



THE IMPACT OF NATIONAL SEED LAWS ON THE FUNCTIONING OF SMALL-SCALE SEED SYSTEMS

A Country Case Study

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INTRODUCTION

This study was conducted for the IFAD-Oxfam Novib program “Putting lessons into practice: Scaling up peoples biodiversity management for food security” and the “Sowing Diversity=Harvesting Security” (SD=HS) program, coordinated by Oxfam Novib and carried out with funding from Sida, IFAD, the Dutch Postcode Lottery and the Dutch Ministry of Foreign Affairs.

The study is one of the stock-taking activities undertaken under the SD=HS program, focusing on policies relevant to the functioning of small-scale farming systems. It aims to guide further work of the SD=HS program by assessing national seed laws in the eight countries covered by the program, to inform recommendations to ensure these laws better support the functioning of farmers’ seed systems.

- **Chapter 1** presents the results of a global literature review on small-scale agriculture and seed systems.
- **Chapter 2** draws on information from SD=HS partners to analyze the situation in the eight program countries – India, Laos, Mali, Myanmar, Peru, Senegal, Vietnam and Zimbabwe.

Extensive research has been done into the importance of farmer-managed seed systems to provide for local, national and global food security and maintain crop and variety diversity in small-scale agricultural production systems. The impact of intellectual property rights legislation on these systems has also been well researched. However, relatively little research has been done on the impact of national seed laws on the functioning of farmer-managed seed systems. This study is an attempt to fill that gap for the SD=HS program countries.

It is recognized that other policies and practices – for instance on land rights, road and water supply infrastructure, family and gender, and health care – may also have a critical role in affecting the functioning of small-scale production systems.

The SD=HS program has shown that farmers can be efficient and professional seed producers, providing a major share of the seed needed as input for the functioning of farmers’ seed systems. It has provided new insights into how seed production of farmers’ varieties and other varieties can be effectively organized at the local level. It has also linked the local farmers’ agenda to the national and global policy agenda, providing evidence – rooted in community experiences – for the need to change seed policy.

EXECUTIVE SUMMARY

Most seed is produced by farmers and circulates within farmers' seed systems. The balance between farmers' seed systems and the formal, largely commercial seed sector varies between and within countries and regions and between crops.

Both farmers' seed systems and formal seed systems are important. For example, farmers' seed systems offer seeds exhibiting high levels of diversity well adapted to local conditions, which can help to cope with climate change, while formal seed systems offer seeds that may be of higher quality or have new and important traits relating to yield and resistance.

Well-functioning seed laws should protect both buyers and sellers. The quality and the variety of seed cannot be reliably assessed by farmers at the time of purchase. Seed laws address this problem by establishing legal obligations for the seller to guarantee the quality of seed, by means that may include standardized inspection and testing procedures, and registration and certification of sellers and seed. Seed laws should also protect seed developers and producers from unfair competition.

However, seed laws typically pay little attention to farmers' seed systems. Current seed law and policy in many developing countries – as well as laws on plant variety protection – are typically drafted with the formal, largely commercial seed sector in mind. Such policy and law pay limited attention, if any, to the role of farmers' sector seed systems – but it can impact on the functioning of those systems in various ways.

International agreements on plant variety protection provide some flexibility. National plant variety protection laws are often based on provisions in WTO TRIPS (Trade Related aspects of Intellectual Property Rights) and in many cases closely adhere to UPOV (International Union for the Protection of New Varieties of Plants) standards. However, national legislators do have some scope to interpret these texts according to their own context.

No binding international agreements regarding seed policy and legislation exist, and many seed laws in developing countries have been modeled to developed country seed legislation. Several regional efforts are currently underway to harmonize national seed laws, which could help farmers by expanding their choice of commercial variety seed but may also make standards stricter in ways that work against small-scale farmers' interests and farmers' seed enterprises.

Seed laws may hinder farmers in acquiring seeds. When only registered and/or certified seeds may be marketed by registered sellers, it may become effectively prohibited to barter or exchange seeds not only of protected commercial varieties but also of farmers' varieties. This seems to be the case for the marketing of farmers' varieties of maize and other cereals in Zimbabwe and rice in Vietnam.

Farmers are generally allowed to save and reuse seeds, and possibly exchange and sell them in local markets. Program countries with plant variety protection laws in place effectively fully exempt small-scale farmers when it comes to saving and re-using seeds on their own farm. The extent to which exchange and selling in the community is also exempted varies from country to country. Small-scale farmers selling to each other appears to be allowed to various extents in India, Myanmar, Senegal, Vietnam, Peru and Zimbabwe, but not in Mali.

It is difficult for farmers to register new farmers' varieties. In most program countries, with the possible exception of India and Peru, legal requirements – for example, for field performance trials – make it unrealistic for small-scale farmers to register new farmers' varieties. Likewise, requirements in areas such as education and access to seed processing and storage facilities make it difficult for them to register as seed sellers, which limits their scope to operate beyond their local communities. Of the program countries, only in Vietnam have farmers' seed

clubs been able to gain informal permission for unregistered rice seed selling at the provincial level.

Seed laws and policies should do more to promote farmers' seed systems. Seed laws in the program countries provide some exemptions for traditional small-scale farmer activities but normally do not create specific facilitating conditions to support farmer seed enterprises.

BACKGROUND

Seed laws address a fundamental problem: farmers cannot reliably assess the quality and the identity (variety) of seed at the time of purchase. Seed laws are meant to protect the farmer by establishing a legal obligation for the seller to guarantee the quality and identity of seed via standardized inspection and testing procedures. Seed laws (dealing with seed identity and quality) and laws on plant variety protection (providing ownership rights) should also protect seed developers and producers from unfair competition.

These laws commonly provide procedures and standards for:

- variety release systems which aim to register only varieties of proven value to be made available to farmers through the formal seed system, and which require registration of seed producers;
- seed certification which aims to monitor and guarantee varietal identity and purity throughout the seed chain;
- seed quality control which checks on additional seed characteristics such as viability and seed health.

Seed laws are typically intended to regulate the formal sector. Many developing country legislators have based their laws on those in developed countries, where small-scale farmers' seed varieties are comparatively unimportant. Yet seed systems in many developing countries are predominantly farmer-based. And even though seed laws have typically not been designed with the intention of affecting the farmer-based seed sector, they may in fact do so. Formalities in registration and certification often impose transaction costs, which are unrealistic for small-scale farmer-seed producers.

For example, the earlier IFAD-Oxfam Novib program trained farmers to: (1) select their own stable varieties from segregating populations obtained from formal breeding programs; (2) develop varieties from crossings entirely performed on their own; or (3) enhance and regain the quality of certain preferred traditional varieties (e.g. sticky rice varieties in Northern Vietnam). If farmers wish to register such a variety to sell, they are usually required to provide detailed information showing that the variety fulfills the requirements for protection ("distinctness, uniformity and stability" – DUS) and/or marketing ("value for cultivation and use" – VCU). Likewise, farmer seed enterprises (FSEs) may be required to register as a legal person, which may require that they demonstrate possessing certain expertise and facilities.

Some seed laws have special provisions for the registration of farmers' varieties, taking into account small-scale farmers' capacities, while others do not. Sometimes these provisions are ambiguous. Governments may also lack the infrastructure, expertise and capacity to carry out regular seed inspections, even in the formal sector. In practice, no problems may occur as long as farmers' varieties are traded locally, but expanding the quantities or marketing areas involved can bring legal oversight that becomes a real impediment.

Holding back the farmers' seed system in developing countries is a problem because the sustained involvement of farmers in producing and distributing seeds is necessary for the seed supply to be sufficient, diverse and well-adapted, and to meet the goals of national food and seed security. In the face of climate change, locally available crop diversity provides coping strategies in small-scale production systems. It is a major challenge to mobilize knowledge on this diversity, facilitate the development of new diversity, and allow for horizontal transfer of materials and knowledge between communities and farming systems.

Seed from formal sources is important, too: it may offer new and important traits relating to yield and resistance which are not available from farmers' varieties offered in local markets. Although formal sector seed is often not readily accessible to small-scale farmers, it is gradually being absorbed in farmers' seed sector activities. It may be offered in local markets by seed retailers

and small-scale farmers, and be crossed with local farmers' varieties and further developed to better suit their needs and preferences.

The balance between formal and farmers' seed systems varies – between and within countries and regions, and between crops and farming systems. In general, the local market provides for many open pollinated varieties and vegetatively propagated crops, whereas seed of hybrid varieties is more likely to be sold (additionally or exclusively) through formal market channels. Formal seed systems tend to focus more on export crops, and farmers' seed systems more on local staple crops.

The challenge for policy makers is to create policies and laws that support each of these seed systems where they are most effective. This means not only attempting to avoid unintended impacts of seed laws on FSEs and farmers' varieties, but using seed laws to create specific conditions that are supportive of the important role they can play.

1. FARMERS' SEED SYSTEMS AND POLICIES

This chapter provides an overview of literature regarding the functioning of farmers' seed systems, and the impact of current seed policy and legislation on these systems. It sets the scene for Chapter 2, which discusses in much more detail policy and legislation in force and its impact in the SD=HS program countries.

Features of farmers' seed systems

Seed systems in many developing countries are predominantly farmer-managed (Richards *et al.*, 2009). These systems are based on collection, selection, crossing, testing, multiplication and storage of seeds and vegetative propagation materials by local farmers, without formal oversight or quality control. In farmers' seed systems, widening of the gene pool and testing of new materials take place continuously, based both on introgression of wild material into successful cultivated material, and on local and formal sector efforts towards varietal change and improvement.

Learning about management of genetic diversity may or may not be supervised or facilitated by external parties. In "participatory plant breeding" (PPB)¹, a group of farmers is trained and assisted to attain an identified outcome such as the development of better-adapted varieties, mutual training playing a major role. In the unsupervised, non-facilitated model farmers acquire planting material from sources including gifts, purchases, and accidental introgression from neighboring populations, such as caused by birds or animals. Farmers may – either consciously or unintentionally – select new varieties and traits in response to various local environmental conditions and cultural considerations, and then pass these on through their social and economic networks, thereby "stabilizing" the system.

