

2. SEED STRENGTHENING SEED SYSTEMS



Imagine a farmer, Jelena, who sustains her family by growing corn and vegetables. A newly formed variety release committee will release improved seed varieties in her country. With this reform, Jelena will also be able to consult an online variety catalog indicating which varieties perform best in her region. All seed sold in the country will be certified to ensure quality. With improved seed varieties, subsistence farmers like Jelena can increase the yield and quality of their crops so that they can sell the surplus on the domestic market.

EBA seed indicators measure laws and regulations on the development, evaluation, release and quality control of improved seed varieties. Improved varieties are a key technology for improving agricultural productivity.¹ Smart regulation of the seed sector can ensure that laws and regulations do not obstruct the timely introduction of improved varieties to the market.

Seed registration, the first seed indicator, was selected for study because burdensome and inconsistent regulations can reduce the number of improved varieties that are released and eligible for commercialization. In countries that require registration of new seed varieties, replacing burdensome regulations with smart ones—preventing long and costly procedures while guaranteeing quality seed—can make improved varieties available to farmers in a timely manner and in sufficient quantity for planting.² Smarter regulations that include the private sector in the release process will provide more transparency and incentivize the private sector to release new varieties in the country.

Seed development and certification, the second seed indicator, is comprised of two components—development and certification. The first component measures regulations that support the private sector's involvement in developing new varieties. This is particularly important since public sector investments in agricultural research, including plant breeding, have declined in many countries since 1997, leaving the task to the private

sector. In some countries regulations limit the private sector's role in the development of new seed varieties, preventing companies from accessing initial classes of seeds. The *EBA 2015* progress report presented Ethiopia, where the public sector's monopoly consistently resulted in shortages of initial seed classes for smallholder farmers and agribusinesses.³ Regulations that limit the private sector's access to initial classes of seed or genetic resources stored by national gene banks reduce the resources available to the private sector for developing new varieties.⁴ In addition, protecting the property rights of seed developers spurs further innovation.⁵

The second component of this indicator captures aspects of the seed certification process. The aim of mandatory seed certification is ensuring the genetic purity and varietal identity of seed varieties. But when the process is government-run, overburdened public authorities and non-transparent bureaucracy can delay the commercialization of new varieties and give rise to corruption. One way to ensure the transparency of the certification is through the public availability of costs associated with government-run certification. Seed certification by nongovernmental inspectors and laboratories reduces the burden on the public sector and speeds the certification process.

The data cover the following areas:

- **Seed registration.** This indicator measures the efficiency of the registration, including the variety release

committee, the content, availability and frequency of the variety catalogue updates and the time and cost to register a new variety (which is not scored).

- **Seed development and certification.** This indicator measures the protection of plant breeders' rights, the access to initial classes of seed and germplasms, the licensing systems for public varieties and additional testing requirements for materials imported for research and development. In addition, this indicator addresses the availability of an official fee schedule for certification and whether third parties can perform it.

The *EBA* country scores vary from 28 to 94 points over all 40 countries (figure 2.1). This variation in scores has to do with the performance of the countries in both the seed registration and the seed development and certification indicators. Overall countries tend to score better in the latter, which focuses on the protection of plant breeder rights, the access to genetic material and initial classes of seed and quality controls. Nevertheless, some countries are exceptions, Bangladesh, Burkina Faso, Côte d'Ivoire, Ethiopia, Ghana, Kenya, Lao PDR, Nepal, Nicaragua and Turkey score higher on the seed registration indicators.

Countries can score lower or higher for different reasons. For the lowest performers, such as Bosnia and Herzegovina, Ghana, Niger, Rwanda and Uganda,

FIGURE 2.1 Countries mostly score better on seed development and certification indicators, while seed registration proves more challenging



Source: EBA database.

the low scores are often from a lack of implementation of laws and regulations. Laws in Bosnia and Herzegovina, Ghana, Niger and Rwanda establish variety release authorities, but in practice the authorities are not operational. In addition, the lack of transparency in mandatory procedures also hurts a country's overall score. In four of the five lowest scoring countries (Ghana, Niger, Rwanda and Uganda), certification of cereal crops is mandatory, but there is no official fee schedule for the certification performed by the public sector.

