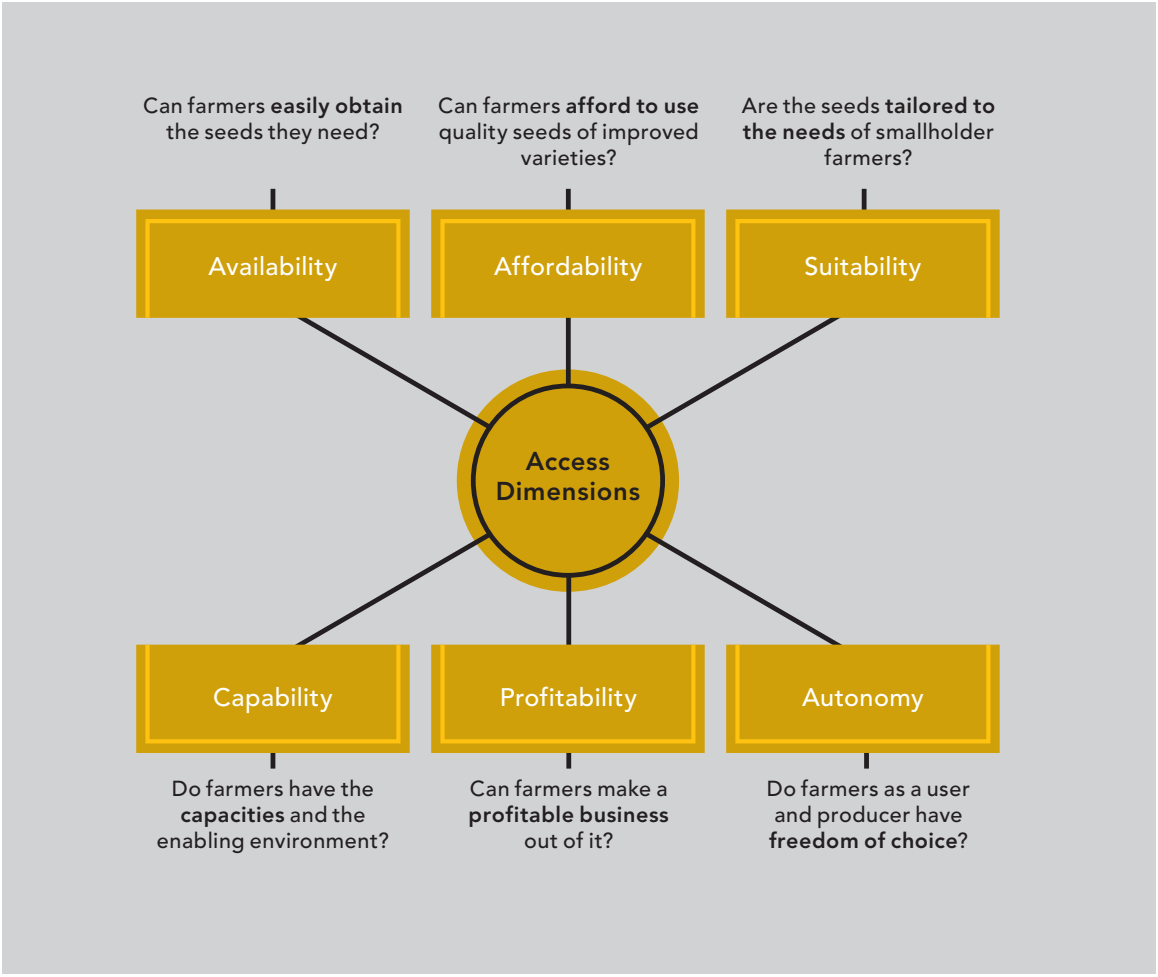
The Access to Seeds Index is guided by four principles: (1) access dimensions, (2) farmer as entrepreneur, (3) farmer development and (4) seed systems. These principles acknowledge that, while seeds are a key technology, empowering smallholder farmers in developing countries entails an integrated approach that extends beyond the seed industry alone.

3.1 Access Dimensions

In consultation with stakeholders, 'access' was defined as a broad concept with six dimensions: availability, affordability, suitability, capability, profitability and autonomy.

Although this is what access means to smallholder farmers, it is not necessarily what is expected of seed companies. For each dimension, the Index seeks to explore both the possible roles and responsibilities of seed companies as well as what cannot be expected from them.

Figure 6 Index Principle 1: Access dimensions



1. **Availability:** this refers to whether sufficient quantities of seed of suitable crops are present within reasonable proximity (spatial availability), in time for critical sowing periods (temporal availability) and in a continuous and reliable supply. It is essentially a geographically based parameter, and is strongly related to efficient and reliable distribution systems.

2. **Affordability:** this is a straightforward dimension: farmers having the means to purchase seeds at a fair price. However, the ability to purchase seeds can also be enhanced by access to credit and insurance to ensure that loans can be paid back if losses occur along the way.

3. **Suitability:** this refers to the development of improved varieties suitable for the needs, preferences and local conditions of smallholder farmers. It includes variety suitability and seed quality. This is about more than simply achieving higher yields; it also refers to cultural preferences. There is a strong desire to improve local varieties: when breeding to meeting local demands, it is important to check what is already available.

4. **Capability:** this refers to a diversity of extension services and capacity building. Important aspects of this are agronomic advice, integrated crop management and after-sales, and feedback systems concerning experiences with the seeds and distribution system. Cooperation with local partners is essential for transferring knowledge and creating a sustainable solution.

5. **Profitability:** this refers to the profitability of the crops that farmers can grow with the seed. Do they have access to output markets? And do the seeds produce crops that can be marketed, for instance because they have postharvest qualities such as a long shelf life?

6. **Autonomy:** farmers' representatives at the Addis Ababa roundtable explicitly added autonomy as a dimension of access. Autonomy refers to farmers not only as end-users, but also as producers of seed and sources of innovation. Crucial to this are community-based seed systems, for which there is currently no legal recognition. In the current legal framework – both locally and internationally – only public and private seed systems are recognized. For smallholder farmers, the breeders' exemption and farmers' privilege are important in this dimension.

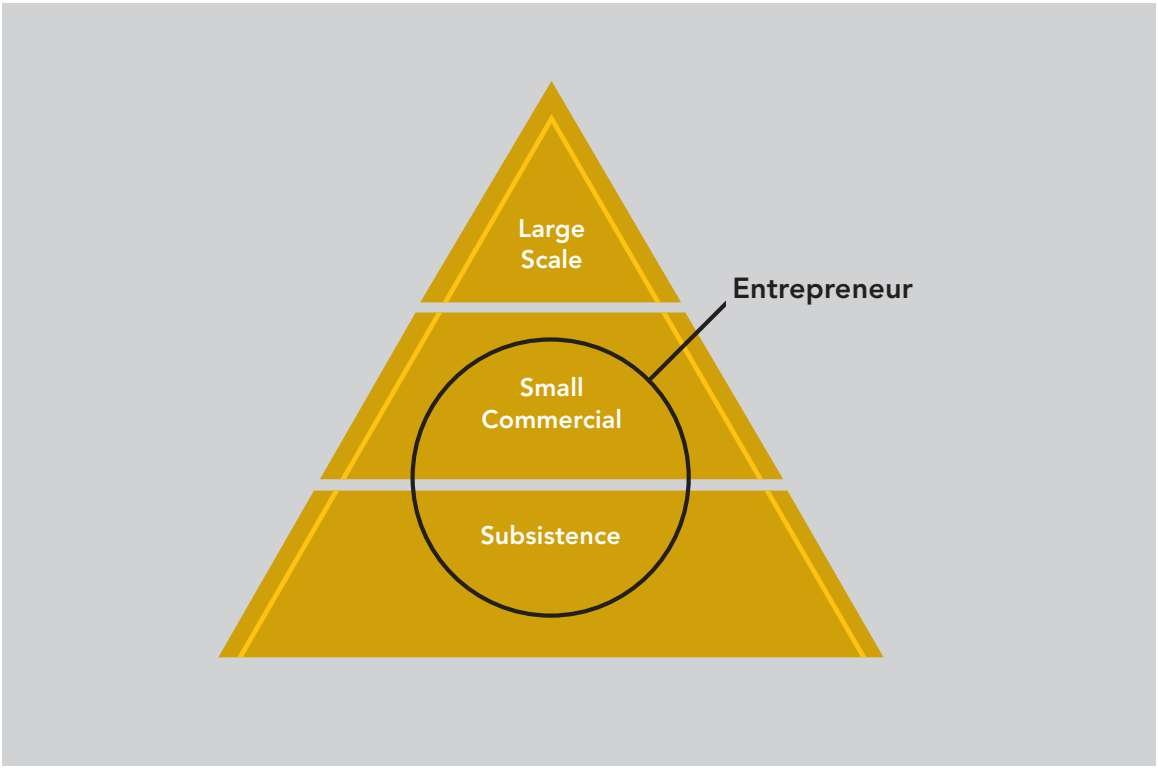
3.2 Farmer as Entrepeneur

During dialogue to determine the Index's scope, stakeholders proposed viewing smallholder farmers as entrepreneurs with differing needs and capacity levels in their own production systems. Smallholder farmers who see themselves as entrepreneurs are more likely to build a business and adopt new technologies. As such, the Index focuses on sustainable business practices and does not emphasize charity or donations.

The literature often distinguishes between three types of farming communities in the developing world: large-scale commercial farmers, small commercial farmers and subsistence farmers. The boundary between large and small is generally set at 2 hectares. The concept of subsistence farming is problematic; farmers who produce mainly for their own livelihood still bring something to the market when the opportunity arises.