Berg (2009) referred to the divergent character of farmers' varieties and the term "landrace", the latter tracing to the late nineteenth century and referring to seeds naturally adapted to local growing conditions usually with no intentional selection by farmers. This term was quickly adopted to indicate all farmers' varieties, including those that are consciously bred by active seed selection on-farm. Berg proposed that such farmer-bred varieties can be better termed 'folk varieties' (this report refers to them as farmers' varieties): vulnerability to genetic erosion and feasibility of on-farm conservation are clearly different for the two categories, as farmers consciously maintain the distinctive features of their folk varieties, so seed policies should distinguish between them.

PPB generates new varieties belonging to the class of folk varieties, or farmers' varieties. Almekinders *et al.* (2006) make the link between PPB and informal seed supply: they describe how well-adapted cultivars developed through PPB may be disseminated by seed production and distribution, without major bottlenecks. In contrast, provision of quality seed from the formal sector to small-holders may be constrained by farmers' poor access to product information, or lack of affordability, infrastructure and market conditions.

Long-term involvement of farmers in producing and distributing seeds is therefore a condition for the supply of diverse and well-adapted seed, whether stemming from PPB or from formal sector sources. Almekinders *et al.* (2006) also argue that even if farmer seed production is not always economically sustainable at household or organization level, public investment in farmer-based seed systems is justified by the benefits to society as a whole.

¹ In this report the term participatory plant breeding (PPB) is used in a wide sense, encompassing not only crossing, but also selection in either segregating populations (PPB *sensu stricto*), comparative evaluation between stable varieties (PVS), and participatory variety enhancement (restoration of traditional varieties; PVE).

Food security following disaster

In disaster situations causing food insecurity (such as adverse weather conditions, pest and disease infestations, or civil unrest), seed aid has often formed part of an emergency response. However, McGuire and Sperling (2011) argue that in practice there is a very weak correlation between acute food unavailability and seed unavailability as, for many crops, only a very small proportion of the harvest is needed to meet the sowing needs for the following season.

As far as the correlation does exist, problems occur most frequently around access to seed rather than production of it. Seed aid can help to address acute seed unavailability in disaster – or, rather, rehabilitation – situations, but may have the side-effect of undermining long term seed security and diversity by undermining local distribution mechanisms, threatening the functioning of local markets and the maintenance of local crops and varieties, and taking away incentives for maintaining household and community level seed reserves.

In general, farmers' production and food security are likely to be affected more by ownership of assets (especially land), use of other inputs, human capital, social capital and climate than by small fluctuations in seed availability.

Food security and climate change

Climate change is projected to affect agricultural production, yet there is a lack of analysis of impacts on *in situ* management of crop genetic diversity and the capacity of farmers who conserve (Mercer and Perales, 2010). It is largely unclear how farmers' varieties, as much as modern varieties, will be able to respond to alterations in climate – although some examples have been documented where adaptation will be difficult, such as in the case of the farmers' varieties of potato maintained in the Andean region.

The general effects of climate change on crop yields have been amply documented by Lobell *et al.* (2008). Altieri and Koohafkan (2008) have argued that locally available inter-specific and intra-specific diversity also offers coping strategies in small-scale production systems, and note that a major challenge is to mobilize the knowledge on this diversity and to allow for horizontal transfer between farming systems. This calls for policies supporting farmer-managed seed systems and a facilitated seed exchange between more distant farming communities.

Informal seed sources and markets

In the developing world, informal markets are the most important sources of seed for small farmers for most food crops, except often for maize and vegetables. Field studies show diverse trends in the functioning of these informal markets, which have unrealized potential to deliver a wider range of higher quality seed (Sperling and McGuire, 2010). A better understanding of the functioning of informal markets is an important prerequisite to strengthening them.

In 2015, McGuire and Sperling documented the degree to which seed acquisition depends on the informal sector, especially in Africa: a data set covering 9660 observations, across six countries and 40 crops, show that farmers access 90.2% of their seed from informal systems, with 50.9% of that from local markets. Further, 55% of seed is paid for in cash, indicating that smallholders are already making important investments in this arena.

The authors argue that seed sector strategy has to become more smallholder-focused. For instance, absolute production gains require a different strategy from the aim of system resilience through offering a wide portfolio of crops and varieties. The data also show that impressive results, at scale, are not necessarily achieved by focusing on the more common metrics used to measure seed sector success, such as “tons of seed produced” (often only a function of how much financial assistance has been allotted) or “value of seed sector” (which looks only at monies earned). The authors argue for broader measures of how “seed channels –

formal, informal and integrated combinations – are actually working to reach smallholders with the seed products and information that such farmers want and need”.

Reliance on the market for seed, whether farmer-managed or of formal origin, is particularly important for poorer farmers – especially in times of stress (Sperling and McGuire, 2010). Farmers may seek seed from the market in response to short-term problems that reduce their own on-farm seed stocks. For example, poor yields may cause some farmers to consume or sell the entire harvest, setting aside little or none for seed. Seed stocks may be sold to meet an acute need for cash, such as with illness. Seed stocks can be spoiled by pests, disease, theft or weather conditions. Or germination may fail because of variable rainfall, poor soil quality, grazing animals or disease, necessitating new seed to be accessed.

Across the globe, supply from other sources than markets – such as neighbors or kin – is in decline, albeit to varying extents and not necessarily in all SD=HS program intervention areas. In many cases this is due to changes in social networks (Sperling and McGuire, 2010). Seed exchange between households depends on the social ties that appear to be in decline due to factors such as labor migration, livelihood diversification or prolonged conflict. Altieri and Koohafkan (2008) suggest strengthening farmer-to-farmer networks to enhance agricultural resilience to climate change. The trend to more extensive market use may also result from chronic poverty: farmers need to procure larger amounts of seed more regularly, which cannot always be easily fulfilled by neighbors in the community.

In this context, a small number of farmers may be identified as ‘key seed suppliers’ by their neighbors. Farmers may also consciously prefer to obtain seed from trustworthy merchants, who have better storage facilities. The existence of seed villages, clubs, regions or centers is also evidence of specialized functions in seed markets. Where crops have to meet specific standards for quality or uniformity in output markets, in particular export markets, farmers may want to purchase higher-quality seed (Sperling and McGuire, 2010). As seed quality cannot be seen, farmers assess also the ‘quality’ of the provider, choosing trusted farmer-sellers or merchants from whom they have previously bought good quality seed.

Often, farmers buy grain and use it as seed – usually from sellers whose farms they know to have conditions similar to their own, to increase the chance that it will provide them with a good yield. It is a challenge for farmers to obtain sufficiently useful information on agro-ecological conditions over larger distances. Traders may also factor in agro-ecological conditions under which seed has been produced when acquiring stocks to sell as seed: they may seek out individual farmers or villages known for producing good seed, in some cases giving standing orders. With such specific demand, farmer-producers know in advance that they are producing ‘seed’ from the moment the crop is sown, and manage the crop accordingly.

Seed from formal sources may offer new and important traits relating to yield and resistance that are not available in informal markets. However, formal sector seed is often not readily available to small-scale farmers. They may have to travel to a nearby town where there is an agrochemical outlet. Usually the farmers do not have information about where seed can be purchased, nor do they know about cultivars, quality or price. Some interventions attempt to take away such limitations, e.g. those under the (controversial) AGRA umbrella promoting the share of commercial private sector seeds.

COMMUNITY-LEVEL SEED ENTERPRISES

Tripp and Rohrbach (2001) have looked into community-level seed enterprises as an alternative for new, non-hybrid crop varieties: “a large number of projects in Africa, Asia and Latin America have pursued this goal”, with NGO or project staff organizing farmers in a village to work as a group. The farmers are provided with source seed, usually acquired from the national agricultural research system, and trained in seed multiplication techniques. Often, quality oversight is provided by staff of the regulatory agency or extension agents. The farmers are expected to use part of the seed, and sell the rest to neighboring farmers. The assumption is that this activity will evolve into a financially viable village-level enterprise, capable of recovering the costs of the source seed and advisory services.

In some cases, these projects have been effective at expanding farmers’ access to seed of new varieties: the seed has diffused well beyond the participating farmers and often to other villages. However, this has taken place through the normal channels between households and farmer communities: the seed is either provided as gifts or sold at the price of grain. The authors report finding no case in which a sustainable farmer-managed seed enterprise has emerged – there is not sufficient demand at the village level, farmers usually have few contacts outside their villages, and none of the projects developed retail trading networks to compensate. Farmers often do not recognize the added value of locally produced but higher quality seed, and see little reason to start paying their neighbors a premium.

These conclusions might, nonetheless, be too negative. Tin *et al.* (2011) provide contrasting evidence about farmer seed clubs in the Vietnam Mekong Delta that have gained a substantial share in the provision of rice seeds with the support of the University of Can Tho and SEARICE. Apparently, farmer seed club-produced seed has provided sustainable added value over commercially available seeds and farm-saved seeds based on local adaptation, quality and price, and contributed to strengthening the farmer-managed seed system and local diversity. In some cases, these seed clubs produce and market specific varieties better adapted to local conditions, such as high saline soils. Also, the success of the Zimbabwe-based farmer seed enterprise ZAKA Super Seeds has so far been sustained.

Tripp and Rohrbach (2001) themselves mention an example of success in Ghana, where individual farmers – often former contract growers for a previous national seed company – had been trained to multiply seed of open-pollinated maize varieties, a crop for which farmers usually buy seeds in the market. The growers bought foundation seed from a government agency, multiplied it, and paid for conditioning and storage at the former seed company’s facilities, with quality control provided by a regulatory agency. The growers were responsible for selling their seed to dealers – often, they helped finance the seed multiplication and storage, with the growers agreeing to be paid for their seed after it has been sold. It is not clear to what extent the project was motivated by empowering farmers and strengthening local diversity.

