

# How to do

## Supporting smallholder seed systems

### Agronomy



**How To Do Notes** are prepared by the IFAD **Policy and Technical Advisory Division** and provide practical suggestions and guidelines for country programme managers, project design teams and implementing partners to help them design and implement programmes and projects.

They present technical and practical aspects of specific approaches, methodologies, models and project components that have been tested and can be recommended for implementation and scaling up. The notes include best practices and case studies that can be used as a model in their particular thematic areas.

**How To Do Notes** provide tools for project design and implementation based on best practices collected at the field level. They guide teams on how to implement specific recommendations of IFAD's operational policies, standard project requirements and financing tools.

The **How To Do Notes** are "living" documents and will be updated periodically based on new experiences and feedback. If you have any comments or suggestions, please contact the originators.

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## Acronyms and abbreviations

AIA	advance informed agreement
CBD	Convention on Biological Diversity
DUS	distinct, uniform and stable
EPB	evolutionary plant breeding
FAO	Food and Agriculture Organization of the United Nations
FSA	Federal Seed Administration
GM	genetically modified
HTDN	How To Do Note
IPPC	International Plant Protection Convention
IPR	intellectual property rights
ISSD	Integrated Seed Sector Development
ISTA	International Seed Testing Association
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
LMOs	living modified organisms
NARI	national agricultural research institute
NGO	non-governmental organization
PBR	plant breeders' rights
PGRFA	plant genetic resources for food and agriculture
PPB	participatory plant breeding
PPP	public-private partnership
PVP	plant variety protection
PVS	participatory varietal selection
QA	quality assurance
QDS	quality declared seed
SDP	Seed Development Programme (Sudan)
SRR	seed replacement rate
SWOT	strengths, weaknesses, opportunities and threats
TL	truth in labelling
OECD	Organisation for Economic Co-operation and Development
UPOV	Union for the Protection of New Plant Varieties
VCU	value for cultivation and use

## Introduction

Sustainably increasing agricultural productivity requires an integrated approach. One of the fundamental elements for increased production and productivity is for farmers to have access to high-quality seed of adapted varieties. Under marginal agroecologies and rainfed conditions, and where most smallholder farmers do not use external inputs, yield stability rather than higher yields is often more important. Despite its importance, seed alone cannot solve the problem. The use of improved seed must be complimented by good agricultural practices adapted to the local farming systems (e.g. integrated soil fertility, water and pest management and market linkages).

The challenges of ensuring access of farmers to quality seed of appropriate and adapted varieties, whether through the **formal seed system** or the farmer-based **informal seed system**, has been a recurrent issue in the quality enhancement and quality assurance review stages of IFAD investment projects. The complexity and requirements of the seed sector are often underestimated in the design and during implementation of projects. It is important to treat seed not only as an agricultural input but also as a carrier of genetic material and source of diversity. Seed needs to be considered under three main components:

- i) the informal system, i.e. community-based seed supply, all within a policy and regulatory framework;
- ii) the formal system, i.e. commercially-oriented seed supply;
- iii) agricultural research.

**Seed** for the purposes of this publication refers to true botanical seed and not vegetative planting materials. **High quality seed** refers to the quality attributes of seed of high germination, physical purity, genetic purity and free of pests and diseases; **adapted varieties** means high yielding varieties well adapted to the local agro ecology and suitable to the preferences of farmers. Within this toolkit, this definition of high quality seed applies to the formal seed systems while the genetic purity aspect of the seed quality is not valid for some areas of the informal seed systems or where seed mixtures are purposely used in planting.

This How To Do Note (HTDN) in this toolkit on Supporting Smallholder Seed Systems tackles the complexities of seed systems, setting out a process to support national agricultural policy decision makers, national and international development agencies and IFAD Country Programme Managers (CPMs) in the design and supervision of seed-related projects. The other publications in this toolkit are the Teaser and Lessons Learned.

## Organization of the How To Do Note

This HTDN is divided into three sections:

- The first section elaborates an analytical framework for national seed systems through suggested key questions for each of the main four areas of any system, namely; the **informal seed systems**, the **formal seed systems**, the relevant institutions and the policy, laws and regulatory aspects. This will provide the basis for a better understanding of the system. For a more in-depth analysis of each area, additional questions are provided in Annex 1.
- The second section outlines the process to gather information on existing and planned seed initiatives by other development partners.
- The third section provides a framework for determining potential seed projects/interventions.

A common glossary of technical terms used in this toolkit on Supporting Smallholder Seed Systems is provided at the end of this HTDN.

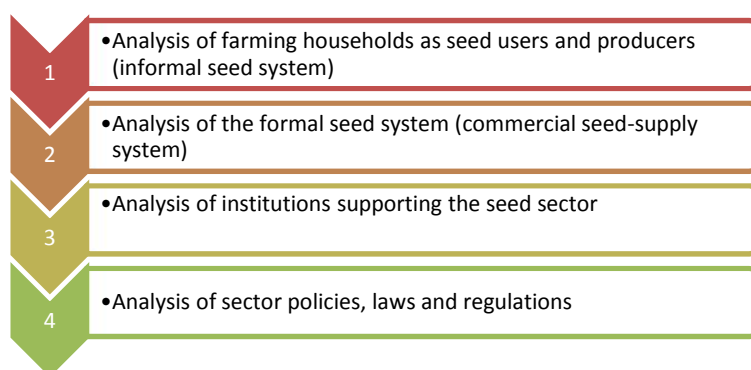
## Scope of the seed systems analysis

A first step in the process is to establish the overall scope for the analysis, which will help to focus information collection. Much of this information can be gathered from secondary sources, supplemented by primary data collection. Some guiding questions are:

- i) **Geographic scope of the potential intervention:** Is the potential intervention covering the entire country or one particular region? What are the major agroecological zones in the intervention area and what are their specific characteristics, i.e. soil type, elevation, slope, temperature regime and rainfall (quantity and distribution), and what is the probability of crop stress or failure due to drought, floods, etc.?
- ii) **Target group's profile:** What is the average landholding per household? What are the main farming systems, cropping systems, sources of community livelihoods and household incomes? Are farming households **seed secure**?
- iii) **Target group's crops:** What is the ranking of the main crops for food and/or for cash, especially from the perspective of women and youth? What percentage of the crop is sold and what are the requirements of the market? What are the related field activities for production of each crop and the respective gender roles, such as land preparation, planting, weeding, harvesting, drying and storage? Which crops are grown in marginal agroecologies? Which crops have a higher nutritional value for the household, especially from the women's perspective? Are there important culinary characteristics of the food crops? Are crop residues used for animal feed, construction or income-generating activities? Which crops could be targeted in a seed project and why?

## Analytical framework for a national seed system

It is important to use an analytical approach to examine all components of a national seed system in order to understand its specific characteristics. The components of the national seed system presented in the Teaser are reorganized into four interrelated areas:



Each of these areas will be explored through technical explanations/background and key questions to help guide analysis to provide an improved understanding of each area. The key questions need to be reviewed and adapted to the specific national seed situation. A suggested list of key informants is provided for each area. Potential areas for interventions based on the responses to the key questions are also provided. If more in-depth analysis is needed, detailed questions for each area are provided in Annex 1.

## Analysis of farming households as seed users and producers (informal seed system)

Understanding farming households as seed users and seed producers is often overlooked as a first step in understanding the national seed system. The informal farmer/community seed systems are the primary source of seed for smallholder farmers who have little access to certified/commercial seed and rely heavily on farmer-saved seeds, sharing seed within the community, and purchasing **landraces**, uncertified seed or even grain (for consumption) from local markets (FAO, 2012) (Lipper, Anderson and Dalton, 2010). Often, farmers are not aware of new varieties, or the new varieties may not be appropriate to the farmers' low-input agricultural practices, agroecological conditions, market requirements or culinary preferences. Certified seed may be too expensive or unavailable at the right time and in sufficient quantities. Consequently, it is important to understand for which crop or (type of) **variety** farmers are producing their own seed and for which crops farmers purchase seed? In some countries, well over 90 per cent of seed, even of major food crops, is managed within the **informal seed system**. This is especially true for **self-pollinated** crops, such as rice, wheat or legumes, for which it is relatively easy for farmers to produce their own seed and maintain varietal purity. When yield and seed quality start decreasing due to varietal mixing or from disease, farmers may renew their seed stocks by buying or exchanging seed from the local market or other farmers, or indeed from seed companies and input dealers. This may happen every 2-4 years, depending on the crop.