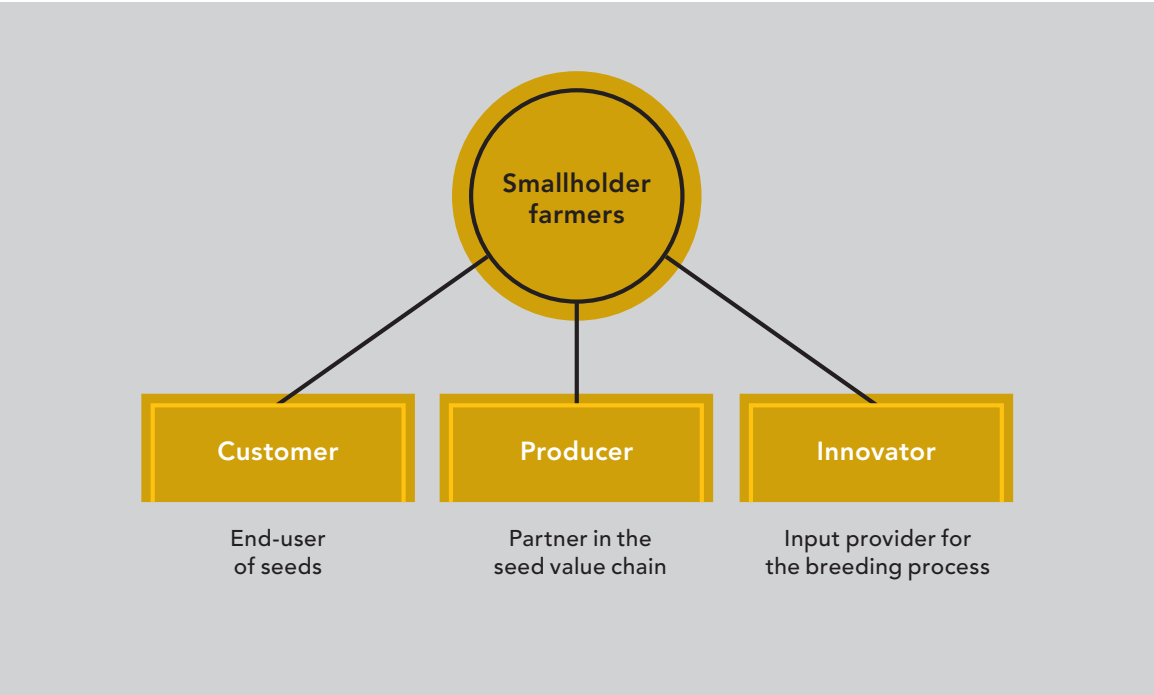
Rather than distinguish between small commercial and subsistence farmers, the Access to Seeds Index views smallholder farmers as entrepreneurs at different stages of development. Large-scale farmers are excluded from the scope of the Index.

Figure 7 Index Principle 2: Farmer as entrepreneur



Additionally, it is important to acknowledge that farmers can play different roles in their interaction with seed companies. Farmers as end-users are primarily regarded as part of a company's customer base. However, smallholders can also act as a link in a company's seed multiplication value chain. Finally, smallholder farmers can be a source of innovation, as providers of local varieties or landraces for further breeding or as a knowledge base for local preferences and needs in the breeding process.

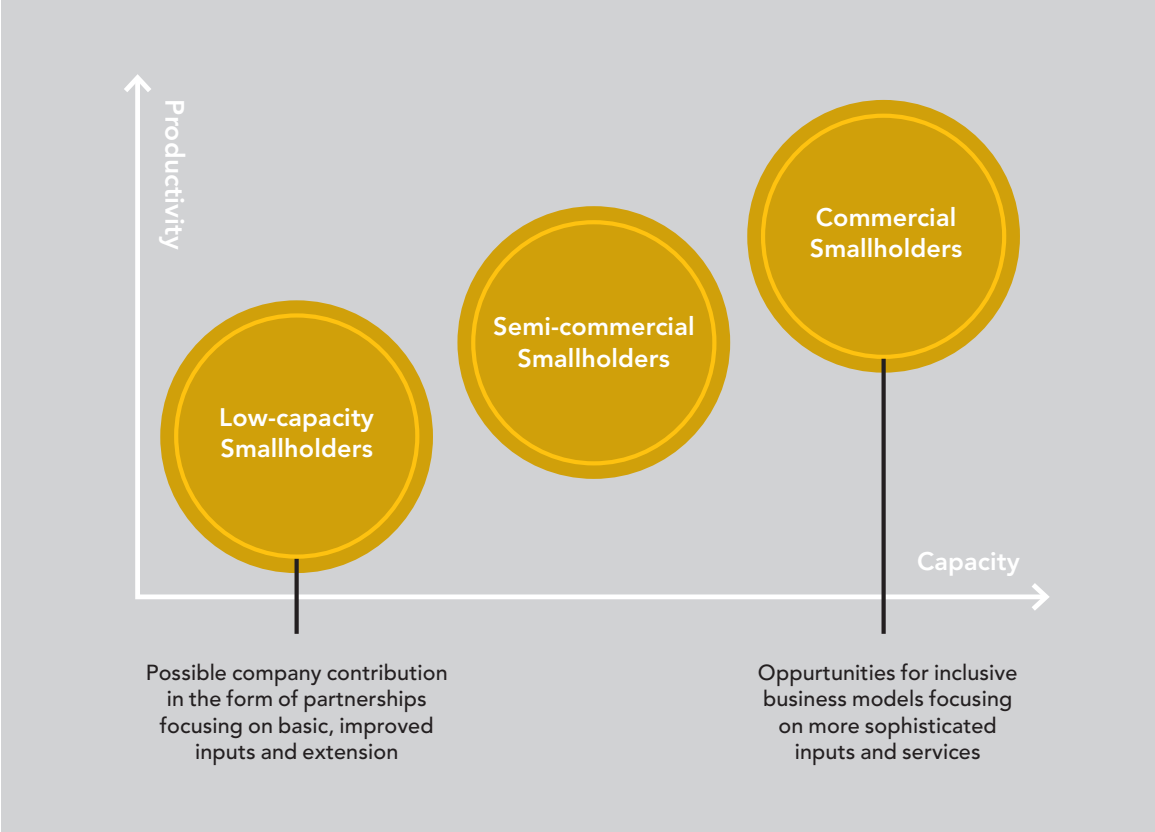
Figure 8 Roles smallholder farmers play in their interaction with the seed industry



The varying stages of development of smallholder farmers can be attributed to the production systems in which they operate. Production systems in fertile and irrigated areas with access to markets tend to use intensive cultivation methods and more modern varieties and seeds. Production systems in marginal rain-fed lands with less access to markets produce mainly for personal or community consumption and use fewer modern varieties and seeds.

The level of capacity development of smallholder farmers has consequences for the possible role companies can play in addressing their needs. Business opportunities for seed companies are predicted to increase as capacity expands. For low-capacity farmers, the contribution of companies will likely be in the form of public-private partnerships that focus on improving agronomy by extension and will work with open-pollinated seeds.

Figure 9 Level of capacity development of smallholder farmers and possible contribution of the seed industry



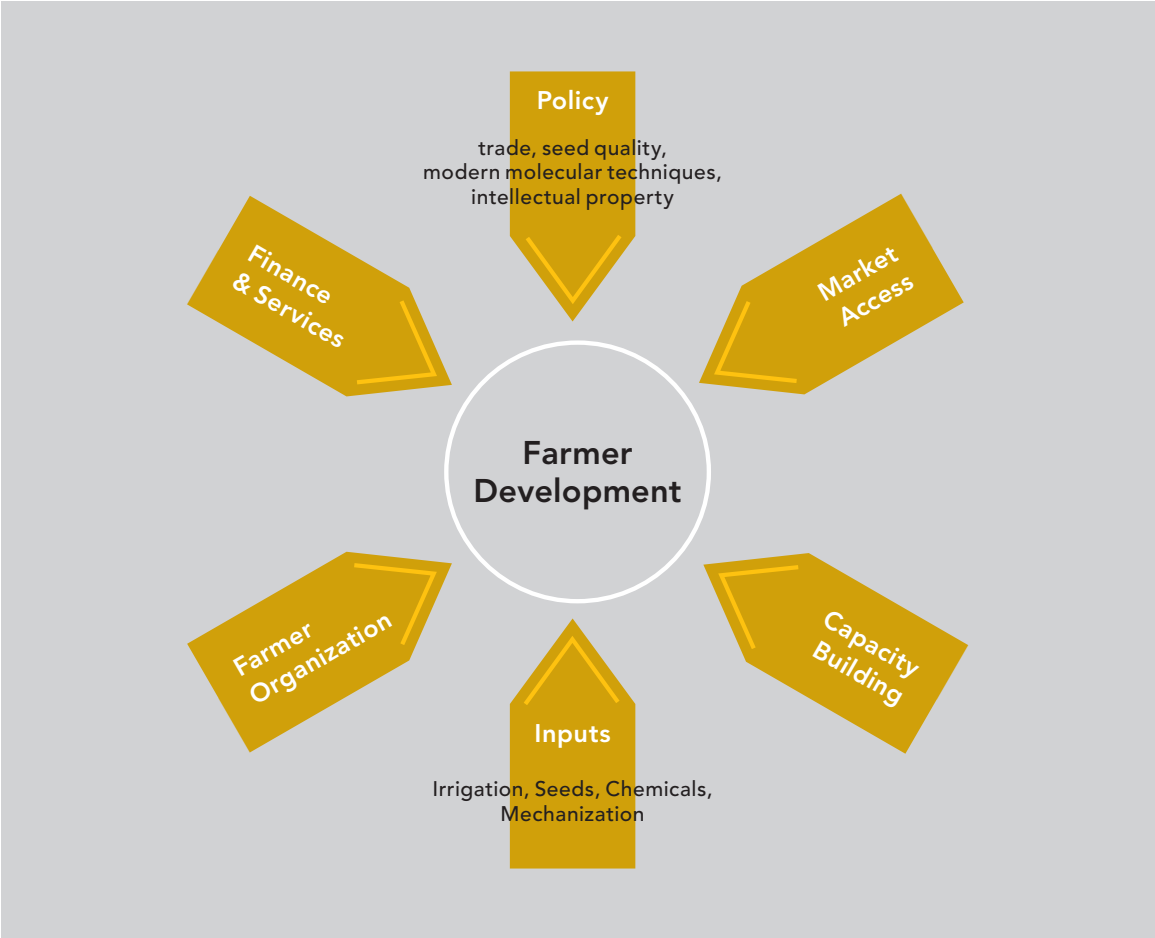
At the other end of the spectrum, more opportunities for (inclusive) business models arise, with semi-commercial smallholders interested in using basic, improved inputs and commercial smallholders having the capacity for more sophisticated inputs. The Index's indicators focus on whether companies see a role for themselves in addressing the needs of smallholder farmers at different capacity levels.