Certified seed production by smallholders has been reported more recently by Guei *et al.* (2011), regarding quality seed production for rice, maize, sorghum and millets in Cameroon. With the support of FAO, the farmers were selected, trained and linked to extension services – the Agriculture Research and Development Institution (for seed supply), the National Seed Service (for seed certification) and financial institutions (for financial support). In total, approximately 450,000 tons of cereal grains were produced. A general conclusion may be that external support in the form of seed supply, local facilities and local government help is instrumental in turning these initiatives into a success.

Seed policies and legislation

The genetic information carried by seed may be associated with traditional or scientific knowledge. It is the subject of policies focusing on private (intellectual property; marketing), community (traditional knowledge) and national (sovereignty over biological diversity) rights and targets (food security, sustainable production). Genetic information can be a kind of technology transfer, helping to increase output and reduce risk while responding to cultural preferences. It may fundamentally transform farming systems.

Across the world, the seed sector develops in diverse ways as differing weights are given to the various policy areas mentioned above and different opportunities are offered by local institutional and commercial settings. In many countries, farmers' and formal seed systems operate side by side, with varying proportions. The balance between public and private roles in formal seed systems also varies. These differences are apparent between and within countries and regions, and between crops and farming systems. The challenge for policymakers is to create policies and laws that support each of these various seed systems where they are most effective (Louwaars *et al.*, 2012; FAO, 2015).

Over the last three decades, government strategies for seed sector development in developing countries have evolved considerably. Until the 1980s, national governments played a major role in seed sector development. Since then, national agricultural research systems and other government agencies have largely disengaged from seed production. In some countries and for certain crops, this has led to the development of a dynamic private seed sector, but in many other countries and for many crops the public seed sector has collapsed whereas no private seed sector has emerged to replace it. As the seed industry in many developing countries is unable to provide farmers with adequate access to quality seed, the farmer-managed seed sector will continue to be farmers' main source of seed (FAO, 2015).

As the farmer-managed seed sector often lacks the ability to offer high-quality seeds exhibiting new traits, in particular higher yields and better resistances, national seed policy should address the respective roles of the public, private and informal sectors and the need for coordination. Louwaars *et al.* (2012) suggested that countries should develop integrated approaches that strengthen both the formal and farmer-managed seed systems and connections between them, to ensure the production of the seeds of crop varieties that are useful for diverse and evolving farming systems. In line with these recommendations, the African Union has adopted a model policy of integrated seed systems.²

Though legislation is important, many aspects of seed sector operations are best managed through voluntary procedures set out in policy documents. Law and policy are complementary – the policy provides objectives and frameworks, while the law provides legal force to certain key issues, notably those relating to seed quality (FAO, 2015).

Seed policy

Some national seed policies recognize the informal sector's important role and promote support – or even official recognition – in areas such as extension, training schemes for farmers, community seed banks, germplasm conservation and seed quality control. In other countries, the farmer-managed seed sector is not recognized at all. In only few cases is the role of women given particular attention.

Community seed banks – collections of seeds that are maintained and administered by the communities themselves – may also be recognized or promoted. Seeds may be stored by a community either in large quantities, to ensure that sufficient planting material is available at the

² <http://www.issdseed.org/resource/african-union-commission-communication-C3%A9-integrated-seed-sector-development>

start of the next season, or in small samples to ensure that genetic material remains available over several growing seasons should varieties become endangered (FAO, 2015).

All seed policies aim to ensure that farmers, including small-scale farmers, have access to good quality seed of a range of major crops and varieties. In practice this aim is often not realized due to factors including (Mutonhori and Muchati, 2013):

- lack of financial resources allowing farmers to purchase seeds and associated inputs such as fertilizers and pesticides;
- limited access to seed markets;
- uncertainty about the advantages of new germplasm as opposed to local varieties;
- lack of knowledge about seed identity and quality;
- uncertainty on yields and fluctuating produce prices;
- lack of capacity to meet phytosanitary requirements; and
- lack of recognition and support for local/small farmers' seed systems.

Seed laws

Seed laws define principles to govern seed production and marketing, identify the competent authorities, define prohibitions and obligations regarding the marketing of seeds, and may stipulate registration for seeds and sellers and set other quality requirements (FAO, 2015). They reflect a fundamental problem: as the quality and variety of seed cannot be reliably assessed by farmers at the time of purchase, they need to be protected by establishing a legal obligation for the seller to guarantee the quality of seed.

Seed laws regularly also protect the seed developer and producer from unfair competition, through measures such as a certification system, quality standards, and accreditation and authorization procedures (FAO, 2015). Various stakeholders question whether in practice seed laws are effective in reaching the goal of protecting both enterprises and consumers. Among other factors, this depends on government capacity to carry out regular seed inspections, which in many developing countries is insufficient.

Even where seed policies recognize farmers' seed systems, seed laws may concentrate entirely on the formal seed systems, ignoring their potential impact on farmer-managed systems. In many countries, legislation focuses on incentives for the development of commercial markets, and little has been done to avoid interference with small-scale farmers' seed systems. During the last decade, seed laws in many developing countries have been reviewed: compulsory rules on seed certification and variety release have been replaced by voluntary ones in a number of Latin American, African and Asian countries, to promote the development of a seed industry; in contrast, India made voluntary rules more compulsory to strengthen farmer protection.

In many countries, in principle the law applies to all seeds and planting materials but implementation is in practice limited to major crops essential for national food security. Despite the growing awareness of the value of the small-scale farmers' sector, very few countries have explicit exemptions in their private sector-oriented seed laws for farmers' seed systems, which may render marketing of local varieties, landrace seeds and farm-saved seeds of improved varieties technically illegal (Louwaars, 2008).

According to Louwaars (2005), seed laws commonly provide the procedures and standards for:

- variety release systems which aim to register only varieties of proven value to be made available to farmers through the formal seed system;
- seed certification which aims to monitor and guarantee varietal identity and purity throughout the seed chain;
- seed quality control which checks on other seed characteristics such as viability and seed health, protecting *bona fide* seed producers from unfair competition.

ASPECTS OF SEED POLICY NORMALLY INCORPORATED IN SEED LAW

As explained in the FAO *Voluntary Guide for National Seed Policy Formulation*, adopted in 2015, the following areas of seed policy will normally be incorporated in seed legislation (FAO, 2015):

Objective. The primary objective of seed legislation is regulating seed production and marketing to protect farmers and the industry from fraudulent sales of low quality seeds. Seed legislation also aims at stimulating research and innovation, fostering a fair seed market – one in which farmers have access to seeds of the varieties they need, at a price they can afford – and promoting food security and sustainable rural livelihoods as well as sustainable management of plant genetic resources.

Scope. The scope of seed legislation determines the types of seeds and other products (such as seedlings) to which the law applies and the seed management activities that it regulates. The scope of the law may cover only selected plant species or varieties of species registered in the national catalogue. It may cover only seeds of a particular category (e.g. certified seeds) or all types, including uncertified seeds. Different processes within the seed production and marketing chain may also be regulated – for example, seed registration, certification, distribution or trade.

Definitions. The seed law should incorporate clear definitions to facilitate implementation. Key terms such as 'seed', 'certification', 'marketing', 'labeling', and 'inspection', should be clearly defined in conformity with international norms so they are interpreted in the same way by all stakeholders.

Institutional framework for implementation and coordination. Seed laws should specify the national authority that will have the mandate and legal power to effectively implement them.

Regulating the pre-marketing phase. The pre-marketing phase covers all stages prior to seed marketing, including variety testing and release, seed production, quality control and certification. Regulating this phase is not a prerequisite for a viable seed supply chain, although most countries with seed laws nowadays tend to regulate some or all of its stages. Instead, countries could decide only to test and control the quality of the seed as marketed, regardless of the conditions under which it was produced.

Given that the main purpose of seed legislation is to improve the overall quality and reliability of seed in the marketplace and protect farmers from low-quality seed, seed laws may also be used to provide a facilitating environment for the development of farmer-managed seed systems and local seed enterprises. The extent to which these objectives are reached in the program countries is analyzed later in this report.

Formal seed production, in both the private and public sectors, involves a systematic process of variety evaluation and seed multiplication in which seeds fall into various classes that are often recognized in law – breeder/pre-basic, foundation/basic, registered and certified. Some countries distinguish a commercial seed class, which guarantees quality but not which variety or the purity. Formal seed production requires means of assuring quality standards and mechanisms for coordinating functions. In the farmer-managed system of saving and exchanging their own seeds, the same processes of variety evaluation and selection may be undertaken – mostly informally and without supervision, except in the case of some FSEs.

For example, Zimbabwe has introduced a three-level seed production system: (1) breeder seed; (2) foundation and registered seed; and (3) certified seed. Foundation seed is normally

produced on state-owned or university farms. Registered seed is produced by registered seed growers from foundation or breeder seeds. Certified seed is the progeny of either foundation or registered seeds. Production of foundation seed and certified seed can only be performed by recognized seed producers (Venkatesan, 1994).

Policy-makers have to consider complicated trade-offs between stricter measures for quality control and the need to encourage the multiplication and distribution of lower-cost seed (Rohrbach *et al.*, 2003). Certification regulations that aim to guarantee quality by providing minimum standards of genetic purity, physical purity and germination rates are often expensive. If large quantities of seed are produced in a small area, inspection costs are manageable, but they quickly become prohibitive if seed production is dispersed across widely distributed groups of small-scale farmers. The higher the number of varieties that need to be certified, the greater the expense.

Several countries have responded to these difficulties by relaxing their inspection requirements: stricter certification standards are demanded only for a few commercial seed crops. Countries may have also different standards for different classes of seed, to try to balance the need to protect farmers with the need not to overburden producers. In 1998, Tripp and Louwaars suggested that national seed regulatory agencies shift their role towards technical and policy support to develop a wider range of seed provision options. For example, the FAO-developed concept of “quality declared seed” (FAO, 2006) reduces the burden of certification while still providing significant consumer protection.