Chile, Denmark, Kenya, Mozambique and the Philippines perform the best overall, all with scores over 80 in both the seed registration and the seed development and certification indicators. In these countries, good seed laws are in place and include provision for the flexibility of the variety release committee, the transparency and efficiency of seed registration and seed certification

activities (when required). They also support the involvement of private sector initiatives in the seed systems. But a good score does not mean those countries cannot improve in certain aspects. In Chile, Denmark and the Philippines the national catalogs listing registered seed varieties do not offer information on agro-ecological zones. Moreover, Kenya does not have an official fee schedule for the certification of seed varieties and Mozambique's national catalog listing registered seed varieties is neither available online nor updated according to the country's cropping seasons.

Links between private and public sector breeding activities are greater in the OECD high-income countries surveyed

Plant breeders create new seed varieties by crossing and selecting specific beneficial traits. Increasing the number of

sources from which private plant breeders can access initial classes of seed produced by the public sector supports private plant breeders' involvement in the country's plant breeding system. But restrictive regulations can obstruct new variety development by the private sector.

In practice links between the private and public sectors take several forms—from producing breeder and foundation seed developed by public sector breeders and made available to private breeders to implementing licensing systems that allow private breeders to use local public varieties to multiply and market their seed. Allowing private breeders access to genetic materials stored in the national gene banks also supports effective collaboration between private and public actors. These practices help private breeders acquire varieties developed or conserved by the public sector and benefit from greater resources for their breeding activities (box 2.1).⁶

BOX 2.1 Good practices for involving the private sector in developing new varieties

- Should grant and protect plant breeders' rights.
- Should allow private companies to use local public varieties to produce breeder/pre-basic seed and foundation/basic seed for the domestic market.
- Should conserve germplasm in national public gene banks and make them accessible to the private sector for research and development of new seed varieties.
- Should allow local public varieties to be licensed to private sector companies for multiplication and commercialization in the domestic market.
- Should facilitate the import of nonregistered materials for research and development.

Regulations that best support private sector involvement in the breeding system are found in Cambodia, Chile, Colombia, Georgia, Greece, Jordan, Kenya, Morocco, Mozambique, the Philippines, Poland, Spain and Sudan.

By contrast, of the 40 countries surveyed, 9 do not grant the private sector access to breeder seed of local public varieties (Bangladesh, Burkina Faso, Ghana, Lao PDR, Mali, Nicaragua, Niger, Tajikistan and Turkey). Nor do Burkina Faso, Lao PDR and Nicaragua grant access to foundation seed of local public varieties. So breeders and seed companies are likely to market fewer seed varieties.⁷

Countries such as Myanmar, the Russian Federation, Tanzania, Ukraine and Zambia impose minor limitations, such as preventing private companies from importing materials for research and development of new varieties without further government field-testing. Similarly, Bolivia, Bosnia and Herzegovina and Denmark do not have systems for licensing public varieties to private seed enterprises for production and sale in the domestic market. Such practice often hampers commercialization of varieties bred by public sector institutes and universities, leaving newly developed

varieties on laboratory shelves rather than in crop fields.

Registration costs vary the most among the lower-middle-income and low-income countries

In countries where registration is compulsory, a new variety of seed must pass specific tests commonly performed over one or more cropping seasons. The first tests are intended to measure the variety's distinctiveness, uniformity and stability (DUS). In most countries, a new variety of seed must also pass the value for cultivation and use (VCU) tests, which identify the advantage of the new seed over already-registered varieties. The data from these tests are reviewed by a scientific committee, which either releases the variety or advises another official body that the variety is eligible to be released.

Across income groups, relative registration costs are the lowest among high-income countries (figure 2.2). Registration costs among countries in this group show little variation—except in Russia, where registering up to five new varieties a year is free—with costs as a percent of income per capita at 6% in Chile, 7% in Poland, 8% in Denmark, 9% in Greece and 10% in Spain.

In Bangladesh, Bolivia, Guatemala, Morocco, Myanmar, Sri Lanka and Ukraine the cost is well below 40% of income per capita. But outliers such as Nicaragua, Sudan and Vietnam, where costs reach 834%, 722% and 426% of income per capita respectively, make lower-middle-income countries the income group with the most expensive registration for a new variety of seed.