3.3 Farmer Development

Increasing the productivity of smallholder farmers in the developing world can make a major contribution to reducing hunger and poverty. However, access to seeds is only one aspect of farmer development. Desk research identified six factors that are essential for improving the output of low-output farmers: policy, inputs, finance, knowledge and capacity, markets and farmer organizations.

It is clear that this integrated approach requires the involvement of various parties. Governments, both on a national and international level, play a key role in introducing policies that enable farmer development, for instance around infrastructure, social security, education, agriculture, intellectual property rights and trade. Civil society actors can also assist with capacity building or supporting farmer organizations. Across the spectrum, multiple activities, alliances and initiatives are being set up, which are examined and assessed in the methodology.

Figure 10 Index Principle 3: Integrated approach to farmer development



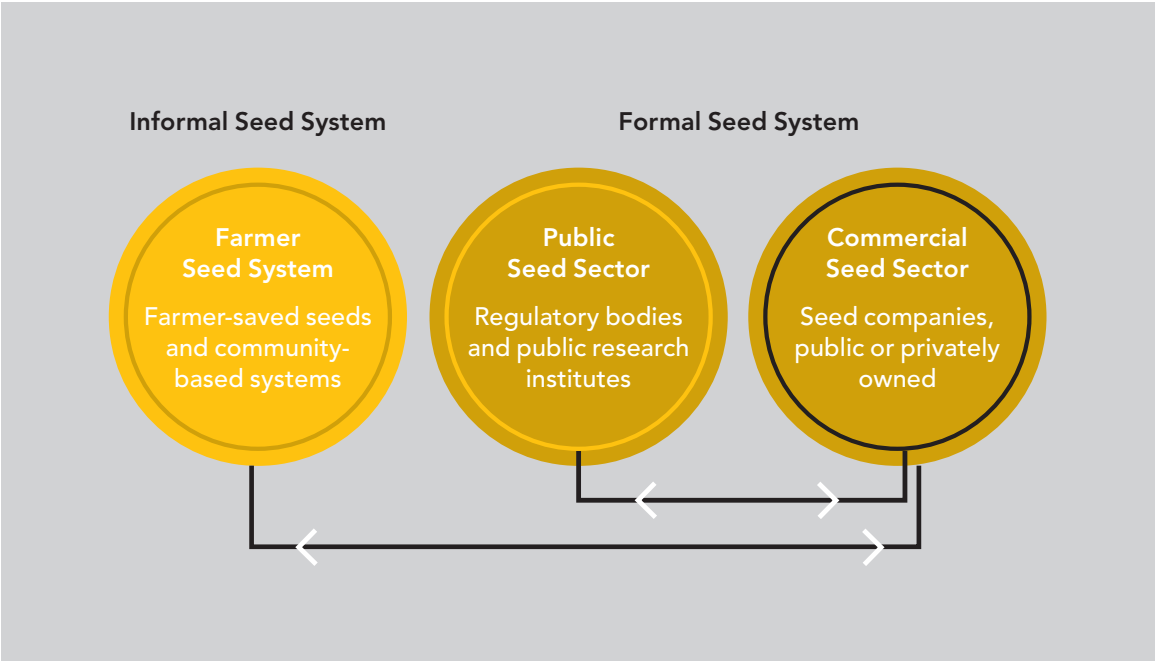
3.4 Seed Systems

The Access to Seeds Index focuses on the commercial seed sector, while acknowledging the important role of the informal seed systems and the public seed sector.

Two types of seed systems are generally distinguished: formal and informal. The informal seed sector, also called the farmer seed system, is usually defined as the total seed production activities of (predominantly small-scale) farmers. In contrast, the formal sector refers to public and commercial seed production activities.

Informal seed sectors consist of community-based systems and farmers who save their own seeds. Farmer seed production is in most cases integrated into normal crop production. Farmers select grains from their crop in order to obtain seed for their next planting. To ensure a good crop in the next season, selection is based on characteristics such as larger grains, non-shattering of seed and erect plant architecture. Since this selection has taken place over centuries by farmers in a number of ecosystems and with a range of objectives (for example grain and straw yield, cooking and consumption qualities, storage characteristics), informal seed systems are important sources of genetic diversity. They may also be the only source of preferred local varieties. Some farmers develop into specialists, supplying other farmers with a portion of their seed requirements.

Figure 11: Index Principle 4: Integrated seed systems approach



Formal seed systems emerged in industrialized countries in the second half of the 19th century. The specialization of seed production and the development of a public and commercial seed sector were triggered by an increased understanding of genetics and plant breeding. The formal seed system is regarded as a chain that represents a one-directional flow of seeds from research through pre-breeding to breeding programs, and further through seed production and promotion and distribution programs to farmers' fields, where they are used as an external input. The formal seed sector is regulated by national legislation and international standardization of methodologies. In developing countries, a formal seed sector has also emerged over the past decades.

Typically, private seed companies concentrate on production and distribution of seeds that are economically profitable such as hybrid corn, cotton and vegetables. For most self-pollinating food crops (cereals, legumes), the public sector, which includes international research institutes, is the major formal seed source. In most of the industrialized world, the formal seed sector has largely replaced the informal seed sector. The public sector has also largely withdrawn from breeding, but often plays a stimulating role in upstream research.

It is uncertain whether seed systems in the developing world will follow the same path as the industrialized world. Many advocate an integrated approach that strengthens both the informal and formal seed sectors.

In line with this approach, stakeholder dialogue underlined the need to acknowledge the existence and importance of the informal and public seed sectors in developing countries. The Index in no way seeks to encourage the seed industry to outcompete existing informal seed systems. The Index will therefore also consider the interaction between the commercial seed system and other seed systems, and its indicators will examine seed companies' positions on topics such as the breeders' exemption and farmers' privilege, which are important for informal seed systems. It will also focus on collaboration with public partners and farmers as a source of innovation.

4. Scope of the Index

The scope of the Access to Seeds Index is defined in terms of (1) the companies included, (2) geographic focus and (3) crop selection. The crop scope was determined largely by the needs and business models of smallholder farmers and encompasses both field and vegetable crops. The leading suppliers of the seed for these crops determined the company scope. The geographic scope covers four target areas in Western Africa, Eastern Africa, South and Southeast Asia and Latin America. These areas were identified by matching the challenge of hunger, poverty and yield gap with agricultural potential.

4.1 Company Scope

The Index assesses the efforts of the world's leading seed companies (based on seed revenue) with an integrated business model to improve smallholder farmers' access to seeds. As the business models of field crop and vegetable seed companies differ, two separate lists have been drawn up for the seven leading field crop companies and the ten leading vegetable seed companies. Four companies that are active in both areas appear on both lists.

Additionally, a regional spotlight Index is being developed for Eastern Africa. This will encompass global companies with substantial activities in this region as well as leading regional and national players.

Table 1. Top seven field crop seed companies (Source: expert consultations, 2013)

Company	Country	Seed Revenues ($mln)	Ownership
Monsanto	USA	10,010	Listed
DuPont Pioneer	USA	7,253	Listed
Syngenta	CHE	3,237	Listed
Groupe Limagrain	FRA	1,789	Cooperative/Listed
KWS SAAT AG	GER	1,319	Listed
Dow AgroSciences	USA	1,360	Listed
Bayer CropScience	GER	1,237	Listed

Table 2. Top ten vegetable seed companies (Source: expert consultations, 2013)

Company	Country	Seed Revenues ($mln)	Ownership
Monsanto	USA	820	Listed
Vilmorin & Cie (Limagrain)	FRA	620	Listed
Syngenta	CHE	550	Listed
Nunhems (Bayer CropScience)	GER	410	Listed
Rijk Zwaan	NED	340	Private
Takii	JPN	340	Private
Enza	NED	250	Private
Sakata	JPN	250	Listed
Bejo	NED	200	Private
East-West Seed	NED	150	Private