Quality declared seed

The FAO introduced the quality declared seed (QDS) system noting that many countries lack the expertise and infrastructure to certify all seed lots offered in the market, and not all producers will be able to meet the strict requirements set for commercial seed enterprise, but minimum standards of genetic purity, physical purity and germination rates may still be relevant.

Aimed to provide “seed standards for a wide range of crop species and agro-ecologies for the development of the agricultural sector”, the system gives major responsibilities to seed producers and dealers. The system was revised in 2003 to improve accommodation of local varieties.³ Still, adoption rates have remained very low, mainly because requirements are perceived to be high in relation to its added value.

QDS has been defined as:⁴

seed produced by a registered seed producer which conforms to the minimum standards for the crop species concerned and which has been subject to the quality control measures outlined in the Guidelines. For seed of local varieties and varieties developed through participatory plant breeding the minimum standards may be different from varieties developed through conventional plant breeding approaches.

It is not intended that QDS should compete with existing schemes of seed quality control, or that the work of other specialized organizations should be duplicated. The purpose of QDS is to offer an alternative, which can be used for those crops, areas and farming systems in which highly developed seed quality control activities are difficult to implement or make relatively little impact. In particular, it may more easily accommodate varieties of crops, which, for different reasons, do not easily fit within a conventional seed quality control scheme. Being implemented primarily by seed producers, it also facilitates local seed production.

³ <ftp://ftp.fao.org/docrep/fao/009/a0503e/a0503e00.pdf>

⁴ <ftp://ftp.fao.org/docrep/fao/009/a0503e/a0503e00.pdf>

QDS may set lesser requirements for the description of farmers' varieties:

For a local variety: (a) a statement giving the origin of the variety; (b) a simple morphological description and its value for cultivation and use with an indication of the agro-ecological zone for which the variety is suited; (c) a statement indicating the procedures to be followed for maintaining the variety.

For a variety developed through participatory plant breeding methods: (a) a statement giving the origin of the variety; (b) data obtained during the farmer evaluation process; (c) a description of the main characteristics, which distinguish the variety from other varieties; (d) a statement defining the agro-ecological zone, for which the variety is suited, and (e) a statement indicating the procedures to be followed for maintaining the variety.

From a recent study by Haug & Hella (2013), it appeared that small-scale farmers in Tanzania still made relatively little use of quality declared seed, as they considered it either to be too expensive or of too little added value. A village seed scheme in Jharkand, India – designed to organize seed production, meet local demands, and introduce new crops – also met with limited success due to bad weather conditions and lack of motivation, though some of farmers' seed production practices reportedly improved as a result.⁵

The International Federation of Organic Agriculture Movements (IFOAM) has developed an alternative certification system,⁶ known as participatory guarantee system, which emphasizes:

- Food sovereignty ('no' to agrifood sector concentration), food security and food safety;
- Being appropriate to the realities of small farmers and enterprises;
- Flexibility and emphasis on learning in a transparent and trust-building system;
- Priority for local markets and long term relationships;
- Co-responsibility and decentralized decision-making, emphasizing empowerment, capacity building and gender sensitivity.

Such systems are still very rare, but do offer guidelines that may be useful in a wider context.

Lack of substantial implementation of the QDS concept, and mixed reports from the few cases where QDS was introduced, warrant a more in-depth study on its strengths and weaknesses. Elements of the QDS principles may be considered in SD=HS efforts to have farmers registered as seed producers and sellers, and farmers' varieties registered in the national catalogue, while offering farming communities a wider diversity of affordable, quality seeds.

Regional harmonization of seed laws

In an attempt to support the private seed sector and boost economies by providing options to sell seed across borders, initiatives for regional harmonization of seed laws have been prepared in West Africa and Southern Africa and suggested in the Association of Southeast Asian Nations (ASEAN). Such harmonization should promote the distribution of appropriate and adapted varieties between countries within the sub-region.

However, these initiatives have also resulted in proposals for stricter rules, often only allowing varieties meeting the International Union for the Protection of New Varieties of Plants (UPOV)-based DUS standards (distinctness, uniformity and stability) to be marketed. Farmers' varieties are distinct, as they recognize them for certain traits, but often not uniform or stable to the same extent as commercial varieties. As in the development of national seed laws, regional harmonization initiatives have paid little if any attention to the role of small-scale farmers' food systems and the informal seed systems (Grain, 2005 and 2015).

⁵ <http://ranchi.rkmvu.ac.in/?q=content/impact-assessment-seed-village-scheme-some-villages-jharkhand>

⁶ <http://www.ifoam.bio/sites/default/files/page/files/alternativecertificationandanetworkconformityassessmentapproach.pdf>

Maize exemplifies the rationale for regional harmonization. The most important food crop in Southern Africa, it accounts for 40-50% of the calories consumed by the poor and has been the target crop for political, research and development interventions for over six decades. Yet seed markets in the region in which companies offer hybrid or OPV seeds are segregated, diverse and difficult to access for newcomers. In each country a new variety must go through lengthy variety testing and release procedures before seed may be marketed.

The harmonization of seed policies and regulations has been a longstanding interest of both SADC and COMESA (Common Market for Eastern and Southern Africa). All SADC member countries have signed protocols aligning the variety release, seed certification and quality assurance system, and providing for common quarantine and phytosanitary measures. Implementation is being piloted in Malawi, Swaziland, Zambia and Zimbabwe with support from the Swiss Agency for Cooperation and Development through the Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN). No country has yet fully officially domesticated the SADC protocols, but seed import and export do occur between SADC states, although this is not always efficient or easy (Kassie *et al.*, 2013).

Over the past five years, considerable progress has also been made in harmonizing seed policies in Eastern and Central Africa. For example, the length of the variety release period has been reduced from three or more years to only two seasons. This has resulted in increased availability of improved seed varieties and private sector participation: in countries with comparable data, the growth in the number of seed companies and seed varieties was substantial. Seed certification procedures in the region have been standardized to OECD standards. However, the failure to establish interagency certification for seeds in transit may be hampering seed trade. Within the harmonization period, quarantine pest lists have been revised for some but not all countries (Waithaka, 2011).

Other legislation in relation to seed laws

Plant variety protection

According to the WTO-TRIPS agreement, all developing country WTO members need to introduce some form of plant variety protection (PVP) system, if they have not yet done so (FAO, 2015). LDCs have an extended deadline until July 2021, which may be extended further.

PVP entails a form of intellectual property rights protection. Under PVP the production and marketing of a plant variety will be protected, but not the use of such variety for further research and breeding (known as the “breeder’s exemption”). In addition, increasingly limited rights may remain with farmers to propagate and use the protected variety for seed production (known as the “farmers’ privilege”).

A rationale often given for PVP is that controlling the use of new varieties will enable breeders to earn more income from their innovations and incentivize investment in further breeding, which should benefit society as a whole. However, research on the impacts of PVP in developing countries suggests that the impact may be limited as demands for commercial seed are relatively low.

An effective PVP system will keep firms from appropriating varieties developed by their competitors and help public research establish clear mechanisms for the production and marketing of its own varieties by the private sector. PVP also allows for controlling farmers’ production and sale of protected varieties, which may or may not be an important criterion for seed firms to decide to enter a seed market. Other mechanisms, such as seed law provisions on the registration of seed sellers and marketed varieties, can also be used to control misappropriation that discourages seed firms from entering a market.

Another type of ‘competition’ that may be recognized by seed companies is farmer seed saving. In most cases attempting to control seed saving is infeasible and unwise, given the nature of

subsistence farming systems. Only in a few cases may such competition be real, e.g. horticultural crops of high economic value grown by commercial farmers or FSEs focusing on local to national markets.

A World Bank report noted that the introduction of PVP will contribute to further seed sector development only when the sector has already reached some level of proficiency (World Bank, 2006). In many developing countries where formal seed systems are just emerging, the efficient and transparent management of regulations for seed marketing, variety registration, and seed certification and quality control under a seed law can do more to encourage commercial seed development of major food crops than the establishment of PVP (FAO, 2015).

It is important not to lose sight of the fact that IPR regimes such as PVP are established to help achieve societal goals. Policy makers in developing countries should view PVP as a tool to be adapted and used for achieving national agricultural development goals, rather than an obligation imposed by industrialized countries. Meeting those goals requires an understanding of the circumstances of different classes of farmers, an analysis of the requirements of different types of commodities, and a capacity to fine-tune IPR regimes accordingly (FAO, 2015).

Against these observations, it should also be noted that intellectual property rights of any nature can result in monopolization, which is in the interest only of the rights holder and not the users or society at large. As Stiglitz (2008) puts it: "Intellectual property, particularly plant variety protection and patents, is not the only form of incentive for innovation. It may even be counterproductive. Because sometimes the best or easiest way of making money is not to come up with a better idea, but to form a monopoly or cartel and restrict competition."

It has been often recommended that PVP schemes distinguish between different crops, markets and farming systems. Proposals have been made to exempt the farmer-managed seed system, in order to not negatively affect or even criminalize their functioning. A very strong PVP system could reduce the farming community's accessibility to seeds: farmers might be pushed to the market for each seed purchase, if not free to exchange and sell seeds of the varieties they maintain (Ranjan, 2009).

Interestingly, the Indian Protection of Plant Varieties and Farmer's Rights (PPVFR) Act contains a requirement for the plant breeder to disclose information regarding the use of any genetic material conserved by local and indigenous communities (Ranjan, 2009), which is relevant in relation to legislation on access and benefit-sharing.