Below are the key questions to understanding seed needs and practices of farming households which are necessary to understand any national seed system, and what may be necessary to improve access to high-quality seed of adapted varieties. Remember gender roles in agriculture and seed are critical and need to be taken into consideration.



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Tunisia - Agropastoral Development and Local Initiatives Promotion Programme in the South-East

Key questions	Key informants
<ol style="list-style-type: none"> <li>1. What crops (and varieties or <b>landraces</b> of those crops) are farming households producing themselves, obtaining from social networks or buying in the local market, and why?</li> <li>2. Are there any problems with the varieties or the quality of seed they are now using and how could this be improved?</li> <li>3. Are practices they use for the seed they produce and save different from food grain production?</li> <li>4. How often are they changing varieties or buying seed? Of which crops and why? How is the seed renewed?</li> <li>5. Do farmers buy, share or save seed?</li> <li>6. Do they have access to sufficient seed for planting? If not, where do they obtain additional seed?</li> <li>7. Is certified or <b>quality declared seed</b> of the different varieties preferred by farmers? If not, why not?</li> <li>8. Is certified or <b>quality declared seed</b> available, accessible and affordable to farming households?</li> </ol>	<p>The primary source of data is directly from farming households through surveys or community focus groups, while ensuring participation by men and women.</p> <p>Women play a key role in household seed-saving practices so involving them is critical. It is also important to gather information from them on production, as women often have a key role in selecting plants for seed saving, harvesting, post-harvest handling and storage of seed separate from food grain.</p> <p>This information can be verified with knowledgeable government extension staff or non-governmental organizations (NGOs) or seed specialists with specific knowledge and experience with farmer and community seed systems.</p> <p>Secondary sources of information, such as extension agents, NGO staff, academic and technical reports, agricultural statistics, seed traders in local markets, etc., can also be useful.</p> <p>Experience indicates that visits to farmer fields to triangulate/complement the findings of data collection can be useful whenever feasible. It helps to identify the varieties farmers are growing, production practices and particular problems in the field.</p> <p>It is recommended in the analysis to follow the seed value chain from farmer to seed trader to seed producer to basic seed producer to researcher and sources of genetic material.</p>

#### Potential areas for project interventions based on the responses to the key questions

- Enhance the quality of community-produced seed in quantity and quality through capacity-building of local seed businesses and upgrading to **quality declared seed**.
- Demonstrations at the community level of quality seed of improved varieties that may address problems of their current varieties (drought tolerance, pest or disease resistance, etc.) and which are currently unavailable to farmers.
- Demonstrate the importance of using quality seed.
- Strategies to improve the way farming households produce and save their own seed (including method of selection and storage of seeds, as well as the recycling period and process).
- Strategies to improve the diversity of varieties available to farmers through community seed banks (Vernooy, Shrestha and Sthapit, 2015), community seed production, seed fairs, sale of small packs in local markets, improving the quality of seed marketed by traders and farmer seed sellers.
- Targeting of extension activities for women and/or men based on their respective roles with specific crops and seed production of those crops.
- Identify ways of enhancing the status of the **informal seed system** within national seed policy, notably for **quality declared seed** systems and farmer and community-based seed systems.



## Analysis of the formal seed system

At an early stage in the development of a national seed system, governments are often responsible for the production and marketing of certified seed of **improved varieties** to farmers. When demand for certified seed increases, local seed businesses and national seed companies may become involved. Therefore, it is important to understand the role of both the government and the seed companies in producing and marketing certified seed to farmers. Large national seed companies (private or government-owned), or international seed companies with national partners, can be key providers of seed to farmers. In general, international and national seed companies are interested in “profitable” seed, e.g. hybrid varieties of maize or vegetables or GM (genetically modified) crops and crops with a high seed replacement rate (SRR). Hybrid and open-pollinated commercial vegetable seed is often imported since it is low volume, high-value seed.

Local seed businesses often start as entrepreneurial farmers or farmer groups that become known in the community for producing quality seed of **local landraces**. However, starting and running a local seed company requires skills in seed production, business management, facilities for seed storage and processing, credit, marketing and an original source of seed of preferred varieties that farmers will buy (FAO, 2010) (FAO, 2017). Local seed companies need **basic (foundation) seed** from which they produce certified seed. Normally local seed companies source **basic (foundation) seed** of improved varieties from national agricultural research institutes or government **early generation seed** production agencies. This is the case usually for the less profitable cereals (rice, wheat, millet and sorghum), legumes (beans and groundnut) and for local varieties of vegetables.

The advantage of local seed companies is that they produce and sell locally adapted and popular varieties. They are often rural-based and provide local employment, and they have a closer relationship with the farmers for advice and follow-up. As a result, seed sector development is often focused on local seed businesses and companies, often, but not always, involved in certified and **quality declared seed** production.

Understanding the commercial seed market and how it functions is critical for local seed companies and to ensure farmers have access to quality seed at a reasonable price and when it is needed for planting. Certified seed sources include seed companies, input dealers, government outlets and, often, relief agencies working in the country. For the local seed companies, it is important to know the crops and varieties that interest farmers and be able to anticipate farmer demand for those varieties.

In many countries, the government intervenes in the seed market. Governments sometimes set prices or have schemes to provide seed free or at a subsidized price. In countries with chronic seed insecurity, governments and humanitarian organizations often distribute free seed, which is very disruptive to both the commercial seed market for certified seed and the local market for quality declared and uncertified seed. Consequently, it is important to determine the government role in the seed market.

The **formal seed system** is the channel through which certified seed of improved varieties is marketed to farmers. An understanding of the current status of the formal seed system, reflected mainly through seed companies and how they market seed to farmers, is key to understanding the national seed sector. The key questions are listed below.

Key questions	Key informants
<ol style="list-style-type: none"> <li>1. Certified seed of which crops and varieties are being marketed to farmers and how (through which channels and companies)? Or what is the effective demand?</li> <li>2. What are the obstacles to the further growth of local seed companies and businesses?</li> <li>3. Are seed-producer groups active in producing certified seeds for local seed companies? What are their constraints? Could they become local seed companies themselves?</li> <li>4. What role do the input dealers/agrovets play in the outreach of certified seeds to remote rural areas? How are they linked with local and international seed companies?</li> <li>5. Is there a national seed association and how does it support national seed companies?</li> <li>6. Is the government producing and marketing seed to farmers or is this function performed only by seed companies or a combination of the two? Which crops is each involved in?</li> <li>7. Does the government (or emergency organizations or NGOs) play a significant role in the seed market through subsidies or free distribution of seed? What is the source of their seed and the quality?</li> </ol>	<p>Ministry of agriculture, ministry of trade or commerce, policy and disaster management officials, international development agencies and NGOs, national seed associations, seed companies, agrovets and traders in local markets.</p>

**Potential areas for project intervention based on the responses to the key questions**

- Survey local seed enterprises to determine their constraints and how to assist them to better serve the needs of farmers through capacity-building in business management, marketing, seed production, etc.
- Support seed-producer groups within the **formal seed systems** to better link to seed companies and agrovets/input dealers.
- Support the role of input dealers/agrovets to provide certified seed to remote rural areas by acting as the link between national seed companies and farmers, providing them with technical and managerial capacity-building, financial support in demonstrations for farmers, seed storage, packaging and sales.
- Through seed policy dialogue examine:
  - Present government's role in the seed sector and notably in seed production and distribution, and identify its appropriate role versus what should be done by seed companies and other seed producers;
  - the government's role in the seed market, pricing policies and development of strategies to facilitate a better functioning seed market and to avoid the free distribution of seed.
- Strengthen the national seed association as a forum and mechanism for policy dialogue and coordination between the seed companies and the government and for the provision of capacity-building for the seed sector, as well as for planning in the seed value chain (e.g. basic seed needs).