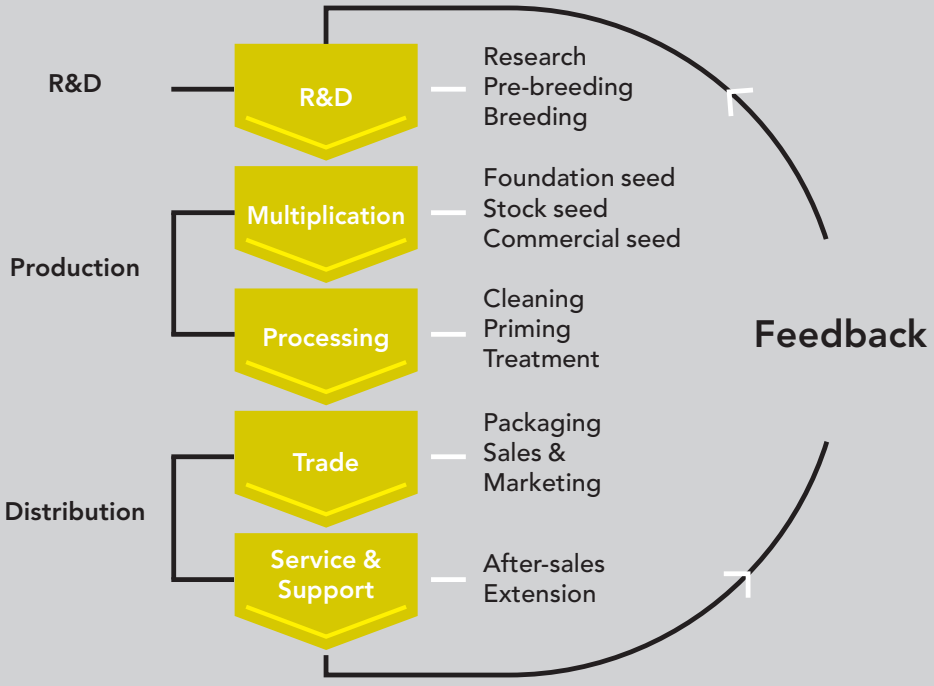
What is an integrated seed business model?

The global seed industry can be described as a small group of leading players and a long tail of regional, national and niche players. Different business models exist throughout the seed industry. The leading seed companies generally cover the full seed value chain, from R&D and production through distribution. This is called an integrated seed business model. Further down the long tail, other models include seed production companies that use the breeding results of public research institutes or other companies, for instance on a license basis. Another common model is seed traders who focus on distribution.

A business development model often seen in emerging markets is a seed company that starts out in distribution and expands upstream to multiplication and R&D. Within the leading seed companies, a shift in the revenue model can be observed, with revenues from intellectual property – for instance through licensing – gaining importance. Consequently, the role of R&D for developing new varieties or traits is becoming more prominent.

The seed value chain can be divided into five stages.

Figure 12 Integrated seed business model



1. **R&D** focuses on developing new varieties to bring to the market, a process that in conventional breeding can take from five to fifteen years. The process starts with pre-breeding, which makes genetic material available to breeders. Basic research, identification, collection and preservation of germplasm and the development of in-bred lines are important activities at this stage. The input is used to begin the actual breeding, resulting in genetically pure breeder seed or foundation seed.
2. **Multiplication** follows consecutive stages to produce sufficient quantities of seed for commercial distribution. In this step, seed multipliers use breeder seed to produce stock seed. In turn, stock seed is used to produce commercial seed for open-pollinated or hybrid varieties.
3. **Seed processing** guarantees the quality of the seed in terms of germination, purity, moisture and phytosanitary requirements. In addition to selection, drying, grading, disinfecting and cleaning, more advanced quality-enhancement technologies are used. These include priming, or pre-germination, which allows for faster and uniform germination, and seed treatment measures to protect the seed against pests and diseases. Seeds can be pelleted to allow mechanized sowing.
4. **Seed trade** is the fourth stage. Packaging at this stage is important for preserving quality during the delivery process as well as tailoring the packaging to the needs of certain markets or target groups. Sales and marketing efforts target farmers directly or indirectly through distribution channels or third parties.
5. **Service and support activities** provide seed companies with important feedback that can be used as input for the breeding process. In terms of extension, seed companies, often in cooperation with government and civil society agencies, can help farmers to improve their agricultural practices and maximize productivity.

4.2 Geographic Scope

The Access to Seeds Index measures companies' efforts to reach smallholder farmers in (1) Western Africa, (2) Eastern Africa, (3) South and Southeast Asia and (4) Latin America. These four target areas were identified by matching the challenge of hunger, poverty and yield gap with agricultural potential.

The challenge was determined using three criteria: (1) countries with a value higher than 5.5 in the Global Hunger Index, (2) the presence of smallholder farmers growing target crops at subsistence and low-input levels and (3) areas with a considerable yield gap. Three other criteria were used to identify potential: (1) suitability for agriculture, (2) the presence of cropland and (3) market accessibility.

Recognizing that seed companies generally take a regional approach when entering emerging markets, four regions with contiguous countries that met the criteria for both challenge and potential were selected as target areas. Given the importance of economic cooperation and harmonization, where possible the borders of economic communities were used to delineate the areas.

Table 3 Criteria for target area selection

	Criterion	Source	Threshold
Challenge	Food insecurity	Global Hunger Index 2013 (IFPRI)	>5.5
	Smallholder farmers growing target crops	Spatial Production Allocation Model 2000 (IFPRI)	Subsistence and low-input
	Yield gap	Global Agro-Ecological Zones v3.0 (IIASA/FAO)	<55%
Potential	Crop suitability	Global Suitability Index (IIASA/FAO)	>25
	Share of cropland	World Soil Database	>5% (IIASA/FAO)
	Market accessibility	Travel time to major city (JRC/LRM)	<4 hours

Western Africa

The area identified in Western Africa roughly corresponds with the borders of the Economic Community of West African States (ECOWAS). As a result, Chad and Cameroon, which also show potential, are not included.

Index countries:
Benin, Burkina Faso, Cape Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, Togo.

Eastern Africa

The area in this region corresponds with the boundaries of the United Nations Geoscheme. Following this scheme, the Democratic Republic of the Congo is excluded. Eritrea and Somalia are out of scope since they do not fit the crop suitability criterion.

Index countries:
Burundi, Ethiopia, Kenya, Madagascar, Malawi, Mozambique, Rwanda, South Sudan, Tanzania, Uganda, Zambia and Zimbabwe.

South and Southeast Asia

All contiguous countries that meet the criteria for challenge and potential have been included in this area. The exceptions are Malaysia, which scored too low in the Global Hunger Index, and Indonesia, which scored above the yield gap threshold.

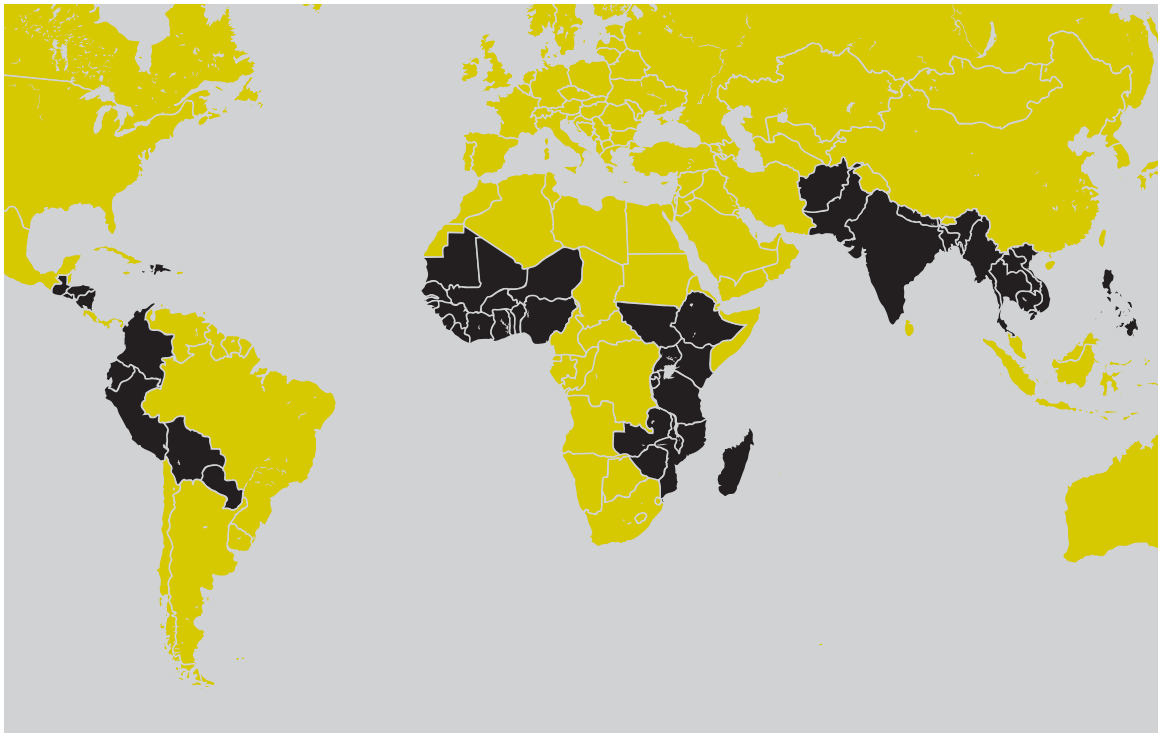
Index countries:
Afghanistan, Bangladesh, Cambodia, India, Laos, Myanmar, Nepal, Pakistan, Philippines, Thailand, Vietnam.

Latin America

All contiguous countries that meet the criteria for challenge and potential have been included in this area. This is with the exception of Panama and Costa Rica, which scored too low in the Global Hunger Index.

Index countries:
Belize, Bolivia, Colombia, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Nicaragua, Paraguay, Peru.

Figure 13: Target areas



4.3 Crop Scope

Determined primarily by the needs and business models of smallholder farmers, the crop scope encompasses both field and vegetable crops. This is with the exception of oil crops such as canola and raw material crops such as cotton. Lists of global field and vegetable crops – relevant for the regions and likely to be in the current portfolio of seed companies – were composed based on the area harvested. Stakeholders also proposed the inclusion of local crops, which are important at the local level but currently sparse in the portfolio of commercial seed companies.