None of the breeding companies active in developing countries interviewed by Tripp *et al.* (2007) indicated that they would expand into breeding open-pollinated varieties because of the introduction of PVP only, since this would need strong enforcement, which is normally not realistic. Instead, it appeared that the option to develop hybrids has provided the impetus for the development of the seed industry in the USA, Kenya and Zimbabwe. When India's seed policy changed in the 1980s to promote private sector development, it was hybrid sorghum and pearl millet that led to the development of a seed industry, not open-pollinated varieties.

Private sector developments can also be noticed for those crops for which seed saving is difficult or inconvenient, as for many vegetables. This reality undermines to some extent the justification for the introduction of PVP, which may remain mainly relevant for exports of high-value commodity and ornamental crops.

Patent law

Patent law differs from PVP law in that the protection covers not just the marketing of a plant variety, but also extends to any research and development involving the plant variety. Patents can relate to production processes (how something is made) as well as products (the result of the process).

In general, patent laws in the program countries (Myanmar is under approval, Mali and Senegal fall under the Bangui agreement) do not allow patents on plants and animals other than micro-organisms, or essentially biological processes for the production of plants or animals, other than microbiological processes, in accordance with the options of the TRIPS agreement (Article 27.3 (b)). With the exception of Zimbabwe, national laws and regional agreements are explicit on non-patentability of plant varieties.

Globally, innovative plant traits – as opposed to plant varieties – may be covered by patent protection in a number of jurisdictions, and some regional organizations do allow for broader patenting. Such patents may cover traits introduced by genetic modification as well as native traits present in plant varieties.

Currently, no plant patents – in particular GM-based patents – appear to have been effective in the program countries, with the possible exception of India, where some GM varieties may be covered by patents under the claim that GM-based plant and animals are the product of a process of genetic engineering that is not to be seen as essentially biological. Since patents commonly provide fewer exemptions than PVP, it is highly relevant to include the effects of patent laws in future analyses of regulations on seed systems.

Relevant international agreements

The WTO TRIPS Agreement requires that before 2021 all member countries introduce legislation on intellectual property protection in international trade, but also allows member states to introduce special (*sui generis*) legislation for plants and animals other than micro-organisms, or essentially biological processes for the production of plants or animals other than microbiological processes. As mentioned above, a proposal for further extension of the deadline for certain developing countries has been made.

Many countries have opted for such a *sui generis* legislation on the protection of plant varieties, and a number have opted for UPOV membership. However, UPOV's lack of flexibility to allow smallholder farmers to use, exchange and sell farm-saved seed of a protected variety has discouraged some developing countries from joining and implementing its PVP model. Over time, UPOV has adopted various acts (1968, 1972, 1978 and 1991) which differ in requirements for variety protection. The 1991 version has the most stringent requirements, and is valid for most current and any new members of the UPOV Convention. In particular, the breeder's exemption and farmers' privilege have become more limited.

UPOV states that “the wording of the Convention clarifies that the optional exception (the farmers' privilege) relates to the use of the product of the harvest by the farmer on his own holding. Thus, for example, the optional exception does not extend to propagating material which was produced on the holding of another farmer.” UPOV also provides for an interpretation of the wording around acts done privately and for non-commercial purposes (Article 15):

“The propagation of a variety by a farmer exclusively for the production of a food crop to be consumed entirely by that farmer and the dependents of the farmer living on that holding, may be considered to fall within the meaning of acts done privately and for non-commercial purposes. Therefore, activities, including for example “subsistence farming”, where these constitute acts done privately and for non-commercial purposes, may be considered to be excluded from the scope of the breeder's right, and farmers who conduct these kinds of activities freely benefit from the availability of protected new varieties.”⁷

UPOV recently relaxed its views on the exchange of seeds of protected varieties among farmers through a new and wider interpretation of its exemption on “private and non-commercial use”, as published on the FAQs page of its website. (“Within the scope of the breeder's right

⁷ http://www.upov.int/edocs/expndocs/en/upov_exn_exc.pdf

exceptions provided under the UPOV Conventions, UPOV Contracting Parties have the flexibility to consider, where the legitimate interests of the breeders are not significantly affected, in the occasional case of propagating material of protected varieties, allowing subsistence farmers to exchange this against other vital goods within the local community.”) However, it remains to be seen how this flexibility is interpreted in the development and implementation of national laws.

It is important to note that neither WTO TRIPS nor UPOV prescribe the exact contents of national legislation: these international agreements provide national legislators with options to interpret them for a national context.

Farmers’ rights is a cornerstone in the implementation of the International Treaty on Plant Genetic Resources for Food and Agriculture, as a precondition for the conservation and sustainable use of these vital resources *in situ* and on-farm.⁸ The treaty recognizes the enormous contributions made by farmers worldwide in conserving and developing crop genetic resources. According to Article 9, governments should protect and promote farmers’ rights, but can choose the measures to do so according to their needs and priorities. Measures may include the protection of traditional knowledge, equitable benefit sharing, participation in decision-making, and the right to save, use, exchange and sell farm-saved seeds and propagating material, “subject to national law and as appropriate”.

Several other articles in the treaty are also important for the realization of farmers’ rights, and the Governing Body of the International Treaty is discussing further measures in the context of its work on sustainable use of plant genetic resources. However, it will have only a limited, advisory role, and the understanding of farmer’ rights and how to implement them at national level remains vague. Many normative discussions still await translation into international and national policies and agreements, as is further discussed below.

Concept of farmers’ rights

Farmers’ rights, endorsed by FAO in 1989, recognize that farmers and rural communities have contributed greatly – and continue to contribute – to the creation, conservation, exchange and enhancement of genetic resources, and that they should be recognized and strengthened in their work.⁹ Farmers’ rights relate not only to genetic resources but also to land, water, education, health care and sanitation. Several organizations have therefore advocated that its definition should be expanded by the human rights community as part of the Right to Food.¹⁰

Related to discussions on the scope of farmers’ rights, food sovereignty has largely replaced the more limited and less empowering concept of food security. Food sovereignty refers to the rights of peoples, communities and countries to define their own agricultural labor, fishing, food and land policies which are ecologically, socially, economically and culturally appropriate to their unique circumstances. It includes the true right to food and to produce food, which means that all people have the right to safe, nutritious and culturally appropriate food and food producing resources and the ability to sustain themselves and their societies.

As noted above, implementation of farmers’ rights is a responsibility of national governments. Until now, this has been limited, although it can be argued that national seed legislation in a number of countries has implicitly taken account of some of the principles described in the International Treaty, in particular Article 9.3: “Nothing in this Article shall be interpreted to limit any rights that farmers have to save, use, exchange and sell farm-saved seed/propagating material, subject to national law and as appropriate.”

⁸ www.farmersrights.org

⁹ For an overview of documentation, see <http://www.farmersrights.org/fr-project/products.html>

¹⁰ See, for example, <http://www.etcgroup.org/issues/farmers-rights-food-sovereignty>

Some but not all program countries have legislation or practice allowing selling of seeds by farmers within the informal system (see below). The Act on Plant Breeders and Farmers Rights in India, for example, includes the right of farmers to “save, use, exchange, share and sell seed”, provided the seed is not branded and conforms to quality requirements (Art 43.1). However, it is not clear how this right should be read in the light of the proposed (but not enacted) Seed Bill of 2005, which would introduce compulsory certification. In some countries the laws explicitly apply only to seed that is packaged and certified, leaving the farmers’ seed system untouched. These laws basically protect only the seed label (FAO, 2015).

The Nagoya Protocol to the Convention on Biological Diversity provides for measures to be taken by users of genetic resources to guarantee compliance with access and benefit-sharing requirements of countries of origin and providers of genetic resources. Impact on local seed system development might be remote, but become relevant upon the introduction of genetic resources from external sources in the context of participatory selection and breeding programs. In such cases, and depending on the requirements set by the provider, the use of potentially useful germplasm may be curtailed when acknowledging that it will not appear feasible to track the use of genetic resources in such programs or the generated benefits.

2. IMPACT OF POLICIES AND LEGISLATION ON THE FUNCTIONING OF SMALL-SCALE SEED SYSTEMS IN PROGRAM COUNTRIES

The information offered in this chapter specifically focuses on relevant policy and legislation in the program countries – India, Laos, Mali, Myanmar, Peru, Senegal, Vietnam and Zimbabwe. The following requirements and exemptions for small-scale farmers are discussed, along with their impact on farmers' seed systems:

- registration of seed producers
- registration of marketed varieties
- certification of seed lots
- registration for the purpose of plant variety protection.

Impact of policies: focus and limitations

Current seed policy in most of the partner countries is still aimed at promoting the distribution and use of formal sector seed varieties, with no or limited reference to the role of farmer-managed seed supply.

In India, the formal seed market mainly provides hybrid and GM seeds (DDS, personal communication). In Peru, regulation of the production and sale of farmers' seeds is being reconsidered to recognize and better facilitate small-scale seed systems. In Zimbabwe, national legislation reflects a long history of exclusively promoting hybrid maize varieties developed by the formal sector. In Vietnam, small-scale farmers have experienced resistance when seed clubs wished to market their own seed.

In general, the informal market provides for many open pollinated varieties and vegetatively propagated crops in response to farmer demands. Many small-scale farmers are not aware of their obligations and rights. In India, small-scale farmers have been reportedly harassed for the exchange of seeds although this is entirely legal (DDS, personal communication).

Policy and institutional support for the farmer-managed seed supply system is reported to be weak in India, Peru and Zimbabwe, which probably reflects a global trend. For example, although the Seed Village Scheme in India promotes the upgrading of farm-saved seed, the source of such seeds remains certified seeds from the state seed supply system (DDS, personal communication). In Vietnam, the seed clubs of the Mekong Delta provide a substantial portion of total seed demand, but formal registration is burdensome so the selling of their seeds is still not legalized and geographically limited.

As a result, the role of the farmer-managed seed sector is not only poorly recognized, but opportunities to strengthen it to contribute to local and national food security are underexploited. In that context, current efforts undertaken in Peru to implement the revised Seed Law in ways that better accommodate the interests of farmer producers are encouraging.