## Analysis of the institutions supporting the seed sector

High-quality seed of improved varieties, especially in the **formal seed system**, cannot be produced and marketed to farmers without the support of different institutions, e.g. the national agricultural research body (responsible for developing new varieties and **early generation seed** production) and the national seed certification agency (responsible for variety testing and release and seed certification) (FAO, 2017). In addition, there are other organizations supporting the seed sector, including international seed companies with local partners involved in seed varietal development, marketing and seed sector development, and national seed associations, usually active in training and supporting the seed enterprises, as well as cooperatives and other farmer organizations supporting their members in the organization of seed production, seed sale and inputs supply. Agricultural extension (public and private) is important to promote use and strengthen demand for quality seed of improved varieties.

**Development of new varieties:** The development of new varieties is a fundamental function of the seed sector and these new varieties need to be better than what farmers currently have in terms of yield, tolerance to pests and disease and environmental stresses, and suited to farmers and consumer preferences. For major food crops, this function is undertaken by national agricultural research institutes (NARIs), often in collaboration with international agricultural research institutes, including the Consultative Group on International Agricultural Research (CGIAR) centres. International and sometimes national seed companies perform this function mainly for export crops and hybrid varieties of food crops and vegetables.

The first step in the development of new crop varieties is the conservation of plant genetic resources for food and agriculture (PGRFA) in national and international gene banks. Gene banks conserve genetic material from wild relatives of domesticated crops, **landraces** or improved varieties ex situ (outside their ecological environment) and act as a source of genetic material for breeders. Locally preferred germplasm is commonly crossed with superior exotic germplasm (for specific traits such as drought tolerance, pest and disease resistance, higher yield) to produce adapted improved varieties, a process that can take more than 10 years. Ideally, there should be continuous development of new varieties of nationally important crops and this should create a pipeline of new varieties to ensure that farmers have continuous access to new varieties that meet their changing needs with changing climate, biotic constraints and market demands.

The context has been changing rapidly in national seed systems. With the partial privatization of seed value chains, more attention has been given to seed demand and the need to address some of this demand through local seed businesses, as well as to the need to develop more locally adapted varieties. In recent years, breeding strategies have become more participatory, with breeders working closely with farmers under local field conditions rather than in research stations (**participatory plant breeding** or **evolutionary plant breeding**) to jointly develop varieties or mixtures of varieties that are highly adapted to local conditions. These approaches increase crop diversity in the field (Murphy et al., 2004) and are highly adapted to low-input and marginal production systems typical of smallholder farmers who are vulnerable to climate change, as well to organic farming systems. These strategies also enhance the adoption rate of new varieties or mixtures of varieties by farmers.

**Variety testing and release:** Promising new varieties developed by agricultural researchers are further tested before they can be officially released. Tests include the **VCU** (value for cultivation and use) test, which is done on-station and in multilocational trials to assess performance and compare it to existing varieties. Farmers are sometimes involved in the variety testing through participatory varietal selection (PVS), before or after the variety is released, which has the advantage of creating awareness among farmers about new varieties, hence increasing the adoption rate. Another test often required before varietal release is **DUS** (distinct, uniform and stable) testing, which determines the variety identity and uniqueness and serves for **plant variety protection (PVP)** and variety registration. The variety is then registered as a new variety by the national **variety release committee** and is officially released and included in the **national variety catalogue**. Seed of these varieties will be provided to government agencies and/or seed companies for further multiplication to eventually produce certified seed. Often, however, new officially released varieties do not get into the hands of seed companies or other sources of further multiplication and never reach the farmers.

**Early generation seed production:** Seed production starts with a small quantity of very high-quality seed. Nucleus seed is produced by the plant breeder and multiplied to produce **pre-basic (breeder) seed**. Then **basic (foundation) seed** is used to produce certified 1 (registered) seed and then certified 2 (certified) seed, with strict quality controls, to produce a large enough quantity of seed to sell to farmers. While research institutes/breeders are often responsible for the production of nucleus and **pre-basic (breeder) seed**, the **basic (foundation) seed** production is normally undertaken by a government agency or seed companies. It is critical that institutions producing **early generation seed** are sufficiently equipped with land, irrigation, qualified staff and seed production and testing facilities to fulfill their role. Planning and coordination is necessary to produce adequate quantities of the right varieties at the time when farmers need them.

Increasingly, seed companies are producing **basic (foundation) seed** under the supervision of a seed certification agency. The availability of sufficient amounts and quality (genetically pure) **early generation seed** is often a constraint that limits the quantity of **basic (foundation) seed** available to be further multiplied to produce certified seed, thus limiting the availability of certified seed to market to farmers ([www.issdseed.org](http://www.issdseed.org)).

**Seed quality control:** To produce high-quality certified seed (i.e. high germination, physical and varietal purity, low moisture content and freedom from pests and diseases), it is necessary to follow strict seed production protocols. **Quality assurance (QA)** systems ensure those protocols are followed through field inspection and seed testing, which when combined provide an analytical basis for verifying seed quality. The **International Seed Testing Association (ISTA)** has developed the standards for seed sampling and laboratory procedures for seed testing. Most countries use its standards and many are members of **ISTA**. There are several seed quality assurance systems, and a country should use the one appropriate to the level of development of its seed sector.

Many countries have mandatory certification, which requires certified seed to meet established minimum quality standards. Other countries have adopted the truth in labelling (TL) system in which there may or may not be a minimum standard but the seed label must indicate the actual quality of the seed. A few countries in the early stages of developing their seed sector use the **quality declared seed (QDS)** approach, whose minimum quality standards are lower than those of certified seed. While the QDS system is less rigorous, it can help decentralize seed production and get quality seed into the hands of farmers.

Seed **quality assurance** systems are normally outlined in national seed laws and regulations. Seed certification agencies, both public and private, need to have the capacity to carry out their functions, which requires sufficient qualified staff, facilities and operational budget. Fees for seed certification must be aligned with costs, but also with the realities of the seed market. Weak seed quality control systems can result in low-quality certified seed, which can lead to farmers not purchasing certified seed, because they have lost trust. Therefore, seed laws and regulations require sufficient institutional capacity for effective implementation of seed certification to ensure availability of high-quality certified seed and to facilitate the development of a flourishing seed sector.