Depending on the production systems and agricultural conditions in which they operate, it may be advantageous for some smallholder farmers to focus on a single field or vegetable crop. Other farmers choose a mixed model of field and vegetable crops to spread risks or supply the market as well as their own family and community. Both field and vegetable crops are necessary for global food and nutrition security.

As local crops form an important part of farmers' business models, despite currently being neglected in breeding programs and commercial seed production, stakeholders suggested including these crops to encourage seed company activities in this area. Local crops are often referred to as 'neglected and underutilized species' or 'orphan crops'. Since they may be anything but underutilized at a local level, the Index methodology considers 'local crops' to be crops that are currently found to a limited extent in the portfolio of the commercial seed sector versus 'global crops' that are currently in the portfolio of seed companies. It is likely that more can be expected initially from seed companies for crops that are already in their portfolio.

Global field crops

The list of global crops was compiled from two sources. Annex 1 of the International Treaty on Plant Genetic Resources for Food and Agriculture lists the common crops regarded as vital for global food security. This list, however, is not exhaustive and many vegetable crops in particular are missing. Using FAOSTAT data, Annex 1 of the International Treaty was matched with important crops in target countries in sub-Saharan Africa, South and Southeast Asia and Latin America, based on arable land.

As a result, nine field crops important for smallholder farmers in the Index regions have been identified. These include all field crops with arable land over 1 million hectares that are relevant as a staple crop and, according to input from expert consultations, have potential for commercial breeding. Sorghum and millet are also on the list. These dry-land cereals are often referred to as 'neglected and underutilized', but are significant for all Index regions and already present in some seed companies' portfolios. The inclusion of dry beans brings the list into line with the crop list for the Regional Access to Seeds Index for Eastern Africa. Although dry beans are not common in the portfolios of leading global companies, they are in the portfolios of regional companies and represent an important staple crop in Eastern Africa.

Table 4. Global field crops (area harvested in target countries in Sub-Saharan Africa, Latin America, South and Southeast Asia. Source: FAOSTAT, 2013)

No	Crop	Area harvested (ha)	Crop type
1	Rice, paddy	105,546,101	Cereal
2	Maize	47,540,063	Cereal
3	Wheat	42,815,450	Cereal
4	Millet	27,196,623	Cereal
5	Sorghum	23,550,605	Cereal
6	Beans, dry	19,142,515	Legume
7	Soybean	16,682,195	Legume
8	Potatoes	4,728,099	Roots & tubers
9	Barley	2,176,791	Cereal

Global vegetable crops

The global vegetable crop list is mainly compiled from FAOSTAT data as the number of vegetable crops in the International Treaty is limited. Okra, which is third on the list based on area harvested, is often referred to as a 'neglected and underutilized species.' Due to its importance, mainly in West Africa and Southern Asia, and because some companies have it in their portfolio, this vegetable is included on the global list rather than the local crops list.

Table 5. Global vegetable crops (area harvested in target countries in Sub-Saharan Africa, Latin America, South and Southeast Asia. Source: FAOSTAT, 2013)

No	Crop	Area harvested (ha)
1	Onion, shallot, garlic, leek & other alliaceous vegetables	1,898,264
2	Tomato	1,521,162
3	Okra	978,444
4	Eggplant (aubergine)	761,698
5	Pumpkin, squash and gourd	706,471
6	Brassica complex (incl. cabbage, cauliflower & broccoli)	594,205
7	Pea, green	509,935
8	Green and string bean	498,532
9	Chili and pepper, green	307,855
10	Watermelon	237,879
11	Lettuce and chicory	202,307
12	Melon	124,834
13	Carrot and turnip	124,136
14	Cucumber	77,908
15	Spinach	23,091

Local crops

Due to their geographic specificity, a myriad local crops are currently excluded or included only to a limited extent in the portfolio of commercial seed companies. Following expert consultations, an initial list of important local crops was composed. This list is non-exhaustive and gives an indication of the crops on which seed companies could focus.

Table 6. Local crops per region (non-exhaustive. Source: expert consultations, 2013)

	Sub-Saharan Africa	Asia	Latin America
Cereals	Fonio Teff Triticale	Pearl millet Triticale Buckwheat	Quinoa
Legumes	Cowpea Groundnuts Lablab Long bean Marama	Mung bean Chickpea	
Roots & tubers	Sweet potato Yam Cassava		Yacón
Vegetables	Amaranth African eggplant Celosia Egusi melon Moringa Sukuma wiki Gboma West African okra Jew's mallow	Bitter melon Lemongrass Gourds Amaranthus Coriander Celery Chinese kale Okra Eggplant Purslane Palak Fenugreek Kangkong	Papalo

The crop lists have two functions. Using the global crops lists, seed company portfolios are first evaluated on relevance for the Index regions. If a portfolio is less relevant for the regions, this is reflected in the scores in the eventual ranking. The global and local lists are then used in the Index indicators to determine whether companies have activities relevant for smallholder farmers in the Index regions. These activities can be in either R&D or distribution and promotion.

5. Methodology

The Access to Seeds Index uses a framework that allows for benchmarking, comparison and trend analysis over time. The framework is composed of seven measurement areas identified by stakeholders as those in which companies can play a positive role in increasing access to seeds.

A. Governance and strategy

This measurement area focuses on the integration of access to seeds issues into companies' core policies, strategies, governance structures and management systems. The objective of this measurement area is to capture companies' overall commitment to global food and nutrition security, and more specifically their commitment to farmer development, by sharing their knowledge, technologies, varieties and seeds. The Index seeks to understand the strategic reasoning behind companies' access to seeds initiatives, as they tend to be most effective and sustainable when developed as part of a clear corporate strategy.

Global food and nutrition security

Seed companies can contribute in many ways to the global food and nutrition security agenda and sustainable intensification of agriculture, including outside the Index regions. The incorporation of global food and nutrition security issues into company policy shows the company's willingness to contribute to these issues. A clear strategy drives company actions and enables partners to engage with the company and stakeholders to hold the company accountable.

Access to seeds for smallholder farmers

A commitment to global food and nutrition security should encompass a more specific commitment to increasing smallholder farmers' access to knowledge, technologies, varieties and seeds, thereby facilitating sustainable agricultural intensification. A clear commitment and strategy to help improve the situation of smallholder farmers explicates how the company can contribute based on its portfolio, assets and capabilities.

Governance and accountability

Improving access to seeds requires governance structures that build accountability and incentivize companies to fulfill their commitments to food and nutrition security and smallholder farmers. Assigning responsibility and accountability for access to seeds to the board or senior executives helps to ensure that such commitments are integrated into a company's corporate strategies. Clearly formulated goals and targets, supported by incentives to reward activities that promote access to seeds or global food and nutrition security more generally, can improve implementation and assessment.

2015 Indicators

A.I Commitment

A.I.1 Global food and nutrition security
The company has a policy statement in which it articulates a commitment and strategy to enhance global food and nutrition security.

A.I.2 Access to seeds for smallholder farmers
The company has made a formal commitment to contribute to the sustainable intensification of smallholder farm production, in particular through increased access to quality seeds.

A.I.3 Corporate targets
The company has set targets to enhance its contribution to global food security and to increase access to seeds for smallholder farmers in Index countries.

A.II Performance

A.II.1 Governance and accountability
The company has a management system in place, overseen by a senior executive and a committee of the board, to implement and measure the outcomes of its programs and activities related to access to seeds for smallholder farmers in Index countries.

A.II.2 Management incentives
The company has systems in place to incentivize management to advance its strategy and goals regarding global food and nutrition security, the sustainable intensification of agriculture in Index countries and/or increasing access to quality seeds for smallholder farmers in Index countries.

A.II.3 Programs and resources
The company's dedicated programs and allocation of resources demonstrate a strategic and proactive approach to increasing smallholder farmers' access to quality seeds.

A.III Transparency

A.III.1 Reporting on commitments and strategy
The company discloses its high-level policies, strategy, targets and management systems related to global food security and to increasing access to quality seeds for smallholder farmers in Index countries.

A.IV Innovation

A.IV.1 Innovation in access to seeds strategies
The company has established innovative strategies and approaches to improve smallholder farmers' access to its knowledge, technologies, varieties and seeds.

B. Public and Stakeholder Engagement

This measurement area seeks to capture how companies engage with policymakers and other stakeholders to influence national and international policies and markets in ways that can affect access to seeds for smallholder farmers. Companies can be actively involved in collaborative initiatives, international alliances or seed associations that play a role in seed sector development in Index regions.

Industry engagement

Companies are in a position to promote awareness of the role that the seed industry can play in increasing global food security and access to seeds. Through active membership in seed associations and industry organizations, including participation on boards, in relevant committees and working groups, seed companies can contribute to greater understanding of the specific needs of smallholder farmers in Index countries and the opportunities to participate in solutions.

Multi-stakeholder initiatives

In order to contribute to global food security and improved access to seeds, it is important that seed companies engage and collaborate with stakeholders, including universities, international research organizations, farmer organizations, local and international NGOs and industry peers. An example of such collaboration is the establishment of public-private partnerships.

Lobbying and public dialogue

Seed companies have a significant influence on public policy matters relevant to access to seeds. The policy positions that they advocate through their lobbying activities, as well as their participation in trade associations, think tanks, interest groups or other organizations, are an important element of their contribution to global food security and access to seeds. It is important that companies be transparent about their lobbying activities and their membership in and financial support for trade associations and other organizations that advocate public policy positions that may impact access to seeds. Moreover, seed companies are in a position to engage actively in the public debate on global food security.