Exemptions in plant breeder's rights laws for the small-scale sector

PVP laws in most case countries contain provisions aiming to exempt some activities in farmer-managed seed systems from the scope of the legislation and limit its effects.

At one extreme, the PPVFR Act of India, adopted in 2001, provides a relatively wide exemption: farmers are entitled to save, use, sow, resow, exchange, share or sell farm produce including seed of a protected variety, though not entitled to sell branded seed of a protected variety using the official brands and labels of the rights holder. It still remains to be seen to what extent the

registering of farmers' varieties in accordance with articles 16 and 39 of this Act will indeed benefit farmers by providing an enlarged and protected market for their own, newly developed varieties.

At the other extreme, plant breeders' rights laws in Peru and Vietnam are relatively strict as both have adopted UPOV 1991. The Peruvian law allows the storing of seeds for own use "within reasonable limits and subject to the safeguarding of the legitimate interest of breeder", a phrase directly taken from UPOV 1991. Small-scale farmers in Peru, whether organized as legal persons (associations, cooperatives) or individuals, can apply for PVP if the variety fulfills regular protection requirements – novelty, uniformity, distinctiveness and stability (Decision 345 and Article 6 of Seed Decree).

Under the formal seed framework, all commercial seed needs to be certified by a third party organization recognized by INIA; for small-scale farmers, an alternative option for certification is available. This organic production regime has incorporated "participatory guarantee systems" as a form of social control and certification of organic production by small-scale farmers themselves. Small-scale farmers are adopting this form of certification in regions including Huánuco, Cajamarca and Cusco.

Also closely following UPOV provisions, Article 190 of the Law on Intellectual Property of Vietnam (2001) states: "the following acts shall not be regarded as infringements of rights to protected plant varieties: using plant varieties for personal and non-commercial purposes", and "using harvested materials of protected plant varieties by individual production households for self-propagation and cultivation in the next season on their own land areas". The law contains no further qualifications.

The other national PVP laws are situated between these two extremes. Article 17 of the Plant Breeders Rights Act of Zimbabwe allows small-scale farmers (with less than 10 hectares) to propagate the seed of a protected variety on their own land, and allows farmers who derive at least 80% of their income from farming on communal land to exchange such seeds with any other such farmers. In Myanmar, Article 31 of the Seed Act exempts the distribution and sale of seed produced by any peasant to another peasant.

The intentions of these provisions seem to be to exempt the small-scale sector from the effects of plant breeders' rights legislation, although some ambiguity remains. For example, who qualifies as a peasant in Myanmar? And are small-scale farmers in Zimbabwe allowed to sell seeds of protected varieties as a means of exchange? Along with India, neither Myanmar nor Zimbabwe are members of the UPOV conventions.

As yet, Senegal and Mali have not adopted a national PVP law, but may do so in the near future given the recent OAPI membership of UPOV 1991. In the Agreement Revising the Bangui Agreement of March 2, 1977, on the Creation of an African Intellectual Property Organization, Annex X – an agreement applicable to both Senegal and Mali – Article 30 makes reference to the option to exempt acts done for non-commercial purposes, on a farmer's own holdings, in line with the relevant provision in UPOV 1991. In Mali, Article 16 of law 10-032 explicitly allows the use of protected varieties on a farmer's own land, but does not refer to any other activity.

Recently, members of the African Intellectual Property Rights Office (ARIPO) adopted the so-called Arusha Protocol, which calls on member country governments to ratify the UPOV 1991 Protocol. Its provisions are stricter than those of the current national law in Zimbabwe, in particular with regard to farmers' privilege. It may take several years before the current PVP law will be amended to conform to UPOV 1991 obligations. Until then, dual registration will allow for registration of varieties at the regional level through ARIPO, or at the national level through the Seed Services Department of the Ministry of Agriculture. The IFAD-Oxfam Novib program partners have concluded that, with a view of supporting farmers' seed systems, national interpretation of this clause in Zimbabwe should be such that sales of seeds by a farmer in his/her own community should be regarded as for "private and non-commercial use".

Registration of farmers as seed sellers and farmers' varieties and certification of variety seed lots

If FSEs wish to register as producers, whether for the production and selling of their own varieties or varieties obtained from third parties, national seed laws may require that they demonstrate they possess certain expertise and facilities, which may be a challenge. If farmers wish to register their own varieties for protection under plant breeders' rights, or to sell in the market, they are usually required to provide detailed information showing that the variety fulfills the requirement for protection ("distinctness, uniformity and stability") or marketing ("value for cultivation and use"). Registration may be required for some or all crops, and/or for the seller. Some seed laws have special provisions for the registration of farmers' varieties, taking into account their specific features and small-scale farmers' capacities, whereas other do not.

India

In 2004, India introduced the Seeds Bill to replace the Indian Seeds Act 1966. Farmers' organizations and NGOs have campaigned against it and until now, it has not been enacted, though it remains in Parliament (DDS, personal communication). Its objective is to regulate the quality of seeds for sale, import and export, encompassing all players from seed producers to retailers, and to increase private sector participation in the production, certification, distribution and testing of seeds.

According to Ranjan (2009), the Seeds Bill could undermine the PPVFR Act, which incorporates farmers' rights over their varieties. It proposes mandatory registration of all marketed and distributed seeds, which may include seeds of farmers' varieties. Clause 13 Bill states that "no seed of any kind or variety shall, for the purpose of sowing or planting by any group, be sold unless such seed is registered", which appears to apply even to seeds of farmers' varieties held by farmers. The Bill does not set out criteria for registration.

In addition, Clause 22 reads: "any person who desires to carry on the business of selling, keeping for sale, offering to sell, bartering, import or export or otherwise supply any seed by himself or by any other person on his behalf shall obtain a registration certificate as a dealer in seeds from the state government". This definition would not exclude farmer-sellers. The two clauses together would impose a double obstacle for farmers to sell their seeds, because they would have to register their seed lots and themselves.

However, Article 43 of the Bill states that nothing in the Act shall restrict the rights of the farmer to save, use, exchange, share or sell his/her farm-saved seeds or planting material. The same article does also require that seeds conform to a minimum level of germination, physical purity and genetic purity, which would be difficult to measure and control for small-scale farmers.

Myanmar

The law in Myanmar defines commercial distribution as the distribution of seed above a certain weight or volume threshold to be determined by the National Seed Committee (Article 5). This may provide some room for FSEs.

Article 31 states that "the provisions contained in this Law shall not apply to the following facts: distribution and sale of seed produced by any peasant by himself to another peasant", which exempts seed control on traditional farmer activities – although "peasant" has not been defined in this law. FSEs might be exempted, according to Article 32, if "peasants and seed researchers (...) produce seed in cooperation with departments and services under the Ministry". In all other cases, for both seed lots and sellers, a license is required.

Peru

In Peru, the Seed Law requires registration of seed researchers, producers and traders (SD 006-2012-AG). Producers must comply with conditions proving involvement of a qualified professional in seed production, identifying the legal status of the land used in production (property or lease), and describing the assets to be used in seed production.

Use of certified seed in Peru is still limited – in 2014 it accounted for only 13% of the seed market. Currently, unregistered “non-certified seed” (native or local) may be commercialized but under certain minimum conditions. These conditions include that, for example, the seed producer is registered, or that the producer takes full responsibility for seed quality, or that the field is also registered. In practice it is very difficult for small farmers to comply with these conditions (Ruiz, personal communication).

The Seed Regulation, which implements the Seed Law, includes clauses that should promote the registration of native varieties “that can be exploited economically” by exempting them from trial payments and taxes (ANDES, personal communication). Further measures should promote the competitiveness of ancestral varieties by creating appropriate categories; communal seeds (*semilla común*) are recognized as a specific category in the General Seed Law, albeit for specific species or groups of species (Article 19). Again, the exchange of such seeds that do not need to fulfill certification requirements still requires minimum levels regarding quality and health.

Finally, one of the implementing resolutions (0533-2008-AG) has introduced the National Register for Native Potatoes, a non-constitutive register not granting specific or exclusive ownership rights to individual farmers or communities. In its implementing guidelines, INIA specifies that the objectives of the Register are to:

- Register the genetic diversity and variability of Peruvian native potatoes;
- Recognize cultivars of native potatoes as originated in Andean communities and developed and conserved by generations of farmers;
- Promote inter-institutional collaboration to generate data and information regarding native potatoes;
- Implement an official national database with passport data, morphologic information, agronomic evaluations, and photographic images of native potatoes;
- Contribute to developing tools to identify developers of these native varieties and prevent bio-piracy acts.

Small-scale farmers or individuals can request INIA to register their native varieties of potatoes. They must comply with certain conditions, which in practice can be met with the technical assistance of INIA and other institutions including NGOs.

Peru has recently made other efforts to better accommodate the functioning of small-scale seed systems, in particular by the National Seed Authority based in INIA. Such efforts focus on the Seed Regulation (2012), related to the Seed Act (originally enacted in 1980 and revised in 2010), which provides that: “The Authority should establish the classes and categories adequate to regulate seed production systems, including systems of small producers.”

In response, the National Seed Authority has proposed to establish – in addition to the *clase genética* and *clase artificada* – the *clase declarada*. In the current plans, in Article 11 of the Seed Regulation, this proposed class of declared seed is divided into two categories, declared and traditional. The quality of the seed offered as “declared seed” is the responsibility of the producer, whereas the traditional category would recognize traditional farmers’ varieties. This would allow the registration of newly developed farmers’ varieties, as for example resulting from farmer field schools.

No requirements would be set for farmers to register as maintainers, seed producers and sellers of traditional varieties. The category of traditional seeds should increase the competitiveness of

small producers and promote the sustainable use of plant genetic resources and conservation of agro-biodiversity. The same provision keeps open the possibility that traditional varieties may be certified in the future, which would require registration of the seed producer. It is expected that the Seed Regulation will be completed and enforced in the course of 2017.