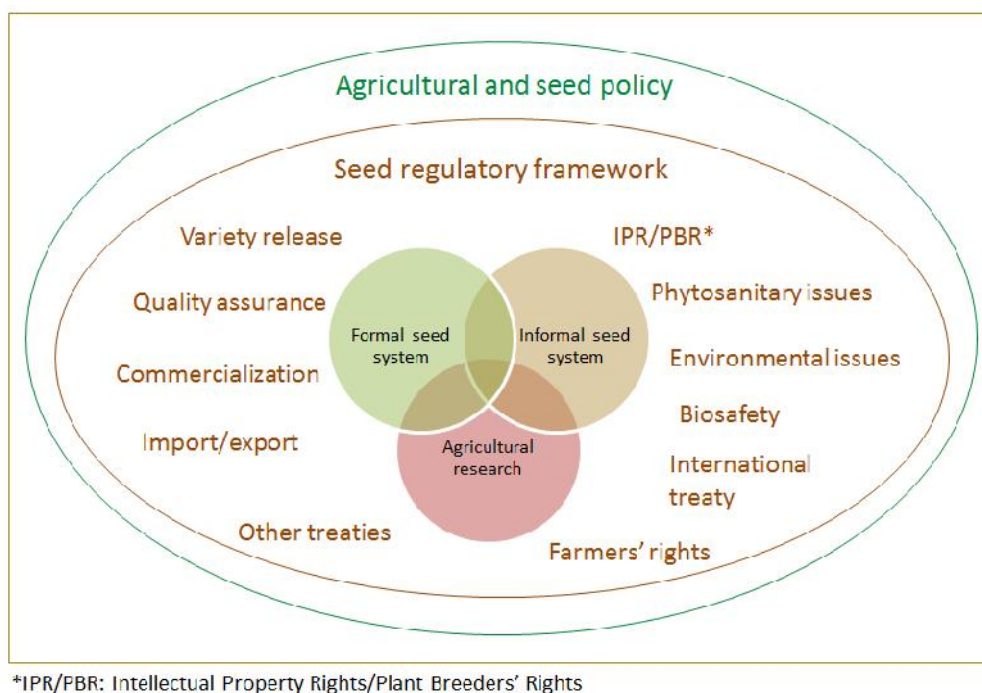
Key questions on institutions supporting the seed sector	Key informants
<ol style="list-style-type: none"> <li>1. Are farmers involved in participatory plant breeding (PPB) or evolutionary plant breeding (EPB) for the development of new varieties or in participatory varietal selection (PVS) for the testing of new varieties and varietal mixtures?</li> <li>2. Are there national gene banks? For which crops? How can these be accessed?</li> <li>3. Are there new varieties of major crops being officially released every year? What is the variety turnover?</li> <li>4. Are the public seed multiplication institutions and local companies aware of these new varieties and their characteristics?</li> <li>5. Are there demonstrations to make farmers aware of new varieties?</li> <li>6. Is there sufficient capacity in the research institutes to produce sufficient quantities of <b>pre-basic (breeder) seed</b>? Do they have sufficient capacity to produce <b>basic (foundation) seed</b>?</li> <li>7. Is there a clear responsibility of the government or seed companies to produce the demanded <b>basic (foundation) seed</b> such that seed companies and contracted farmers can produce adequate quantities of certified seed?</li> <li>8. Does the national seed certification agency have adequate staff and facilities to perform the roles of seed certification and ensure certified seed is of high quality?</li> <li>9. Are there seed cooperatives and seed-producer groups active in the seed sector? Are there opportunities to work with or strengthen these organizations so farmers have better access to high quality seed?</li> <li>10. Is there a national seed association to represent and promote the seed industry? Could the supply of quality seed to farmers be improved by strengthening the national seed association?</li> </ol>	<p>Plant breeders and agronomists at national agricultural research institutes, national seed agency staff, including seed quality-control field and laboratory staff, national seed associations, farmers and their organizations, seed companies, relevant NGOs and international organizations.</p>

**Potential areas for project intervention based on the findings of the key questions**

- Strengthen variety development through the national agriculture research institute, or national or regional/international seed companies through public-private partnerships (PPP).
- Strengthen PPB, EPB and PVS with the national agricultural research institute to help ensure new varieties, **landraces** and mixtures are adapted to farmers' needs and have been tested in marginal agroecologies with low-input practices, and to enhance their adoption by farmers.
- Strengthen and streamline variety testing and release procedures, along with demonstrations of newly released varieties with farmers, to create awareness, determine suitability to farmers' needs and increase potential demand.
- Support **early generation seed** production by the government and the private sector to ensure there is sufficient high-quality **basic (foundation) seed** to produce certified seed.
- Capacity development with the national seed certification agency so it can perform its services and ensure certified seed is of high quality, as well as increasingly involve district-level and private seed inspectors.
- Capacity development of other seed-related organizations, such as seed-producer cooperatives, to boost the availability of and access to quality seed.

## Analysis of seed policy, laws and regulations

The development of the seed sector is facilitated by government providing an enabling environment through appropriate policy, legislation and regulation. In the diagram (FAO, 2005), agricultural policy (indicated as the outer oval in the diagram) should include national seed policy as one of its supporting policy documents. National seed policy should be developed with wide seed sector stakeholder participation, which includes farmers/farmer organizations, agricultural research institutes, national seed certification agencies, seed companies/national seed associations and policymakers.



**Figure 1. National seed system: policy and regulatory framework (FAO, 2015)**

Arising from seed policy should be an appropriate legal framework for the seed sector which includes seed law and associated regulations for the implementation of the law (FAO, 2017). As illustrated in the diagram, a seed regulatory framework has several components. The four shaded boxes on the left are components that are part of seed law and regulations, while the remaining boxes on the right represent components that are related to seed but not necessarily part of any seed law and regulations – but they can be laws or international treaties and conventions affecting the seed sector (all terms are defined in the glossary). These include intellectual property rights (**IPR**) and plant breeders' rights (**PBR**) related to the ownership of plant varieties and the incentive to develop new plant varieties. **Phytosanitary issues** are covered through regulations in line with the International Plant Protection Convention (IPPC), which are important for seed production, import and export. **Environmental issues** deal with pesticides associated with seed and, more specifically, seed treatment. **Biosafety** refers to the safe handling of living modified organisms (LMOs), as stipulated in the Cartagena Protocol. The **international treaty** refers to the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) on the sharing of genetic resources for breeding, as well as access and benefit-sharing for local PGRFA. **Farmers' rights** refers to the rights of farmers for local PGRFA, including access and benefit-sharing of genetic resources, as outlined in the ITPGRFA.

Depending on the stage of development of the seed sector and the role of the seed industry, the country could participate in seed-related organizations, such the International Seed Testing Association (**ISTA**), the Union for the Protection of New Plant Varieties (**UPOV**) and the Organisation for Economic Co-operation and Development (**OECD**) Seed Schemes.

Historically, most national seed policies focus on the **formal seed system** with limited guidance on supporting the **informal seed system**, including farmers' rights for access and benefit-sharing of genetic resources (www.issdseed.org). Recently, there have been efforts to provide a more broad-based and participatory approach to seed policy formulation to address seed policy in a more holistic way (FAO, 2015).

Key questions on seed policy, law and regulations	Key informants
<ol style="list-style-type: none"> <li>1. Is there a national seed policy, related seed laws and regulations appropriate to the needs of the country which are actively implemented to promote the development of the seed sector and to provide high-quality seed of improved and adapted varieties to farmers?</li> <li>2. Are there elements of the seed regulatory framework and policy that could be improved to ensure farmers have access to high-quality seed?</li> <li>3. Is there adequate attention and regulation in support of farmers' rights and the <b>informal seed system</b>?</li> <li>4. Is the country a member of relevant international treaties, conventions and organizations?</li> </ol>	<p>Ministry of agriculture senior staff, national seed associations, farmers/farmers' associations.</p>

#### Potential interventions based on the finding of the key questions

- Conduct a participatory review of current seed policy (FAO, 2015) and strategy with all seed sector stakeholders to determine the status of implementation and need for revision, with particular attention to the needs of farming households.
- Provision of capacity building for the national seed council and its administration to improve the strategic vision and management of the seed sector.
- Awareness raising with the national seed council and key policymakers regarding the international organizations and conventions related to seed.
- Involvement and awareness-raising with farmers regarding seed policy, regulations and farmers' rights.

## Other seed sector development initiatives

To have a complete status of the seed sector it is important to gather information on significant initiatives by the government, donors, international organizations, NGOs and international seed companies that are on-going or completed in the country. Interviews will need to be conducted with government officials, project donors, implementers and beneficiaries to develop an unbiased understanding of these initiatives/projects. This information-gathering should follow the normal process of IFAD's approach to partnerships. This information should be used to determine gaps and opportunities for potential cooperation and synergies with on-going and planned national activities to avoid duplication of efforts and optimize resource use. It is also useful to explore the outcomes of completed projects and activities to assess lessons learned to be taken into account when developing new projects.

## A framework for determining potential seed projects/interventions

The information gathered in the assessment framework, including the responses to the key questions and the potential interventions in each of the four areas, is the initial data collection phase. This information is then viewed in the context of the profiles of seed sector development initiatives. When these two elements of key findings and initiatives are combined, it will facilitate the identification of weaknesses and potential areas to be strengthened in the national seed system and/or the specific region in the country under consideration. It will also guide the users of this tool in identifying the most appropriate areas and themes of intervention to close gaps and to optimize investments and partnerships to enhance the livelihood of smallholder farmers through an efficient and effective seed sector.