2015 Indicators

B.I Commitment

B.I.1 Stakeholder and industry engagement

The company commits to work with stakeholders, including universities, national and international research organizations, farmer organizations, local and international NGOs, industry peers and governments, with the goal of increasing global food security and improving access to seeds for smallholder farmers.

B.I.2 Policy on political involvement

The company has a formal policy statement governing its lobbying activities and political involvement.

B.II Performance

B.II.1 Public policy advocacy

There is no evidence that, through its lobbying activities, the company has advocated legislation and regulations that serve to restrict access to quality seeds.

B.II.2 Participation in multi-stakeholder initiatives

The company is involved in international multi-stakeholder initiatives that focus on increasing global food security and improving access to seeds for smallholder farmers.

B.II.3 Participation in public and industry dialogue

Senior executives at the company are actively involved in public and industry dialogue on global food and nutrition security and access to seeds in particular.

B.II.4 Lobbying practices/bribery and corruption

There is no evidence that the company has breached local regulations or international standards through its lobbying activities or been involved in bribery and corruption.

B.III Transparency

B.III.1 Lobbying positions

The company discloses its lobbying positions on public policy matters that may impact access to seeds for smallholder farmers in Index countries.

B.III.2 Membership and support

The company discloses its membership in and financial support for trade associations, think tanks, interest groups or other organizations that advocate public policy positions at national, regional or international levels and that may impact access to seeds for smallholder farmers in Index countries.

B.IV Innovation

B.IV.1 Innovation in public and stakeholder engagement

The company has adopted an innovative approach to engage stakeholders and promote the public policy debate on global food security and access to seeds for smallholder farmers.

C. Genetic Resources and Intellectual Property

Access to genetic resources is vital for breeding companies and smallholder farmers to develop new varieties. At the same time, intellectual property (IP) protection enables companies to generate a return on R&D investment through licensing. IP protection can, however, have implications for established smallholder practices such as farm-saved seeds and the breeders' exemption. This measurement area therefore seeks to clarify and assess the positions of companies on these issues.

Preservation of agricultural biodiversity

The growth of the formal seed sector can reduce the local crop diversity currently conserved in informal seed sectors. Seed companies can help preserve local crop diversity and the informal seed system by supporting public gene banks and community seed banks. Additionally, breeding companies can help preserve biodiversity e.g. by engaging with local governments, supporting the Global Crop Diversity Trust and continuing to breed local varieties from the gene banks of an acquired local company.

Access to genetic resources

Access to genetic resources is important for breeding companies, public research institutions and smallholder farmers to develop varieties that are tailored to local conditions and crop preferences. Support for public gene banks and community seed banks, access to company gene banks and commercial varieties for further breeding can all facilitate the development of new varieties appropriate for smallholder farmers.

Intellectual property rights

The handling of intellectual property rights can significantly impact access to seeds for smallholder farmers. The long-established breeders' exemption makes commercial varieties available for further breeding; the farmers' privilege allows on-farm seed saving. This access can be restricted, for instance by the use of contractual clauses and patents not just on plant varieties but also on traits, methods and technologies. Conversely, specific licensing strategies can improve access to patented varieties, traits, methods and technologies for breeding for smallholder farmers.

2015 Indicators

C.I Commitment

C.I.1 Preservation of agricultural biodiversity
The company is committed to the preservation of agricultural biodiversity in general and crop diversity in particular.

C.I.2 Access to genetic resources
The company commits to facilitating access to genetic resources – both public and private – for the purpose of allowing variety development tailored to the needs of smallholder farmers in Index countries.

C.I.3 Breeders' rights
The company commits to recognizing breeders' rights in conformity with the UPOV convention.

C.I.4 Farmers' privilege
The company commits to recognizing the farmers' privilege in conformity with the UPOV convention.

C.II Performance

C.II.1 Preservation of genetic resources
The company is involved in programs and/or initiatives that encourage the preservation of agricultural biodiversity, in particular genetic diversity of crops relevant to Index countries.

C.II.2 Support for public gene banks
The company supports, through monetary and/or in-kind contributions, public gene banks and/or global funds serving gene banks in Index countries.

C.II.3 Access to company genetic resources
The company gives access to its own genetic resources for the purpose of breeding crops tailored to the needs of smallholder farmers in Index countries.

C.II.4 Breeders' rights
The company's practices demonstrate respect for plant breeders' rights, most notably the breeders' exemption, in plant variety protection (PVP) and patent laws.

C.II.5 Farmers' privilege
The company's practices reflect a recognition of the important role that farm-saved seed currently plays for many smallholder farmers in Index countries and the company respects this practice.

C.II.6 Benefit sharing
The company contributes to the Benefit-sharing Fund created by the International Treaty on Plant Genetic Resources for Food and Agriculture (IT-PGRFA).

C.III Transparency

C.III.1 Positions on genetic resources and IP

The company discloses its policies and practices regarding access to genetic resources and intellectual property for the purpose of developing varieties suitable to smallholder farmers in Index countries.

C.IV Innovation

C.IV.1 Innovation in genetic resources and IP

The company has adopted innovative models for sharing its genetic resources and/or providing access to IP.

D. Research and Development

This measurement area focuses on companies' research and development efforts, especially activities that consider local conditions in Index regions and the key crops for farmers in those regions. These activities include adapting global crops for local use and breeding programs aimed at improving e.g. the yield and climate resilience of local crops. Additional activities, such as cooperation with local and/or public research institutions, evaluation of the needs of local farmers and consumers and the development of appropriate seed treatment technologies, are also considered.

Improved varieties for smallholder farmers

Breeding activities tailored to the needs and preferences of smallholder farmers in Index regions demonstrate the company's commitment to the development of improved varieties. By conducting variety trials, the company can test varieties in its existing portfolio for suitability in Index regions. It can also contribute to the availability of improved varieties in Index regions through dedicated breeding programs focusing on both global and local crops.

Specific traits for smallholder farmers

Dedicated programs to develop specific traits with tolerance to abiotic stresses such as heat, drought, flooding and salinization can significantly improve the yield and performance of local varieties. Similarly, the development of improved varieties with specific traits that increase the nutritional value of crops can contribute greatly to food and nutrition security.

Seed quality

Improving seed quality, for instance by developing and using novel diagnostic tests or applying seed treatments, supports a secure and optimal yield. Seed treatments that may be applied are heat treatments, priming, pelleting and coating seeds with crop protection agents. Such technologies can contribute to improved crop performance and stable yields.

Local cooperation

Specific needs, preferences and knowledge can be incorporated into the company's breeding program by involving local farmers, consumers and other stakeholders in the variety selection. Similarly, cooperation with local research institutes and farmer organizations can be of tremendous value. In some cases, local research institutes may already have developed germplasm that is available for use in breeding programs.

2015 Indicators

D.I Commitment

D.I.1 Improved varieties for smallholder farmers
The company commits to the development of varieties appropriate to the local conditions and preferences of smallholder farmers in Index countries.

D.I.2 Breeding program for specific traits
The company commits to developing specific traits useful to smallholder farmers in Index countries, such as traits that increase crop robustness, climate change resilience or nutritional value.

D.II Performance

D.II.1 Testing of existing portfolio
The company makes an effort to test its existing varieties for suitability in Index countries.

D.II.2 Developing improved varieties of global crops
The company has a breeding program that aims to develop varieties of global crops appropriate to the local conditions and preferences of smallholder farmers in Index countries.

D.II.3 Developing improved varieties of local crops
The company's breeding program includes research on local crops that are relevant to food and nutrition security in Index countries.

D.II.4 Breeding program for specific traits
The company's breeding program includes developing specific traits useful to smallholder farmers in Index countries.

D.II.5 Seed quality enhancement
The company has programs for seed quality enhancement that address the conditions of smallholder farmers in Index countries.

D.II.6 R&D budget
The company allocates a portion of its R&D budget to the development of varieties/traits and/or the improvement of seed quality in order to meet the needs of smallholder farmers in Index countries.

D.II.7 Local knowledge
The company has mechanisms in place to ensure that the knowledge and preferences of local consumers, traders and smallholder farmers are incorporated into its breeding programs in Index countries.

D.II.8 Collaborative research
The company is involved in collaborative research with local public or private partners such as research institutions, non-governmental organizations and/or farmer organizations in Index countries.

D.II.9 Use of germplasm of local research institutes

The company incorporates inbred lines and/or varieties of local public research institutions into its breeding program.

D.III Transparency

D.III.1 Transparency in R&D

The company reports publicly on its R&D efforts that address the needs of smallholder farmers in Index countries.

D.IV Innovation

D.IV.1 Innovation in R&D

The company has adopted innovative sustainable or open business models to further the global R&D agenda for the development of seed products for Index regions.

E. Marketing and Sales

This measurement area assesses the ways in which companies make quality seeds of improved varieties available and affordable to smallholder farmers and promote adoption. This could include tailored packaging and trusted distribution networks. Promotion of new varieties can be done through demonstrations and on-farm trials, which help to raise awareness among smallholder farmers of advancements in breeding and the use of other inputs. Other relevant practices are similar to those used in developed countries, including professional testing of varieties before release, quality assurance and after-sales support systems.

Release of new varieties

New varieties are most beneficial when tailored to the needs of smallholder farmers in Index countries. These varieties may be the result of companies' global breeding programs or varieties that were developed by companies' local breeding programs or local research institutes. Smallholder farmers often use open-pollinated varieties (OPVs), from which they can save seeds for their own use in the next growing season. This seed-saving system is not technically possible with F1 hybrids, which are the commercial standard for many crops because they produce better yields. The indicators consider how companies deal with this issue and whether their portfolio includes OPVs appropriate for release in Index countries.