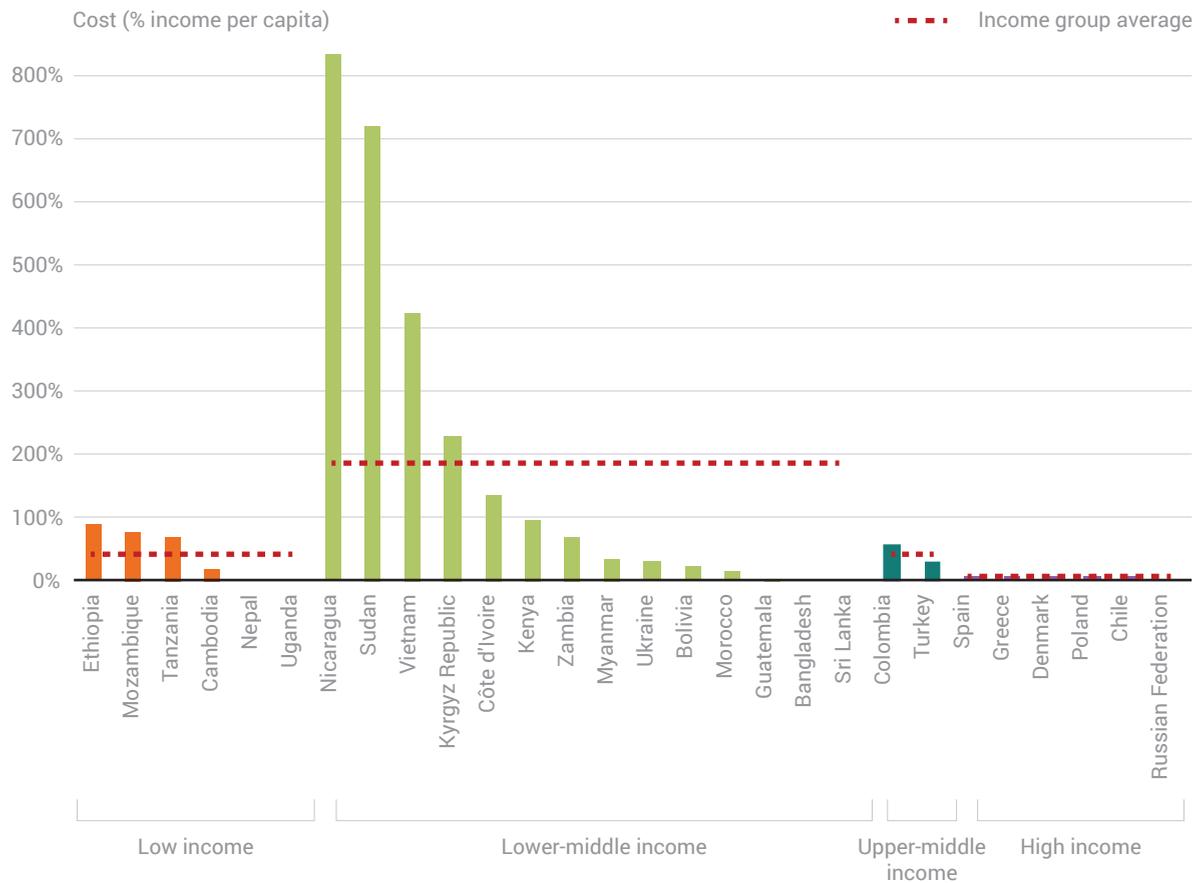
There is also great variation among low-income countries. In Nepal and Uganda registering a new variety is free, whereas registration costs reach 79% and 89% of income per capita in Ethiopia and Mozambique.

Most countries have variety release committees

At the end of the registration process, the variety release committee (VRC) approves the results of several years of new variety development by plant breeders in line with VRC standards.⁸ But a requirement to register a new variety of seed that is not supported by rules that ensure a flexible and effective process may discourage breeders from releasing new varieties. Of the 40 countries surveyed, 39 legally mandate the establishment of a VRC (although in Bangladesh, Guatemala and the Philippines registration of cereal varieties is not mandatory). Among them, Bosnia and Herzegovina, Cambodia and Niger have yet to establish their VRCs in practice. To reduce delays affecting the release of improved varieties into the market and the farmers, the registration and release process needs to allow seed companies to start producing the newly released variety for the next cropping season (box 2.2). In practice, this means that the release of a new variety by a VRC should be possible before each cropping season starts. Among the surveyed countries, 7 have a VRC that is fully flexible and meets on demand, and 22 have a VRC that meets after each cropping season (table 2.1). Registration applicants are thus informed about the VRC decision far enough in advance to start production.