Vietnam

The Seed Ordinance (2004) of Vietnam distinguishes between major crops (which are regulated) and other crops (which apparently are not). Article 4 mentions as an operating principle that seed production and seed business for the varieties belonging to major crops will be strictly managed, meaning that in order to produce and sell seeds of the selected species, producers need to fulfill specified requirements. Article 15 states that the Ministry will compile the List of Major Species as well as the List of Plant Varieties for production and business.

However, the seed law also provides for a small-holder exemption, stating that “households or individuals who produce and trade in major crops and do not belong to a person that has to register for business do not have to obey regulations stipulated, but must ensure the quality of plant variety and environmental sanitation (identity and phytosanitary condition, *author*) according to the law on plant protection and quarantine, the law on environmental protection and the law on fishery”.

So, in practice, farmers can still sell their seeds even if not certified, as long as the variety performs well and the seeds are of good quality – although in general selling uncertified seeds is an illegal act. Lacking a legal basis in national law, such activities are only tolerated by provincial authorities at a rather limited scale and within certain geographic boundaries (Searice, personal communication).

The many seed clubs established in the Mekong Delta – which are responsible for up to 40% of the rice seed supply in Vietnam’s rice bowl – clearly reach beyond such limited scale. In addition, some farmers active in these seed clubs have developed new farmers’ varieties adapted to local conditions such as high salinity. This raised the policy issues of whether seeds of farmers’ varieties may be allowed in the market, how these varieties may be registered, and whether seed lots produced by farmers should be inspected and certified. Local authorities confirmed that farmers would have to respect the seed law requirements.

Currently, farmers in the Northern Vietnam project sites were not yet producing seed for sales outside their community. However, in the Mekong Delta, two farmer varieties have been registered, and seed of a number of public sector varieties was produced by small-scale farmers’ seed clubs. Seed of a number of non-registered varieties was also produced. This could be sold by farmers only in their own province, a policy recognizing that these varieties were best adapted to local conditions, in particular salinity.

Many farmers feel that the compulsory registration scheme incorporated in national measures is not to their advantage. Farmer-breeders cannot afford the costs of certification, which amounts to a minimum of USD 625 per variety, in addition to the costs of multi-location trials for the registration of a farmers’ variety, given uncertainty about the return on such investments (Searice, personal communication).

Zimbabwe

The Seeds Act of Zimbabwe (Chapter 19:13) stipulates that the obligation to register “shall not apply to the sale of seed which is grown by any farmer and sold by him to a person for use as seed by such person” (i.e. another farmer). Small-scale farmers in the UMP and Tsholotsho districts have established community seed banks where they save, use, exchange and sell farm-saved seeds (CTDT, personal communication). It is not clear whether these banks and FSEs are covered by the exemption. Realization of new farmers’ varieties may be within reach, but only if the authorities interpret the law positively.

Zaka Superseeds, a community-owned cooperative in Zaka district listing 450 members, has certified seeds of cowpea, sugar bean, maize, sorghum and rice for sale in the local market (Mutonhori and Muchati, 2013), although quality standards applied may have been relaxed. Still, even when farmers can meet the requirements, many feel that they are not necessary when social structures can control the quality of the offered seed.

Compulsory seed certification has been reported to act as a disincentive for local seed companies to invest in low-value non-hybrid seeds such as for sorghum, millet, soybean and groundnut (Mutonhori and Muchati, 2013). This may also be the case for FSEs.

Most legislation in Zimbabwe was developed in the colonial era, when small-scale farmers were not able to influence the contents of laws. Since the adoption of the new Constitution it is a requirement that the government consults all relevant stakeholders before any new legislation is enacted. Recent legislation may better take into account the interests of the small-scale farmers and the role of the farmer-managed seed system, as apparent from CTD T's involvement in drafting a memorandum of principles for farmers' rights legislation in Zimbabwe.¹¹

Mali and Senegal

The regulatory frameworks and implementing measures in Mali and Senegal are intended to strengthen the formal seed sector and pay less attention, if any, to farmers' approaches to seed production and management. In both countries, the institutional set-up and implementing measures assume a public seed sector as structured around the state's research agency that is responsible for plant breeding, and involve farmer networks that organize seed production of public sector varieties.

The seed laws of Senegal (law 94.81 on the registration, production and certification of plant varieties) and Mali (law 10-032 on crop seeds) hardly refer to the small-scale sector. The Senegalese law stipulates the registration of varieties that have to fulfill DUS and VCU requirements (Article 3) and the registration of seed sellers (Article 5). Certification of marketed seeds is required according to Article 9, and only seed of registered varieties can be certified (Article 12 of Decree 97-616). Article 40 states that this regulation does not apply to small farmers who are forced to sell part of their produce reserved for seed, while Article 45 rules that certification is not required for seed from small-scale farmers' holdings, thereby explicitly exempting farmers' seed production.

The more recent law (2010) of Mali defines various seed categories in relation to certification. Articles 3 and 4 provide for the option to exempt certain products from its regulations. An official catalogue of species and varieties is to be established (Decree 10-428), and only seed of registered varieties may be produced and certified. Article 19 explicitly refers to the needs of benefit-sharing based on the use of traditional genetic resources.

Laos

In Laos the Vice Minister's Decree on Plant Variety Management and Utilization, referring to the Law on Agriculture, the Law on Plant Protection and the Amendment Law on Intellectual Property, covers the management and conservation of plant genetic resources. This decree applies to legal and natural persons engaged in activities related to research, production, certification, registration and marketing of all types of plant varieties including so-called indigenous and native plant varieties. For new varieties, DUS and VCU testing is required for market approval.

According to Chapter IV, seed producers need to provide information on available infrastructure and staff qualifications. Although indigenous varieties and native varieties are defined in the

¹¹ CTD T stands for Community Technology Development Trust and is a long-time partner of Oxfam Novib.

decree, no specific rules are given for their production and marketing, and it is not clear from the decree if marketing of indigenous and native varieties falls under quality control. Similarly, no exemptions have been included regarding seed production by small-scale farmers.

FARMERS' PERCEPTION OF CERTIFICATION STANDARDS

According to the Seed Ordinance of Vietnam, only registered varieties of major crops can be marketed and all seed lots of registered varieties have to be tested and certified. Asked whether meeting certification standards was perceived as a problem, seed club farmers in the Mekong Delta said they could meet the seed lot certification requirements as a result of the trainings.

In Zimbabwe, it appeared from various sources that generally farmers active in the project have no problem in meeting certification standards. To the contrary, they are confident and proud that they can meet the same standards as the commercial producers.

In Laos, farmers collaborating with the SD=HS program stated that they would not have problems meeting the standards for seed quality certification (personal communication).

CONCLUSION

This study has drawn on information from farmers experiencing the impacts of legislation, and from legislators providing insight into the intentions and nature of implementation of the seed laws, as well as from public sector researchers. Such information was obtained by the project partners and in the context of national workshops discussing the current and projected legislation impact.

Limits of exemptions

All seed laws studied provide for exemptions for traditional small-scale farmer activities, including the sales of some or all seeds, but sometimes require that certain quality conditions are met (Vietnam, Peru, proposed in India). However, they often do not create specific conditions for FSEs, with the possible exception of Myanmar (if in collaboration with departments and services of the Ministry).

In the case of FSEs, both registration of varieties and registration of the seller (as a legal or natural person), as well as the certification of seed lots of registered varieties, generally appear to be required. If such seed is sold in local markets only, meeting certification standards may be facilitated in some countries (e.g. Zimbabwe) but not in others (e.g. Vietnam), although it may tacitly be accepted as an established practice. Such policies limit farmers' options to market their seed outside the local community, and in particular to market the seed of farmers' varieties that are maintained only in small-scale systems and that contribute to a wider diversity in farming systems.

Except in the case of Zimbabwe, no special reference is made to the role of seed fairs, although they can be understood as facilitating the exchange, barter or sales of seeds from one small-scale farmer to another, thereby falling under the exemptions for traditional activities.

Costs as a barrier

Formalities in seed registration and certification often impose transaction costs, which small-scale farmer-seed producers cannot meet. No problems may occur as long as farmers' seeds are considered local, and therefore not qualifying for oversight and regulation, but as soon as quantities or marketing areas expand these requirements may become real impediments.

Options for support to small-scale farmers' role

Efforts should be considered to develop national seed legislation that would strengthen the functioning of small-scale seed systems and enhance seed security. The FAO's "quality declared seed" system is complicated and demanding, but SD=HS might consider adoption and/or adaptation of certain concepts underlying this system in its efforts to create options for farmers and their cooperatives to register as seed producers and seed sellers and to promote the wider use, including by marketing, of farmers' varieties.

Potentially, such an approach might both assist the development of seed enterprises and guarantee minimum levels of quality of seed offered in the market. Elements may include: (1) establishing a public register of seed producers; (2) developing a list of varieties maintained and distributed under a light registration scheme; (3) support from public organizations such as for training and inspection; (4) establishing minimum seed quality requirements regarding identity, purity, germination rate and phytosanitary condition; and (5) labeling of seed lots offered in the market.

Such initiatives could be bottom-up, for example in the form of joint efforts by seed clubs. Alternatively, exemption of small-scale farmers from any quality control requirements could be promoted in consultation with local farming communities and farmer seed producers.

Plant breeders' rights and farmers' rights

Some partner countries have adopted PVP legislation or developed practice that allows farmers to save, use, exchange and sell farm-saved seed and other propagating material within farmer-managed seed systems, but other countries have not. At the international level, the interface between Article 9 of the International Treaty and Article 15 of the UPOV 1991 Convention requires further clarification.

On the one hand, the legitimacy of intellectual property rights interfering with the small-scale sector may be fundamentally challenged, and instead the development of farmers' rights legislation might be promoted. On the other hand, advocacy efforts may focus on Article 15.2 of UPOV 1991, by claiming that all activities undertaken by small-scale farmers at the community level should be understood as "acts done privately and for non-commercial purposes", and all activities to save, use, exchange and sell farm-saved seeds and propagating material of protected varieties by small-scale farmers should thus be exempted.