It is suggested a workshop of seed-sector stakeholders be undertaken to review findings and develop consensus around key issues and lessons learned from existing seed projects, and to determine potential activities. A facilitator who has reviewed all the information generated, and

who has strong experience of the seed sector, would be helpful to lead such an exercise. The Integrated Seed Sector Development (ISSD) methodology, involving SWOT and opportunity analysis, is an approach that may be useful during such a workshop and in the final analysis of the information gathered, as well as to develop a seed sector development strategy ([www.issdseed.org](http://www.issdseed.org)).

By combining these analyses, it is possible to identify opportunities for development of the range of activities to be included in a new project that has a seed component, or subcomponent. Using this tool CPMs, project designers and others will have tools to help them design more effective seed projects. Box 1 provides an example of how interventions could be selected through the analysis of key questions using an IFAD seed project in Sudan. It shows how some issues were not considered and demonstrates that a holistic approach is needed because of the linkages between the areas.

The references at the end of this publication provide the user of the HTDN with access to more in-depth information on the various areas of the framework, as required.



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**Box 1. Example of analysis of key questions using an IFAD seed project in Sudan**

The Seed Development Programme (SDP) is being implemented by the Ministry of Agriculture in Sudan. The goal of the SDP is to improve food security, incomes and resilience to shocks of smallholder producers. Its development objective is to increase crop productivity for 69,000 smallholders who adopt improved seeds in North and South Kordofan regions.

The primary target group is smallholder farmers growing less than 15 feddans (6.3 ha) of land and who engage in traditional, rainfed production of sorghum, groundnuts, sesame and cowpea as their main source of livelihood. The project focuses on linking the formal and informal seed systems and supports the relevant public institutions for the production of early generation seeds and the certification units.

Seed sector areas – key questions	Key findings from four areas of analysis	Other seed support development initiatives	Suggested activities to address identified issues
<b>The farmers as seed producers and users</b> <ul style="list-style-type: none"> <li>▪ Assessment of farmer seed demand</li> <li>▪ Farmer seed production</li> <li>▪ Seed security</li> <li>▪ Linking to inputs, advice/markets</li> </ul>	<ul style="list-style-type: none"> <li>▪ An initial seed demand assessment should have been undertaken during design</li> <li>▪ No formal seed system production in the two target states of the SDP</li> <li>▪ Very limited linkages to input and output markets</li> <li>▪ Input and insurance scheme in place but not effective</li> <li>▪ Weak extension services</li> </ul>	<ul style="list-style-type: none"> <li>▪ Rural finance project under way</li> </ul>	<ul style="list-style-type: none"> <li>▪ Conduct farmer seed demand survey after project implementation</li> <li>▪ Establish seed-grower groups</li> <li>▪ Establish grain-producer groups</li> <li>▪ Support extension services</li> </ul>
<b>Formal seed system</b> <ul style="list-style-type: none"> <li>▪ Roles of the government and seed companies in seed production and marketing</li> <li>▪ Potential assistance to seed companies (public/private)</li> <li>▪ Seed market Intervention</li> </ul>	<ul style="list-style-type: none"> <li>▪ Seed companies not operating in the area as it is a high-risk rainfed zone</li> <li>▪ The grant to subsidize private seed companies' investments should be withdrawn</li> <li>▪ Seed companies currently focused on marketing to large farmers and NGOs</li> </ul>		<ul style="list-style-type: none"> <li>▪ Engage private seed companies to establish and run seasonal demonstrations on improved seeds, mechanization and herbicide use</li> </ul>
<b>Institutions supporting the seed sector</b> <ul style="list-style-type: none"> <li>▪ Variety testing and release</li> <li>▪ Early generation seed</li> <li>▪ Seed quality control</li> </ul>	<ul style="list-style-type: none"> <li>▪ Inadequate supply of early generation seed</li> <li>▪ Low capacity of seed certification (FSA)</li> </ul>		<ul style="list-style-type: none"> <li>▪ Strengthen FSA</li> </ul>
<b>Seed policy, laws and regulations</b> <ul style="list-style-type: none"> <li>▪ Seed law and regulations</li> <li>▪ Seed policy or seed plan</li> <li>▪ PVP</li> <li>▪ ISTA accreditation</li> </ul>	<ul style="list-style-type: none"> <li>▪ No seed policy</li> <li>▪ No PVP</li> </ul>		<ul style="list-style-type: none"> <li>▪ Seed policy formulation</li> <li>▪ PVP formulation</li> </ul>

## Annex 1. Suggested detailed questions for the analytical framework

These questions provide more in-depth analysis to those provided in the section on the Analytical Framework for a national seed system.

### 1. Analysis of farming households as seed users and producers (informal seed sector)

#### a. Seed sources

Determining farming households' seed sources will inform decisions about interventions to improve the availability of seed for farmers. These questions should be disaggregated by gender as men and women may grow different crops.

1. What are the sources of seed for the main crops used for food and for the market? Private sector, government, NGOs, own-saved, neighbours, local market, etc.
2. What is the priority ranking of seed sources for farmers?
3. Are there nearby (one day's travel) sources of certified seed of improved varieties?
4. Is certified seed affordable? What do farmers do if they cannot afford to buy it?
5. Is seed always available when needed? What do farmers do when seed is not available?

#### b. Suitable varieties and **landraces**, and seed quality

1. What are the crop varieties which farming households are currently using? Are they **landraces**, seed mixtures of different **landraces**, old improved varieties ("recycled" from previous years) or new improved varieties?
2. Are their current varieties well adapted? Are their varieties tolerant of drought, pest and disease problems and post-harvest losses? Do they have high, low or stable yields in the changing climatic conditions? Do their varieties have a market demand? Have they good cooking and nutritional qualities or other income-generating uses, etc.?
3. Are farmers exposed to on-farm demonstrations or participatory varietal trials of new varieties undertaken by research, extension, seed companies or NGOs to inform them about the characteristics of new varieties?
4. Is there a strong preference for **landraces**? If so, is there a community seed bank or other ways that **landraces** and local genetic material is preserved and shared in the community?
5. What are farmers' sources of knowledge about crop varieties – social networks, community seed banks, seed fairs, extension officers, seed companies, input dealers/agrovets, NGOs?
6. Are farming households experiencing quality problems with the seed they produce or purchase? For example, poor germination, contamination with weed seeds, contamination with pathogens and pests, damage or loss of seed during storage?

#### c. Seed in the agriculture/livelihood context

1. **Other production factors:** If farmers are able to obtain quality seed of improved varieties, are the other factors of production and post-harvest in place so farmers can obtain the full yield potential of the crop variety, i.e. soil fertility, good production practices (crop rotation, soil erosion control, proper water conservation and use, agroforestry, crop density and seed rate, etc.), good harvesting, drying and storage capacities.
2. **Markets:** Do farmers have access to markets to sell what they produce at a reasonable profit? Is there a price differential for **landraces** or improved varieties in the market, with respect to nutritional, culinary or processing qualities? Is there the potential to establish new value chains for **landraces** or improved varieties that link farmers with new markets?

#### d. Farming households as seed producers for the farmer/community seed system

1. For which crops is the farmer using his/her own seed? Why?

2. Are there farming practices specially for seed production that are different from those for food grain production, harvesting, drying, winnowing or storage?
3. Are there problems, constraints or advantages (storage losses, poor germination, deterioration of the variety) related to producing and saving the farmers' own seed?
4. How often does the farmer buy certified seed to replace the seed he or she has been saving? Why?
5. Does the farmer give, barter or trade seed with other farmers? How often? Is the price higher than that of certified seeds or those sold in the local market?