In addition to the frequency of VRC meetings, *EBA* seed indicators measure the involvement of the private sector in the variety release decision-making.

FIGURE 2.2 The lower-middle-income and low-income countries show the greatest variation in official registration costs



Source: EBA database.

In practice, the representation of other stakeholders within the VRC may raise private sector confidence in the variety registration and release process. Of the 36 countries with an established VRC, Colombia, Ethiopia, Jordan, Lao PDR, Myanmar, Russia, Rwanda, Sri Lanka, Tajikistan, Ukraine and Vietnam do not include representatives of the private sector (figure 2.3).

In addition to the VRC review and decision, countries may require additional formalities that delay the release of the new variety without providing any additional technical verification. In 14 of the surveyed countries, the decision of the VRC does not automatically lead to the release of the variety. In practice,

additional administrative formalities must be satisfied for the variety to be released. In Kenya a registration applicant will be delayed on average 31 days in releasing a new variety.

Once released, the information relating to new varieties should be accessible, reliable and useful.⁹ EBA seed indicators measure accessibility through the availability of an online version of the national variety catalog listing the latest varieties released in the country. Of the 40 surveyed countries, 30 have a national variety catalog, but only 19 make it available online. Bangladesh, Bolivia, Burkina Faso, Ethiopia, Georgia, Jordan, Kenya, the Kyrgyz Republic, Lao PDR, Mali, Morocco, Mozambique, Niger, Tanzania and

Zambia have variety catalogs, but they are not updated after each cropping season, so information about new varieties is not released as soon as it is available.

Bangladesh, Burkina Faso, Ethiopia, Guatemala, Kenya, Mali, Mozambique, Nepal, Niger, Russia, Tajikistan, Tanzania, Ukraine and Vietnam have national variety catalogues that specify agro-ecological zones—areas indicated by the national seed registration authority as regions in which growers can expect optimal results for specific seed varieties. Specifying agro-ecological zones enables agricultural producers to use new seed varieties properly according to the soil, landform and climatic characteristics of their farms, increasing crop yields.

BOX 2.2 Good practices for evaluating and registering new varieties

- Should include both private and public sector representatives in the VRC.
- VRC should meet after each round of DUS/VCU tests.
- Should allow new seed varieties to be released immediately after a favorable decision of the VRC.
- Should maintain an up to date national variety catalog listing, with agro-ecological zones and available online.

bodies in charge of inspections, testing and labeling. While this may slow the certification process, it can also improve the quality of new seed varieties.

Regulations that allow accreditation of nongovernmental inspectors or laboratories to carry out certain certification activities can reduce potential delays caused by an overburdened public authority (box 2.3). This option allows accredited private companies to support the public sector in the certification process, increasing the speed and efficiency of quality control and ensuring that quality seed is delivered to market on time.¹¹ Seed companies and other private institutions can be accredited to carry out part or all of the maize seed certification process in Bolivia, Côte d'Ivoire, Denmark, Georgia, Ghana, Greece, Kenya, Niger, Spain, Tanzania, Vietnam and Zambia.

TABLE 2.1 Variety release committees meet after each cropping season in most countries

VARIETY RELEASE COMMITTEE	NUMBER OF COUNTRIES	COUNTRIES
Meets on demand	7	Bangladesh, Bolivia, Colombia, Côte d'Ivoire, Kenya, Lao PDR, Nepal
Meets after each cropping season	22	Chile, Denmark, Ethiopia, Greece, Jordan, Kyrgyz Republic, Mozambique, Myanmar, Nicaragua, Philippines, Poland, Russian Federation, Spain, Sri Lanka, Sudan, Tajikistan, Tanzania, Turkey, Uganda, Ukraine, Vietnam, Zambia
Does not meet after each cropping season	1	Morocco
Established but does not meet	6	Burkina Faso, Burundi, Georgia, Ghana, Mali, Rwanda
Not established	4	Bosnia and Herzegovina, Cambodia, Guatemala, Niger

Source: EBA database.