SD=HS may consider an international campaign to realize such interpretation by the UPOV Council, benefiting in particular farmer communities in those countries that have adopted UPOV 1991, such as Vietnam and Peru. These approaches may not be mutually exclusive, and could be adopted alternatively between partners and over time.

Similarly, an interface with national legislation implementing the Nagoya Protocol might develop, potentially threatening the full use of genetic resources from external sources in participatory selection and breeding programs. Such developments must be closely monitored and challenged when necessary.

ACKNOWLEDGEMENTS

The work and resulting documentation generated by Marcelin Tonye Mahop and Manuel Ruiz Muller has formed essential support for the development of this paper. The author wishes to thank the following persons for their detailed comments on earlier versions of this paper: Gigi Manicad, Bertram Zagema, Rene Salazar, Nori Ignacio, Niels Louwaars, Julia Rogers, and Sangeeta Sashikant. Last but not least, the partner organisations Searice, DDS, CTDI, ANDES, COFERSA, CAWR, and ASPSP involving women farmers from Camance provided clarifying and highly useful inputs and feedback.

ANNEX: THE STATE OF FARMER-MANAGED SEED SYSTEMS IN SOME PROGRAM COUNTRIES

In all eight program countries, informal seed systems are of major importance for national seed supplies, and hence for food security. Below, relevant information from partners and additional literature is presented.

Myanmar

While there is a lack of reliable data on Myanmar's economy, the agricultural sector – including livestock and fisheries – is estimated at between 35-40% of GDP, with industry accounting for around 25% and services 35%. As in other countries in the region, a significant proportion of industry is also related directly or indirectly to the agriculture and natural resource sector.

Some 70% of the labor force (of 32.5 million) are reportedly engaged in agriculture or depend to a significant extent on agriculture for their income, compared to 7% depending on industry and 23% on services. The agriculture sector accounts for 25-30% of total exports by value. Pulses (including soy bean) are currently the largest agriculture export item, bringing in \$1,400 million in 2010-11, with rice, rubber and fisheries – the other main agricultural export items – each generating \$300-400 million.

Paddy rice dominates the sector, accounting for around 60% of the net sown area and around 80% of the total value of sector production. Other key crops include pulses, oilseeds and rubber. However, the country's diverse agroclimatic zones also enable it to produce sugar, maize, a wide range of fruit and vegetables (some of which are exported, particularly to China), palm oil and coffee. The fisheries sector has substantial potential for further expansion, both in capture fisheries and aquaculture.

Livestock is currently a relatively small sector, contributing only 7.5% of total agricultural GDP. With the exception of the dynamic poultry industry, the sector has stagnated. As the economy grows, the livestock subsector can be expected to increase in importance to meet growing domestic demand. It could also have considerable potential as a source of meat for the region, provided that animal health and transboundary disease issues are addressed.

Despite its potential for development, the agriculture sector has suffered for decades from a lack of investment, including in basic infrastructure such as roads and support services such as research, extension and finance. While there has been production growth in some subsectors, farm gate prices have generally been low, either due to policy or structural reasons, resulting in stagnant or declining rural incomes, a growth in landlessness, a high degree of rural indebtedness and widespread rural poverty.

In 2004, some 32% of the rural population was reported to be living below the poverty line, with the highest rates in remote upland areas such as Shan State (50%) and Chin State (73%). Landlessness affects 25-40% of the population and has increased along with population pressure. It is argued that the incidence of poverty may have increased since 2005/6 as the appreciation of the kyat has turned the terms of trade against exports of agricultural products, and as a result of the massive destruction wrought by Cyclone Nargis in 2008.

Food security is a problem in remote upland areas, and – according to some sources – also in the more prosperous areas of the Delta since Cyclone Nargis. Pressure on living standards has increased levels of indebtedness and fuelled large-scale migration to neighboring countries in search of employment. Developing a more accurate profile of the current poverty situation and the extent of food insecurity and malnutrition is clearly an urgent need. However, there can be no doubt that achieving rapid and sustainable growth in the agricultural sector will be critical to reducing rural poverty, inclusive growth and social development (Vokes and Goletti, 2012).

Peru

The farmers' seed system which has operated for thousands of years remains the norm, especially in the central and southern portions of the Andes. Farmers know the varieties adapted to different ecological niches, especially altitude. Farmers continuously exchange and test cultivars. Local markets, including barter markets, facilitate the movement of varieties. Farm-saved seed is the norm: seed lots are usually selected from the best of the harvest, and farmers do not maintain special plots for seeds. Potato seedlings can fetch a high price, though Zimmerer (2003) reported that supplies of tuber seed in local markets were not always reliable.

The farmers' seed system provides 95% of seed lots for Andean regions. The formal seed system has been important primarily as a means to introduce new varieties, including many selected for resistance to local hazards, particularly potato late blight. Farmers have also been involved in the selection of new varieties. CIP reports that two modern potato varieties it released in 2004 sustained yields of 5 tons per hectare in 2010, while other varieties' yield went down to 2 tons, when late blight caused the government to declare a "state of emergency" in the southern Andean region of Peru (Salazar, 2015).

Vietnam

Rice is the staple food of more than half of the world's population, many of whom are also poor and therefore extremely vulnerable to high rice prices. About 90% of the world's rice is grown in Asia. Rice is an extremely versatile crop: it grows in dry and wetland conditions and low and high altitudes.

In the Mekong Delta, Vietnam, the formal seed sector only meets a small proportion of farmers' rice seed requirements. To cope with growing demand, farmers have organized themselves into seed clubs to produce and supply the needed seeds themselves. The informal system has significantly lower seed prices and more diversity of rice varieties than the formal system. Both seed systems supply new varieties that have not yet been certified but are in high demand. Socialization of seed production has been recommended to ensure the local seed supply systems can help to develop sustainable agriculture in the future (Tin *et al.*, 2011).

Total demand for rice seeds is 865,000 tons per year. Nationally, 26% of seed supply consists of certified seeds provided by the formal seed sector and organized farmers' seed multiplication groups, valuing the sector at 131 million US dollars per year. This percentage is higher in the Mekong Delta, at around 40%. For comparison, the global average among tropical countries is around 10%. There are 300 registered and approved varieties of rice, though the National Center for Crop Test and Inspection of the Ministry of Agriculture and Rural Development estimated farmers grow 688 varieties. At least 159 of these are local traditional rice cultivars.

The Asian Development Bank estimated the maize seeds market at 38 million US dollars per year – though this estimate looks too low, as seeds cost at least 40 USD per hectare for simple hybrids and 80 to 100 USD for GMOs and the country has 1.1 million hectares of maize planted. For vegetables, half of the seed needs are provided by the formal sector; the vegetable seed market is estimated at 70 million USD per year. IFPRI estimates that Vietnam imports around 70-80% of its hybrid maize, rice and vegetable seeds, totaling 150 million US dollars: that includes 20 million for maize, the same for rice, and 50 million for vegetables.

Vietnam has two national seed companies, 100 provincial seed companies and seed centers, and – as of 2007 – 315 private seed companies and eight multinational companies. The farmers' system continues to play a major role. Farm-saved seeds can be easily selected from the farm especially for self-pollinating crops such as peanut and soya beans, where 90% of demand is met by farm-saved seeds. Although rice is also a self-pollinating species, demand is growing for high quality certified seeds from the formal sector and farmers' seed production groups, up to 40-50% (Salazar, 2015).

Zimbabwe

Almost all the maize seed is purchased from seed companies through a wide agro-dealer network and most of this seed is hybrid. At least 95% of maize seed planted in Zimbabwe each year is sourced from seed companies. On the contrary, most of the sorghum, pearl and finger millet and legumes such as groundnuts, Bambara nuts, cowpeas and indigenous vegetables are sourced from farmer seed systems (CTDT, 2015).

Zimbabwe's formal, commercial seed sector is unusually developed, with more than 15 companies supplying seed, primarily for maize. However, formal seed production in Zimbabwe virtually collapsed between 2006/2007 and 2009, along with allied rural businesses such as agro-dealers, due to the effects of hyperinflation – which reached 56 million % in 2008 (FAO/WFP, 2009) – and policies such as price controls. Only in 2009 did inflation come under control following liberalization of input and output markets and a switch to the US dollar.

Emergency seed aid has been routine in Zimbabwe, occurring in 15 of the last 29 years, in response to frequent droughts, input bottlenecks and currency breakdown. In 2015-2016, crop losses resulting from the impact of El Nino were dramatic across the country, particularly in the south. The largest distribution of recent years was in 2009–2010, when donors sought US\$140 million, planning to supply seed (mainly hybrid maize) and fertilizer to 600 000 families – half the farming population.

However, contrary to assumptions in the aid community, farmers were generally seed secure: despite following two drought-affected years, the 2008-2009 season produced above long-term averages, and – for crops other than maize – the informal system supplied nearly all the seed farmers sowed. Farmers' own harvests and social networks provided between 40% and 92% of total seed for key crops in 2008-2009, and 56% of seed across all crops. Significantly, farmers also sourced from local shops still operating, developing complex barter economies with exchange rates reflecting local scarcities.

Vigorous unregulated markets also supplied hybrid maize, often broken up into smaller packet sizes to increase accessibility. New varieties entered local systems through means such as on-farm trials, cross-border trade or seed fairs, helping to keep them dynamic. And commercial seed production and marketing was beginning to recover after the 2009 liberalization, though at modest scales and vulnerable to being undermined by seed aid. Overall, feedback loops between formal and farmer-managed systems helped maintain a diversity of crop varieties, suppliers and seed production mechanisms, helping many farmers access seed (McGuire and Sperling, 2013).

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Published by Oxfam Novib in May 2017. Oxfam Novib, P.O. Box 30919, 2500 GX The Hague, The Netherlands.