Quality of varieties and seeds

Some Index countries have legislation regarding quality control and the testing of new varieties and seed lots, but most do not. It is the role of the breeding company to ensure that only varieties suited to local conditions are released into the market, and that the seeds of these varieties meet certain minimum standards. This can be done through professional variety testing and adherence to internationally adopted quality control protocols and codes. Seed quality should also be consistent throughout the distribution channel.

Packaging, distribution and affordability

When entering a new market, an existing distribution network can be used or new distribution channels can be created. This is of particular relevance when trying to reach smallholder farmers in remote regions. Depending on the local situation, it may be necessary to target specific groups such as female farmers and youth, who play a significant role in agricultural productivity. Distribution channels must be robust and reliable in order to prevent the sale of counterfeit seeds. Training distributors in inventory management and taking responsibility for the distribution channel can prevent misuse. The packaging should include clear instructions and warnings in the local language and in pictograms. Finally, smallholder farmers generally require smaller quantities of seeds and a pricing strategy adapted to their local situation. Affordability can also be improved when breeding companies partner with other organizations to introduce finance or insurance services.

Adoption strategies and access to adjacent technologies

A promotional strategy, including field days and initiatives targeting lead farmers, improves local knowledge about different varieties and their potential. During demonstrations and on-farm trials, the use of adjacent technologies such as agrochemicals, fertilizers and irrigation can be introduced.

After-sales support

In order to ensure that the varieties and seeds they produce meet local needs and demands, companies should have customer feedback and grievance mechanisms in place. This feedback can serve as an important part of the learning process for breeders.

2015 Indicators

E.I Commitment

E.I.1 Marketing of commercial varieties
The company has made a commitment to market varieties and seeds in Index countries that are appropriate to the needs of smallholder farmers.

E.I.2 Quality of varieties and seeds
The company has policies and protocols to ensure that, when entering new markets, it tests its varieties and seeds in accordance with international best practices, even where local standards are lower, to ensure their suitability and quality.

E.I.3 Marketing policy
The company has a policy or code of conduct that governs its marketing activities in Index countries.

E.II Performance

E.II.1 Marketing of commercial varieties
The company distributes, directly or through partnerships, licensing or other mechanisms, varieties suitable to the conditions and preferences of smallholder farmers in Index countries.

E.II.2 Marketing varieties of research institutes
The company assists in bringing the varieties of international or national research institutions to markets in Index countries.

E.II.3 Open-pollinated varieties
Through its marketing practices in Index countries, the company accommodates the differing capacity levels of smallholder farmers by offering, for instance, open-pollinated varieties (OPVs) appropriate to their local conditions and preferences.

E.II.4 Distribution channels
The company has established distribution channels in Index countries that effectively make its seeds accessible to smallholder farmers, including in remote areas.

E.II.5 Packaging
The company packages its products in quantities appropriate to the needs of smallholder farmers and its packaging includes information in a local language and in pictograms.

E.II.6 Other agricultural inputs
The company makes an effort to ensure that smallholder farmers learn about and have access to necessary agricultural inputs other than seed.

E.II.7 Quality assurance

The company has implemented management systems to ensure that its seed quality is maintained throughout the distribution system and that counterfeit seeds are not sold under its brand.

E.II.8 Adoption strategies

The company has programs, such as field days or other demonstration services, to promote adoption of new varieties and adjacent technologies.

E.II.9 Affordability

The company is involved in programs, either directly or through partnerships, to help make seeds more affordable to smallholder farmers, such as financing or insurance services or differential pricing schemes.

E.II.10 After-sales support and stewardship

The company has customer feedback and grievance mechanisms available to smallholder farmers.

E.II.11 Marketing practices

There is no evidence that the company has engaged in misleading marketing or advertising in Index countries.

E.III Transparency

E.III.1 Transparency in marketing and sales

The company discloses in its public reporting the countries in which it has a sales and distribution presence.

E.IV Innovation

E.IV.1 Innovation in marketing and sales

The company has introduced innovative approaches to the testing, distribution, promotion and adoption of seed products, which may support the sustainable delivery of such products in Index countries.

F. Capacity Building

This measurement area focuses on the ways in which seed companies invest in local capacity building to ensure that farmers have the right knowledge and tools to realize the full potential of quality seeds of improved varieties. Offering or participating in extension services and agronomic training and education such as field schools can help achieve this goal. This area presents many opportunities for public-private partnerships.

Capacity building

Activities that build the capacity of smallholder farmers and farmer cooperatives include extension services, training and educational programs. The development of such activities and programs shows the willingness of companies to invest in the capacities of smallholder farmers and to help improve the yield and performance of local crops. Extension services can be offered by breeding companies themselves or in partnership with local organizations. Training and educational programs for smallholders, such as field schools and field days, can be organized for specific target groups such as women, young farmers or community trainers. Seed companies can connect different programs and topics so that technical expertise and adjacent technologies are included in extension services. (Mobile) ICT applications that provide agronomic support and advice to farmers deserve a special mention.

Farmer organizations

Farmer organizations can help smallholders to acquire skills, access financial agricultural inputs such as credit, seeds and fertilizers, and to process and market their products more effectively through the development of linkages to output markets.

Access to output markets

Most farmers grow crops not only for their own use but also for commercial sale. Breeding companies can help farmers to increase the profitability of their business by linking them to output markets and assisting in the development of a local or regional market. Additionally, breeding companies can partner with other organizations to offer farmers training on post-harvest handling and product hygiene.

2015 Indicators

F.I Commitment

F.I.1 Capacity building

The company commits to assist smallholder farmers to increase their production and income in a sustainable manner.

F.II Performance

F.II.1 Agricultural advisory services

The company offers, directly or through local public or private partners, agricultural advisory/extension services to smallholder farmers in Index countries and helps farmers to transform and improve their use of agricultural technologies.

F.II.2 Farmer education

The company contributes to formal agricultural education programs and/or institutions, most notably concerning the importance of proper variety trials, including adjacent technologies.

F.II.3 ICT

The company supports, directly or through partnerships, initiatives that advance the use of information and communications technology to help build the capacity of smallholder farmers and increase their access to seed and adjacent technologies.

F.II.4 Programs for specific target groups

The company supports programs, directly or through partnerships, that are specifically designed to build capacity among female farmers and next-generation farmers to access and utilize seeds and adjacent technologies.

F.II.5 Farmer organizations

The company supports, directly or through partnerships, the development of farmer organizations focused on improving agricultural practices in Index countries.

F.II.6 Access to output markets

The company is engaged in developing the food value chain through its involvement, directly or through partnerships, in collaborative initiatives that link smallholder farmers to output markets.

F.III Transparency

F.III.1 Transparency in capacity building

The company publicly reports on its programs to assist in building capacity among smallholder farmers.

F.IV Innovation

F.IV.1 Innovation in capacity building

The company has introduced innovative approaches to build capacity among smallholder farmers, promoting and enabling the use of quality seeds of improved varieties and adjacent technologies in Index regions.

G. Local Seed Sector Advancement

This measurement area seeks to capture the extent to which seed companies are involved in advancing a professional seed sector on a local level. Companies can contribute to the development of essential infrastructure such as local research capacity or registration and certification offices. In addition, through local breeding activities or by including smallholder farmers as seed multipliers in their value chain, companies can facilitate capacity building.

Recognition of local seed sectors

Local and informal seed sectors play a vital role in Index countries as they provide a significant share of the seeds used by smallholder farmers. Recognition of this role reflects the commitment to the food security of smallholder farmers who continue to rely on informal seed sectors for a large number of crops.

Advancing the local seed sector

Seed companies can have a beneficial impact on the development of local formal seed sectors by introducing new technologies and expertise. Additionally, companies can encourage local seed production in Index countries by enabling smallholder farmers to produce seeds under fair conditions. Working with local seed growers generates incomes and contributes to capacity building. The construction of local production facilities can also create employment opportunities and encourage knowledge transfer. Through partnerships with local seed companies, these facilities can access advanced technologies and expertise. Companies can also play a beneficial role by actively participating in local or regional seed trade associations.

Supporting certification and registration systems

Seed production registration and certification systems are often absent or underdeveloped in Index countries. Seed companies can help to develop these systems by offering knowledge of and experience with registration systems in other countries. They can also influence the changing regulatory environment by encouraging legislation that does not hamper development and innovation.

Advancing local research institutions

Seed companies can enhance local research capacity in seed sectors in Index countries by providing local organizations with resources or knowledge. This can be done by partnering with local institutions such as universities to establish R&D-focused activities. Another possibility is to partner in offering variety-testing services to stakeholders, including public breeding institutions and other governmental agencies. Training local employees in breeding techniques and variety testing can indirectly influence the advancement of local research institutions and breeding companies through knowledge transfer.

2015 Indicators

G.I Commitment

G.I.1 Informal seed systems
In its policy statements the company recognizes the importance of informal seed systems in Index countries.

G.I.2 Formal seed sector development
The company commits to helping to advance the development of the formal seed sector in Index countries.

G.II Performance

G.II.1 Smallholder in value chain
The company involves smallholder farmers in its seed value/production chain.

G.II.2 Local seed industry
The company supports the development of the local seed industry in Index countries through, for example, cooperation and partnerships with local seed enterprises.

G.II.3 Registration and certification systems
The company supports local government efforts to develop and/or strengthen legislation, registration, certification, phytosanitary and biosafety systems in local seed sectors.

G.II.4 Local research institutions
The company supports the development of local research capacity in the seed sectors in Index countries.

G.III Transparency

G.III.1 Transparency in local seed sector development
The company discloses its policies and approach to dealing with and supporting local seed sectors and their development.