**e. Local market in community seed system**

1. Local markets are often a significant source of seed ([www.seedsystem.org](http://www.seedsystem.org)) for – mainly – community seed systems but also **formal seed systems**. If this is the case, then there are a number of topics to be examined:
  - a) Do traders have seed, as distinct from food grain, which they sell to farmers at planting time?
  - b) If so, according to the traders and farmers, what is the difference between food grain and seed? What is the difference in prices?
  - c) Are **landraces**, new and/or recycled improved varieties sold in the local markets?
  - d) Are there farmer seed producers selling seed in the local markets or at seed fairs, or do they sell to buyers directly?
  - e) What volumes of seed are sold in local markets?

**2. Analysis of the formal seed system**

1. Is certified seed of improved varieties adapted to farmers' needs being produced and/or imported by national seed companies?
  - a) Can farmers afford to purchase the seed in local outlets?
2. How many seed companies are in the country and/or the target area?
  - a) Which crop varieties do they produce, **import or export**? Do they use farmers as contract growers to produce seed?
3. How many input dealers/agrovets are in the target areas?
  - a) What is their relationship to the seed companies?
  - b) Where do they purchase their seed? How do they promote use of quality seed?
  - c) What do they sell besides seed?
  - d) Do they have proper seed storage conditions (dry and cool, hermetic, hygienic, etc.)?
  - e) Is the quality and label of the seeds they sell controlled by the government or the seed company that they are distributing for?
4. What do national seed companies see as their biggest obstacles to growing their businesses?
5. What are seed companies doing to promote their seed with farmers?
6. Have seed companies developed their own brands such that farmers know and trust the brand?
7. What is the outreach of sale points for seed in the country through input dealers, seed companies, government input stores, etc.?
8. What are the sources of **basic (foundation) seeds** for national companies (government, own production, other sources)? Are **basic (foundation) seeds** available in a timely fashion in the quantity and quality needed?
9. Is the government producing and marketing certified seed?
  - a. If so, for which crops and what quantity of seed produced annually?
10. What is the **seed replacement rate** (SRR) (percentage of certified seed planted compared to total amount of seed planted)? This will provide an idea of how significant the commercial seed market is?
11. Is there a national seed association?

- a) What kind of services does it offer to members?
  - b) Is the national seed association a member of regional or global seed associations?
  - c) How many members are there (international, national, government, local)?
  - d) Are most seed companies members of the national seed association?
12. Rank the seed companies in the country by sales and number of crops.
13. The formal sector seed market:
- a) What varieties of the specific target crops are being locally produced commercially or imported and sold to farmers?
  - b) Does the government buy and distribute seed to farmers? On what terms, i.e. free, loans?
  - c) Does the government subsidize seed or influence the seed market in other ways?
  - d) Are there emergency organizations/programmes or NGOs distributing seeds to farmers?

### 3. Analysis of institutions supporting the seed sector

#### Development of new crop varieties

1. Are there new varieties being regularly developed by agricultural research to address the needs of farmers and consumers?
2. Is plant breeding (for the target crops) being conducted in the country or is there only screening of new crop varieties obtained from international sources?
3. Is there a national gene bank? Is it actively collecting and characterizing **landraces**?
  - a) Are there efforts to work with community seed banks?
  - b) Are local **landraces** used in developing new varieties?
4. Is the private sector breeding new crop varieties in the country or only introducing new varieties from outside?
  - a) If the private sector is breeding inside the country, is there the potential for a PPP in variety development?

#### Variety testing and release

1. Is there an active variety-testing and release system that provides new varieties for further multiplication and distribution to farmers?
2. Are farmers involved in evaluating new varieties as part of the variety-testing and release process (PVS)?
3. How many years of testing is required before a new variety is released?
4. How many varieties of significant food and cash crops are released every year? (*Obtain a national variety catalogue of release varieties.*)
5. Do agricultural research institutes test new varieties on farmers' fields?

#### Early generation seed production

1. Which government body is responsible for **early generation seed** production, i.e. pre-basic (breeder) and basic (foundation)? (*Obtain a copy of the early generation seed production figures, if available.*)
2. Do the bodies producing **early generation seed** have sufficient material and human capacity to plan for the effective demand and to produce the seed needed? What are the constraints?
3. Are seed companies also producing **early generation seed**? If so, for which crops and varieties?
4. How is the planning for **early generation seed** production coordinated to meet the demand for basic seed by the seed companies for further multiplication of certified seed? (*Obtain a copy of the seed demand planning document, if available.*)

5. Which agency is responsible for **early generation seed** production and for quality control of the **early generation seed**? Are there constraints to producing sufficient quantities of high-quality **early generation seed**?

#### Seed quality control

1. Is there a national seed certification agency?
2. Where is it located in the government structure?
3. How many seed-testing laboratories are there and what is the total number of laboratory staff?
  - a) Are ISTA procedures used?
  - b) Are there ISTA-accredited laboratories?
  - c) How many seed tests are conducted per year and for which crops?
4. What is the quantity of seed for each crop variety certified each year?
5. What is the quantity of seed for each crop (and variety, if possible) imported and or exported each year?
6. Does the government seed certification agency have the capacity (human capacity and funds) for nationwide coverage for certification of seed produced by local seed companies?
7. What is the cost of certification (certified and quality declared) for the national seed company and local seed businesses?

#### Other seed-related organizations:

1. What other international or national organizations support the seed sector (both formal and informal seed systems)?
2. What role do they provide?
3. Could they be significant partners in seed sector development directly or indirectly?

## 4. Analysis of seed policy, laws and regulations

1. Is there a recently written national seed policy which is a supporting element of the national agricultural policy? (*Obtain a copy from the ministry of agriculture.*)
  - a) How was the policy developed? Does it address the four interrelated areas of the analytical framework?
  - b) If not, what are its main elements and objectives?
2. Is there a national seed plan or strategy to implement the principles outlined in the seed policy? (*Obtain a copy from the ministry of agriculture.*)
3. Is there a national seed law and supporting regulations? (*Obtain a copy.*)
4. Is there a national seed board/committee and what are their responsibilities?
  - a) Who is on the board and how often does it meet?
5. What kind of certification is outlined in the seed law? Compulsory certification, truth in labeling, **quality declared seed**?
6. Are farmers' rights included in seed law or in other legislation?
7. Is there a plant variety protection law? Is the country a member of UPOV?
8. Has the government signed and ratified related international treaties (ITPGRFA, the Biosafety Protocol, the Convention on Biological Diversity (CBD), the International Plant Protection Convention (IPPC) and other related conventions and treaties)?
9. Is the country a member of the Organisation for Economic Co-operation and Development (**OECD**) Seed Scheme to facilitate international certification of seed or is it a member of a regional organization with harmonized seed trade regulations?

## Background documents

### National seed systems

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- \_\_\_\_\_. 2015. *Voluntary Guide for National Seed Policy Formulation*. Commission on Genetic Resources for Food and Agriculture. Rome: FAO. Available at: <http://www.fao.org/3/a-i4916e.pdf>
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- Technical note 3 - Seed value chain analysis
- Technical note 4 - Seed intervention landscape analysis
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- Turner, M. 2010. *Tropical Agriculturist Series/CTA – Seeds*. London: Macmillan Education.

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### Seed security

- Food and Agriculture Organization of the United Nations (FAO). 2011. *Seeds in Emergencies: A technical handbook*. FAO Plant Production and Protection Paper 202. Rome: FAO. Available at: <http://www.fao.org/docrep/014/i1816e/i1816e00.pdf>
- \_\_\_\_\_. 2014. *Seed Security Assessment: Practitioner's Guide*. Rome: FAO.

### Community biodiversity management

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- MacRobert, J.F. 2009. *Seed business management in Africa*. Harare, Zimbabwe: International Maize and Wheat Improvement Center (CIMMYT).