Seed quality certification in surveyed countries is mainly government-run

Seed certification subjects registered seed to controls and inspections, before it reaches farmers and other agricultural producers.¹⁰ Certification processes commonly include field inspections,

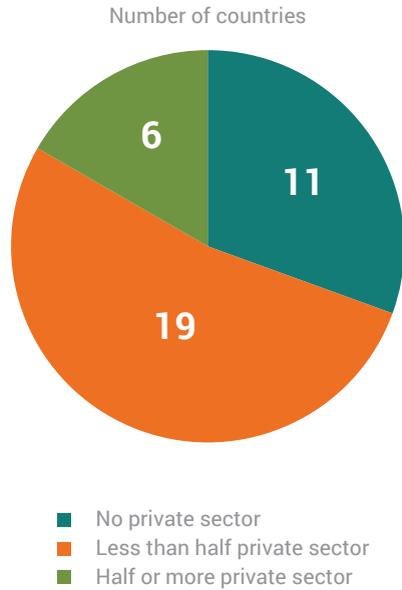
laboratory analysis, packaging and labeling. Most countries surveyed (31 of 40) establish a mandatory government-run seed certification system for cereal seed (figure 2.4). While quality control offered by government-run systems can ensure the quality of seed sold in the country, efforts may also be hindered by the limited resources available to regulatory

Conclusion

Strengthening seed systems through smart regulations is an essential component to the creation of an enabling environment for the business of agriculture. This year's findings show that laws and institutions are mostly in place, but with some differences in the developed indicators and challenges in implementation of the laws. There is room for improvement in all countries surveyed, such as:

- **Transparent variety release procedures allowing new varieties to be available in time for farmers and other stakeholders.** In Bolivia the variety release committee includes an equal number of public and private sector representatives, and meets on demand to prevent delays in the release of the new variety.
- **Laws that protect plant varieties developed by plant breeders to ensure sustained breeding efforts in the country.** Tanzania, which already had a law granting and protecting the rights of plant breeders over their new varieties, became bound by the 1991 UPOV Act in November 2015.
- **A legal environment that facilitates the private sector's access to**

FIGURE 2.3 In the majority of countries studied with a variety release committee, the private sector is involved in the variety release process

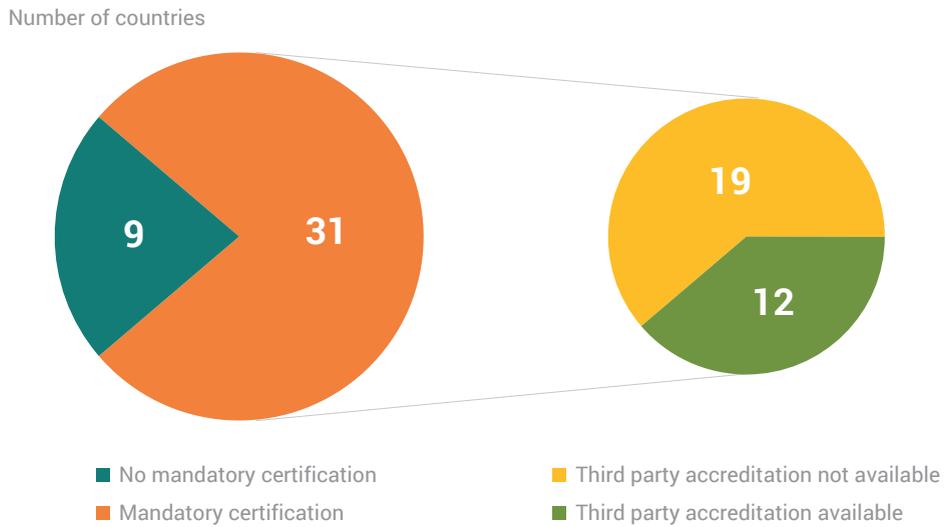


BOX 2.3 Good practices for countries requiring mandatory certification

- Should provide for an option for companies (self-accreditation) and private institutions (third-party accreditation) to be accredited for the performance of part or all of the certification process.
- Should provide seed producers with official fee schedules that detail the costs associated with the certification performed by the public authority.

Source: EBA database.