G.IV Innovation

G.IV.1 Innovation in capacity enhancement
The company has introduced innovative approaches to local capacity enhancement, working with Index regions organizations to improve the quality and performance of local seed sectors.

Acronyms

ATSI	Access to Seeds Index
CEO	Chief executive officer
CHE	Switzerland
CSR	Corporate social responsibility
DG	Directorate-general
ECOWAS	Economic Community of West African States
ERC	Expert Review Committee
EU	European Union
FAO	Food and Agriculture Organization
FAOSTAT	Food and Agriculture Organization Corporate Statistical Database
FDI	Foreign direct investment
FRA	France
GAEZ	Global Agro-Ecological Zones
GER	Germany
GMO	Genetically modified organism
Ha	Hectare
ICT	Information and communications technology
IFPRI	International Food Policy Research Institute
IIASA	International Institute for Applied Systems Analysis
IP	Intellectual property
IPR	Intellectual property rights
ISHI	International Seed Health Initiative
ISTA	International Seed Testing Association
IT-PGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
IUCN	International Union for Conservation of Nature
JPN	Japan
Mln	Million
NARS	National Agricultural Research Systems
NED	The Netherlands
NGO	Non-governmental organization
PPP	Public-private partnership
PVP	Plant variety protection
R&D	Research and development
SPAM	Spatial Production Allocation Model
UNDESA	United Nations Department of Economic and Social Affairs
UPOV	International Union for the Protection of New Varieties of Plants
USA	United States of America
USD ($)	United States dollar

Definitions

These definitions are meant to provide a clear understanding of phrases used in the Access to Seeds Index and may be updated from time to time.

Access to seeds strategy
A strategy that aims to increase access to seeds for smallholder farmers and incorporates the following six dimensions: availability, affordability, suitability, capability, profitability and autonomy. Please refer to the 'Access Dimensions' section for more details.

Adoption strategy
A strategy that enables smallholder farmers to start using a new agricultural product, for example tailored packaging and the establishment of trusted distribution networks.

Advocacy (1)
Any activity carried out to change public opinion or gain public support.

Agricultural biodiversity (2)
Agricultural biodiversity is the diversity of crops and their wild relatives, trees, animals, microbes and other species that contribute to agricultural production.

Benefit sharing (3)
The fair and equitable sharing of benefits derived from the utilization of plant genetic resources obtained from collections under the multilateral system of the IT-PGRFA.

Biosafety system (4)
Any legislation, regulation or policy intended to regulate and control the transfer, handling and use of living modified organisms that may have adverse effects on biological diversity. Such a system aims to ensure the safety of human and animal health and an adequate level of environmental protection.

Breeders' exemption (5)
Exception to the breeders' rights (see below), allowing plant breeders to use freely plant varieties for propagating new and distinct plant varieties.

Breeders' rights (5)
Rights granted to the breeder of a new variety of plant that give the breeder exclusive control over the propagating material (including seed, cuttings, divisions, tissue culture) of that new variety for a number of years.

Bribery (6)
The offering, promising, giving, accepting or soliciting of an advantage as an inducement for an action which is illegal, unethical or a breach of trust. Inducements can take the form of gifts, loans, fees, rewards or other advantages (taxes, services, donations, etc.).

Code of conduct (6)
Statement of principles and values that establishes a set of expectations and standards for how an organization, government body, company, affiliated group or individual will behave, including minimal levels of compliance and disciplinary actions for the organization, its staff and volunteers.

Collaborative research
Research that involves the cooperation of researchers, institutions, organizations and communities with farmers and/or farmer organizations.

Corruption (6)
The abuse of entrusted power for private gain. Corruption can be classified as grand, petty and political, depending on the amounts of money lost and the sector where it occurs:
- Grand corruption: Acts committed at a high level of government that distort policies or the central functioning of the state, enabling leaders to benefit at the expense of the public good.
- Petty corruption: Everyday abuse of entrusted power by low- and mid-level public officials in their interactions with ordinary citizens, who often are trying to access basic goods or services in places like hospitals, schools, police departments and other agencies.
- Political corruption: Manipulation of policies, institutions and rules of procedure in the allocation of resources and financing by political decision makers, who abuse their position to sustain their power, status and wealth.

Ex situ conservation (3)
Conservation of plant genetic resources for food and agriculture outside their natural habitat.

F1 hybrid
Hybrid of two homozygous parent lines. The F1 hybrid combines desired traits of both parent lines and has a uniform phenotype.

Farm-saved seed (5)
Seed that is produced on a farm for the purpose of re-sowing on the same farm and not for the purpose of sale.

Farmers' privilege (5)
The practice by farmers of harvesting and saving seeds for their own use in the next growing season.

Formal seed system (7, 8)
A framework of institutions, both public and private, and well-defined methodologies, linked together by their involvement in or influence on the multiplication, processing and distribution of improved seed.

Genetic resources or Germplasm (9)
Any material of plant origin, including reproductive and vegetative propagating material, containing functional units of heredity.

Global Crop Diversity Trust (10)
An independent international fund which has as its objective the provision of a permanent source of funds to support the long-term conservation of ex situ germplasm. This includes characterization, documentation, evaluation and exchange of related information, knowledge and technologies.

Global field crops or staple crops (11)
Plants grown for food that constitute the dominant part of the human diet and supply a major proportion of energy and nutrient needs.

Global vegetable crops (12)
Any of various herbaceous plants having fruit, seeds, roots, tubers, bulbs, stems, leaves or flower parts that are used as food.

Improved variety (5)
A new variety of plant which produces higher yields, higher quality or provides better resistance to plant pests and diseases while minimizing the pressure on the natural environment.

In situ conservation (3)
The conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated plant species, in the surroundings where they have developed their distinctive properties.

Inclusive business model (13)
Business model that integrates the poor, either as consumers or as distributors, suppliers or employees.

Index country
Any country covered by the 2015 Access to Seeds Index. Please refer to the 'Geographic Scope' section for more details.

Informal seed system (7, 8)
An informally structured mechanism, such as retaining seed on-farm from previous harvests, farmer-to-farmer seed exchange based on barter, social obligation, etc., by which farmers can obtain their seed requirements.

Intellectual property rights (IPR) (14, 15)
The rights given to persons over the creation of their minds which the law protects from unauthorized use by others. IP is protected by, for example, patents, copyright and trademarks, which enable the creators to earn recognition or financial benefit from what they invent or create for a certain period of time. Industrial IP is protected primarily to stimulate innovation, design and the creation of technology. In this category fall inventions (protected by patents), industrial designs and trade secrets.

International Treaty (3)
The International Treaty on Plant Genetic Resources for Food and Agriculture (IT-PGRFA), which strives for the conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of the benefits arising out of their use, in harmony with the Convention on Biological Diversity for sustainable agriculture and food security.

Lobbying (16)
Any activity carried out to influence a government or (public) institution's policies and decisions in favor of a specific cause or outcome.

Local crops (17, 18)
A diverse set of small crops that tend to be regionally important but are not traded around the world and receive little to no attention from commercial breeding companies. They often have a strong cultural importance and can be vital for the livelihood of smallholder farmers in developing countries. They are often called 'orphan' or 'neglected' crops.

Measurement area
One of seven measurement areas in which the companies included in the 2015 Index are assessed. These are: governance and strategy, public and stakeholder engagement, genetic resources and intellectual property, research and development, marketing and sales, capacity building and local seed sector development.

Methodology
The Index framework that measures the extent to which the world's leading seed companies use their knowledge, technology, varieties and seeds to benefit smallholder farmers. The Index is guided by four principles, which, through rigorous stakeholder dialogue, led to seven measurement areas in which company activity is assessed. The four principles are: access dimensions, farmer as entrepreneur, farmer development and seed systems. The scope of the Index is defined in terms of the companies included, geographic focus and crop selection.

Multilateral system (3)
A structure, provided by the IT-PGRFA, through which participating parties (130 countries and the EU) agree to provide facilitated access to genetic resources for food and agriculture, and to share the benefits arising from the utilization of these resources on a complementary and mutually reinforcing basis.

Multiplication
Seed production.

Open-pollinated variety (OPV) (19)
A variety naturally cross-pollinated by insects, birds, wind or water or by self-pollination from male and female flower parts on the same plant.

Phytosanitary system (20)
Any legislation, regulation or policy having the purpose to prevent the introduction and/or spread of pests of plants and plant products, or to limit the economic impact of regulated non-quarantine pests.

Public gene bank (21, 22)
A collection of seeds and other plant reproductive material, primarily of cultivated plants and their wild relatives. The mandate of a gene bank is to conserve these collected plant genetic resources and provide access to them.

Quality assurance
A set of tests, measures and procedures, normally based on international and/or national certification standards, to assure the consistent quality of seeds throughout the processes of development, testing, production and packaging.

Quality seed (23)
Seed that consistently meets required standards of genetic and physiological purity (viability and vigor) and good health.

Sustainable intensification of agriculture (24)

Increasing yields using fewer resources and minimizing or reversing negative environmental impacts. This can be achieved by making the current agricultural system more efficient through the use of new technologies or by improving current production systems.

Technology (25, 26)

The application of scientific knowledge through which the genetic and physical characteristics of seeds are improved. It involves such activities as variety development, evaluation and release, seed production, seed processing, seed storage, seed testing, seed certification, seed quality control, seed marketing etc.

Variety (3)

Plant grouping, within a single botanical taxon of the lowest known rank, defined by the reproducible expression of its distinguishing and other genetic characteristics.

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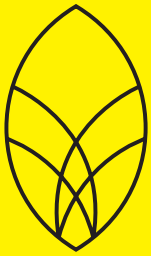

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