### Seed policy regulations and institutions

- Food and Agriculture Organization of the United Nations (FAO). 2006. *Quality Declared Seed System*. Expert Consultation, Rome, Italy, 5-7 May 2003. FAO Plant Production and Protection Paper 185. Plant Production and Protection Division, Rome: FAO. 250 pp. Available at: <http://www.fao.org/docrep/009/a0503e/a0503e00.htm>
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## Glossary of terms used in the toolkit

**Basic (foundation) seed:** Is the progeny of pre-basic (breeder) seed and is multiplied to producer certified (registered) seed which is then used to produce certified 2 (certified) seed which is sold to farmers. It is produced by an agricultural research institute, or specialized government agency or the private sector (for details on seed production and multiplication refer to the section in the HTDN on Early generation seed production).

**Biosafety protocol:** Refers to the Cartagena Protocol on Biosafety to the Convention on Biological Diversity (CBD), which is an international treaty governing the movements of living modified organisms (LMOs) resulting from modern biotechnology from one country to another, i.e. transboundary movement only. It establishes an advance informed agreement (AIA) procedure for ensuring that countries are provided with the information necessary to make informed decisions before agreeing to the import of such organisms into their territory. <https://bch.cbd.int/protocol>

**Breeder seed:** Refers to Pre-basic (breeder) seed.

**CBD (Convention on Biological Diversity):** The objectives of this Convention are the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and technologies, and by appropriate funding. There is a close link between the CBD and the International Treaty for Plant Genetic Resources for Food and Agriculture (ITPGRFA) (see below). The CBD includes all biological diversity, while the ITPGRFA includes only the 64 most important agricultural species. <https://www.cbd.int/>

**Certified seed:** Seed of a prescribed standard of quality, produced under a controlled multiplication scheme, normally from certified 1 (registered) seed. It is intended for sale to farmers (refer also to Basic seed).

**CGIAR (Consultative Group on International Agricultural Research):** A global partnership that unites organizations engaged in research for a food secure future carried out by 15 centres, which are members of the CGIAR Consortium. The work is done in close collaboration with hundreds of partners, including national and regional research institutes, civil society organizations, academia, development organizations and the private sector.

**Commercialization:** Refers to the quality assurance (see below) system and standards, licensing requirements for seed producers and sellers, and monitoring of seed quality in the market, along with the penalties for non-compliance, which control the seed market to ensure seed is of high quality.

**Community seed supply system:** The production and saving of seed by farmers and the exchange of seed within communities and social networks and in local markets. The seed can be from landraces and uncertified improved varieties.

**Cross-pollinated:** Plant species in which self-pollination is prevented by mechanical, biological or other means and as a result these plants have the potential to be more heterogeneous and require greater isolation distances to produce quality seed that is genetically pure and uniform.

**Cultivar:** Synonymous with the term “variety” and indicates a distinct population of plants within a crop species. With improved varieties, the population is relatively uniform/homogenous.

**DUS testing (distinct, uniform and stable):** Refers to tests to determine the varietal identity of a variety in the sense it is distinct from other varieties; it represents a uniform population of plants that is stable over time.

**Early generation seed production:** Refers to the small quantities of very high-quality seed that are multiplied over a series of generations to eventually produce certified seed for sale to farmers. The names of the generation of seed is based on two systems 1) the OECD Seed Scheme that will be used in this publication, and 2) the AOSCA (Association of Official Seed Certifying Agencies).

**Environmental issues:** Examples of environmental regulations related to seed include regulations regarding the safe handling and use of pesticides in seed treatment and living genetically modified organisms (GMOs), referred to as living modified organisms (LMOs) in the Cartagena Protocol. For example, after a living GMO is imported into a country based on the procedures of the Cartagena Protocol on Biosafety (see above), there are national GMO regulations and procedures for variety testing of GMO crops with isolation systems in place to prevent gene flow into the environment, environmental risk assessment of GM crops contaminating similar crops, and regulation of a GMO crop after it is released to farmers, to prevent contamination of conventional and organic crops.

**Evolutionary plant breeding:** An approach that consists of planting in farmers' fields mixtures (evolutionary populations) of very many different genetic types (genotypes) of the same crops (including improved varieties, landraces and genetic material from national and international gene banks). These populations will be mixed, planted and harvested year after year and due to natural crossing (higher in cross-pollinated and less in self-pollinated crops), the genetic composition of the harvested seed is never the same as that of the planted seed. Accordingly, crop population evolves to become progressively better adapted to the environment (soil type, soil fertility, agronomic practices, including organic systems, rainfall, temperature, etc.) in which it is grown. The genetic makeup of the population will change from year to year with changes in climatic conditions, but genotypes better adapted to dominating biophysical conditions will gradually become more frequent in this farming/breeding system.

**Farmer field school (FFS):** The FFS approach is an innovative, participatory and interactive learning approach that emphasizes problem solving and discovery based learning. The FFS aims to build farmers' capacity to analyse their production systems, identify problems, test possible solutions, and eventually encourage the participants to adopt the practices most suitable to their farming systems. This group-based learning process has been used by governments, NGOs and international agencies to promote integrated pest management (IPM) and other agriculture-related topics, including production, sales and use of quality seed.

**Farmers' rights:** As outlined in the ITPGRFA (below), this refers to national regulations on the protection of knowledge on PGRFA, equitable benefit sharing arising from the use of PGRFA and the right to participate in national decision making on PGRFA conservation and sustainable use.

**Farming households:** Rural smallholder households engaged in agriculture consisting of all family members, i.e. women, men and children, and who work as a team in all the practices related to agricultural production.

**Food grain:** The portion of the farmer's harvest for consumption or sale.

**Formal seed system:** Refers to the commercially-oriented production and supply of improved seed varieties by seed enterprises and governments using official quality assurance systems and inspections to ensure the seed produced is of high quality. High-quality seed has the attributes of high germination, physical purity, genetic purity and freedom from pests and diseases.

**GMO (genetically modified organism):** Any organism whose genetic material has been altered using genetic engineering techniques which is a laboratory process where genes from the DNA of one species are extracted and artificially forced into the genes of an unrelated plant or animal.

**Hybrid:** A variety produced by controlled cross-pollination of two distinct parents to provide "hybrid vigour". The progeny will differ from the parents, so requiring farmers to buy hybrid seed every year rather than having the option of saving seed to plant from the harvest.

**Improved variety:** A crop cultivar that has been developed through modern plant breeding methods and subsequently tested and selected for use by farmers based on its specific characteristics of yield, days to maturity, pest and disease resistance, culinary use or nutrition, etc. These varieties are bred to be homogenous and meet the Distinct Uniform and Stable test for uniformity.

**Informal seed system:** Refers to farmer and community-based seed systems for producing, saving and exchanging seed of landraces and improved varieties which are not certified and for which quality could be



variable. This system is a significant source of seed of preferred varieties for farming households because of proximity to the farmers. The cost of seeds in the informal system is lower than in the formal seed systems and farmers may receive seed as a loan, a gift or through barter.

**International treaty:** The International Treaty for Plant Genetic Resources for Food and Agriculture (ITPGRFA) governs access to plant genetic resources for food and agriculture (PGRFA) germplasm for the purpose of breeding new crop varieties. The ITPGRFA proposes guidelines for the equitable sharing of the benefits from 64 of the most important food and forage crop species, referred to as the multilateral system of access and benefit-sharing (the MLS). In addition there is a standard material transfer agreement (SMTA) to exchange germplasm for breeding of new varieties. [www.planttreaty.org/](http://www.planttreaty.org/)

**IPR/PBR (Intellectual property rights/plant breeders' rights), also referred to as PVP (plant variety protection):** National systems for intellectual property rights for new plant varieties provide exclusive commercial rights (for examples royalties) to the plant breeder or institute that develops the variety for a specified number of years and, therefore, these rights are an incentive for the development of new varieties.

**ISTA (International Seed Testing Association):** An international association with the mandate to develop and issue standard procedures for seed sampling and testing and to promote the uniform application of these procedures for evaluation of seed in international trade. This is accomplished through the publication of the international rules for seed testing, training and dissemination of knowledge in seed science and technology. It also operates an accreditation system for public and private seed testing laboratories so the accredited laboratories can issue seed testing certificates that are widely used in international seed trade. <https://www.seedtest.org/>

**Landraces/traditional varieties:** Dynamic populations of cultivated plants that have a historical origin (i.e. that have evolved, or been selected and cultivated in the area for a long time) and distinct identity, lack formal crop improvement, and are often genetically diverse, locally adapted and associated with traditional farming systems. These are often heterogeneous varieties that are adapted to marginal agroecologies and to low-input agricultural practices in which stability of yield is more important than maximum yield under optimal conditions, i.e. conditions generated by good rainfall and use of inputs.