FIGURE 2.4 EBA countries with mandatory maize certification predominantly restrict its implementation to public sector actors



Source: EBA database.

initial classes of seed and materials for research and development and involves private sector companies in the multiplication and commercialization of public varieties.

In Côte d'Ivoire the seed law allows nongovernmental entities to be accredited by ministerial decree for the multiplication of plant materials.

- **A quality control system that provides transparent costs and options for the accreditation of third party inspectors or laboratories.** In Burkina Faso the fee payable for seed quality control is provided by law and proportional to production area.

Improving laws and regulations that affect the development, evaluation, release and quality control of improved varieties is an important step. Research shows that improved seeds account for about 30–50% of the increase in productivity and enhancing profitability of farmers. The seed topic data can inform discussions on strengthening seed systems, indicating regulatory obstacles to the timely release of quality seed along with other factors, including limited public sector capacities and the socio-economic conditions of farmers.

Notes

1. Tripp 1998.
2. Langyintuo and others 2008.
3. *Enabling the Business of Agriculture* 2015.
4. *Breeder seed* is seed directly controlled by the originating or sponsoring plant breeding institution, firm or individual that is the source for the production of seed of the certified classes. *Foundation seed* is a progeny of breeder or foundation seed, handled to maintain specific

genetic purity and identity (USDA 2009, 1).

5. Fernandez-Cornejo 2004.
6. King and others 2012.
7. In Nicaragua no Plant Variety Protection title was approved in 2013 and a total of five Plant Variety Protection titles were in force at end of 2013; UPOV 2013.
8. Tripp 1997.
9. Rohrbach, Howard and Zulu 2004.
10. Aidoo and others 2014.
11. Gisselquist and Van Der Meer 2001.

References

- Aidoo, R., J. Osei Mensah, B. Fenni Omono and V. Abankwah. 2014. "Factors Determining the Use of Certified Maize Seeds by Farmers in Ejura-Sekyedumasi Municipality in Ghana." *World Journal of Agricultural Sciences* 2 (5): 84–90.
- Fernandez-Cornejo, J. 2004. "The Seed Industry in U.S. Agriculture: An Exploration of Data and Information on Crop Seed Markets, Regulation, Industry Structure, and Research and Development." *Agriculture Information Bulletin* 786, U.S. Department of Agriculture Economic Research Service, Washington, DC.
- Gisselquist, D., and C. Van Der Meer. 2001. "Regulations for Seed and Fertilizer Markets: A Good Practice Guide for Policy Makers." *Rural Development Working Paper* 22817, World Bank, Washington, DC.
- International Union for the Protection of New Varieties of Plants. 2013. *Plant Variety Protection Statistics for the*

Period 2009–2013. C/48/7 prepared by the Office of the Union.

- King, J., A. Toole and K. Fuglie. 2012. "Complementary Roles of the Public and Private Sectors in U.S. Agricultural Research and Development." *Economic Brief* 19, U.S. Department of Agriculture Economic Research Service, Washington, DC.
- Langyintuo, A.S., W. Mwangi, A.O. Diallo, J. MacRobert, J. Dixon and M. Bänziger. 2008. *An Analysis of the Bottlenecks Affecting the Production and Deployment of Maize Seed in Eastern and Southern Africa*. Harare, Zimbabwe: International Maize and Wheat Improvement Center.
- Rohrbach, D., J. Howard and E. Zulu. 2004. "Harmonization of Seed Laws and Regulations in Southern Africa." In *Seed Trade Liberalization in Sub-Saharan Africa*, eds., David Rohrbach and Julie Howard. Michigan State University, International Crops Research Institute for the Semi-Arid Tropics (ICRISTAT).
- Tripp, R. 1997. "Seed Regulatory Framework and the Availability of Crop Varieties." In *Easing Barriers to Movement of Plant Varieties for Agricultural Development*, eds., David Gisselquist and Jitendra Srivastava. Washington, DC: World Bank.
- . 1998. "Regulatory Issues: Varietal Registration and Seed Quality Control," In *Seed Industries in Developing Countries*, ed., M.L. Morris. Lynne Rienner Publishers, Boulder, Colorado, USA.
- USDA (United States Department of Agriculture). 2009. "Understanding Seed Certification and Seed Labels." *Plant Materials Technical Note* 10, U.S. Department of Agriculture Natural Resources Conservation Service, Alexandria, LA.