**LMO (living modified organism):** As defined in the Cartagena Protocol on Biosafety, any living organism that possesses a novel combination of genetic material obtained through the use of modern biotechnology. The Cartagena Protocol on Biosafety regulates international trade in living GMOs and not the broader area of GMOs as food.

**Local varieties:** Refers to both local landraces that are indigenous to an area and uncertified, recycled, improved varieties that have been in the hands of farmers for many years.

**Low-input agriculture:** Refers to farming practices with minimum external inputs, such as fertilizer and pesticides, which may not be best for many modern varieties that are developed with optimal use of inputs to achieve maximum yield.

**Mass selection:** This method of selection depends mainly on selection of plants according to their appearance and performance; seed from selected plants are bulked for the next generation. This method is used to improve the overall population by positive or negative mass selection. Mass selection is only applied to a limited degree in self-fertilizing plants and is an effective method for the improvement of landraces.

**National seed policy:** A statement of principles that guides government action and explains the roles of relevant stakeholders in the coordination, structure, functioning and development of a seed system comprising both formal and informal seed subsectors. Ideally, seed policy should be developed with wide stakeholder participation, including farmers/farmer organizations, agricultural research institutes, national gene banks, seed certification agencies, seed companies and policymakers.

**National variety catalogue:** The national list of officially released varieties in the country with the description of their characteristics.

**Nucleus seed:** This is the hundred percent genetically pure seed with physical purity and produced by the original breeder/Institute. A pedigree certificate is issued by the producing breeder.

**Open-pollinated:** When the plants of an open-pollinated variety self-pollinate, or are pollinated by another plant of the same variety, the resulting seeds will produce plants roughly identical to their parents. Therefore open-pollinated varieties (OPVs) can refer to species that are either self-pollinated or cross-pollinated as long as the seed is produced in a controlled way such that the progeny will be identical to the parents.

**Organisation for Economic Co-operation and Development (OECD) Seed Schemes:** Provide an international framework for the certification of seed. They aim to facilitate growth in seed trade by reducing technical barriers, improve transparency and lower transactions costs. The OECD schemes authorize the use of labels and certificates for seed produced and processed for international trade, according to agreed principles. [www.oecd.org/tad/code/seeds.htm](http://www.oecd.org/tad/code/seeds.htm)

**Participatory plant breeding:** A collaborative plant breeding programme between breeders and farmers, marketers, processors, consumers and policymakers (food security, health and nutrition, employment). In the developing world, participatory plant breeding involves close farmer-researcher collaboration to bring about genetic improvement within a species. It is important to develop a clear vision together with the stakeholders in the breeding process.

**Participatory varietal selection:** A methodology for breeders and agronomists to learn, in the early phases of the breeding cycle, which varieties perform well on-station and on-farm from the point of view of the farmers, who will be the end-users, as well as other value chain actors.

**Phytosanitary regulations:** The regulations established by the International Plant Protection Convention (IPPC) on phytosanitary regulations to control the risk of the importation and exportation of pests and disease on or in seed. The approach is science based and uses the pest risk assessment (PRA) approach to avoid phytosanitary regulations being a barrier to trade.

**Plant variety protection (PVP):** Refers to national systems for intellectual property rights (IPR) for new plant varieties that provide IPR protection for a specified number of years to the plant breeder or institute that develops the variety.

**Pre-basic (breeder) seed:** Is produced from the nucleus seed by the agricultural research institute or other body often under the supervision of the plant breeder who developed the variety.

**Quality assurance:** The system by which the physical, physiological, genetic and phytosanitary quality attributes of seed are monitored during seed production to determine if the seed meets the quality standards of the country. The system includes field inspections, seed testing, post control plots and monitoring and traceability to ensure seed meets certain minimum standards. Standards vary for different quality assurance systems which include compulsory certification, quality declared seed (QDS) or truthfully labelled seed where the seed label reflects the actual quality attributes of the seed.

**Quality declared seed (QDS):** A system designed to provide quality control during seed production, which is less demanding on government resources than other more developed quality control systems (e.g. certified seeds), but is adequate for the production of good quality seed within a country. QDS is locally produced and commercialized quality seed of mostly locally adapted improved varieties, locally quality controlled by local seed inspectors licensed by a national seed quality control agency. The system is broadly based on four principles:

- i) A national list of eligible varieties for QDS is established.
- ii) Seed producers are required to be registered with the appropriate national authority.
- iii) The national authority will check at least 10 per cent of the seed crop.
- iv) The national authority will check at least 10 per cent of the seed offered for sale as quality declared seed.

**Seed:** For the purposes of this publication, seed refers to true botanical seed and not vegetative planting materials for which national seed systems are slightly different.

**Seed companies:** Refers mainly to both public and private, national and local, seed companies, including cooperative enterprises that produce and market seed to farmers. International seed companies are also involved in variety development, importation and production of seed.

**Seed quality:** The formal seed system has four attributes – uniform and undamaged; high performance; genetic purity, which relates to specific genetic characteristics of variety; and seed health, which refers to the presence or absence of diseases and pests within the quantity of seed. In the informal sector, the definition of seed quality varies, but farmers often go by appearance – of being relatively clean, smelling fresh and being free of mold, showing minimum insect damage and not being shrivelled or discoloured. They trust their own seed – or the seed they obtain – to give reasonable germination. Farmers sometimes want heterogeneous landraces, for example, of sorghum in Ethiopia or millet in West Africa, or a mixture of varieties, such as varietal mixtures of bean in Burundi, rather than genetically pure types of varieties.

**Seed replacement rate:** The percentage of certified seed purchased within the total amount of seed planted. Typically, the replacement rate in developing countries is quite low at 10-20 per cent.

**Seed security:** Exists when men and women within the household have sufficient access to quantities of available good quality seed and planting materials of preferred crop varieties at all times in both good and bad cropping seasons.

**Self-pollinated:** Plant species in which the stamen (male organ) and stigma (female organ) of the flower are in close proximity in the same flower and the pollen release is timed with the receptiveness of the stigma resulting in self-pollination. This results in varieties that are more homogenous and maintain their genetic purity and identity from one generation to the next. Examples include rice, wheat or legumes.

**Truthfully labelled seed:** Refers to seed produced for which the seed complies to the quality attributes indicated on the label and not an indicated minimum standard which is the case in compulsory and quality declared seed certification systems.

**UPOV (The International Union for the Protection of New Varieties of Plants):** An intergovernmental organization which provides a system of plant variety protection, with the aim of encouraging the development of new varieties of plants. Most countries and intergovernmental organizations which have introduced a plant variety protection (PVP) system have chosen to base their system on the UPOV Convention in order to provide an effective, internationally recognized system. [www.upov.int/members/en/](http://www.upov.int/members/en/).

**Variety:** Synonymous with the term “cultivar” as defined in the International Code of Nomenclature for Cultivated Plants, 1980, Art. 10: “The international term cultivar denotes an assemblage of cultivated plants which is clearly distinguishable by a group of characters (morphological, physiological, cytological, chemical or others) and which, when reproduced (sexually or asexually), retains its distinguishing characteristics.”

**Variety release:** The procedures by which promising new varieties are tested and a decision is made on whether the variety should be included in the national variety register and released for use by farmers.


**Variety release committee:** A national committee of seed sector stakeholders which reviews the results of VCU tests of promising new varieties and decides if the variety should be included in the national variety register and released for use by farmers.

**VCU testing (value for cultivation and use):** Variety testing is conducted to determine if a new variety has superior characteristics to existing varieties and should be included in the national variety register and be released for use by farmers.



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