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Status of seed legislation and policies in the Asia-Pacific region



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FOREWORD

The vast majority of the world's food crops are annuals that are grown from seed sown at the start of each production season. The quality of that seed is a key determinant of production. Farmers cannot easily observe the quality or identity of seed at the point of sale, which creates a risk on the part of the farmer. With the development of the commercial seed trade and the increasing number of varieties during the 20th century it became important to reduce this risk. This led to the formulation of laws and regulations intended to protect farmers and increase agricultural productivity through the adoption of modern varieties.

The commercial seed industry has grown rapidly in Asia over recent years and these laws should be reviewed to ensure that they reflect recent developments in both technology and trade. In practice, the progress of this updating varies widely across the region; some countries have completed, some are working on it now, while others have not yet started. The purpose of this study is to review the current status of seed legislation in countries of the Asia-Pacific region, to share experiences and to make recommendations for future development of the seed sector in a way that serves the best interests of farmers and society as a whole.

We hope that the results of this study will lead to a further strengthening of the seed sector in the region and will benefit all stakeholders in the seed chain, especially farmers and their families. We also hope that there will be a continuing dialogue within and between countries to promote better understanding and achieve the urgent goals of improving the quantity and quality of crop production in the region.

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KEY FINDINGS

1. The structure of the seed industry in Asia and the Pacific has changed rapidly in the past 30 years due to the acceleration of private sector breeding, particularly in hybrid crops and vegetables. However, progress in regulatory reform has not been uniform, leading to a wide spectrum of experiences across the region.
2. Where technology has run ahead of legislation this has created problems for stakeholders. Variety testing systems that were established long ago for staple food crops are no longer appropriate for the present situation. An example is stringent DUS (distinctness, uniformity and stability) and VCU (value for cultivation and use) testing requirements for vegetables found in some countries.
3. In contrast, the private seed sector has made little progress in self-pollinated food crops such as rice, wheat, grain legumes and oilseeds. For these crops, variety development has remained largely in the public sector domain, unless a hybrid option becomes available, notably in rice. The informal sector continues to be the main seed supplier for these crops, even in countries with an advanced seed industry. The regulatory framework must be sensitive to these important differences between crop groups.
4. There is a need to regulate the seed industry to prevent malpractice. However, inappropriate laws and regulations limit farmers' choice of good varieties. More seriously, they may increase illegal activities that create greater risks for farmers. Laws and regulations should be framed in a way that encourages compliance.
5. Reputable seed companies maintain high-quality standards in order to protect their brand image and this reduces the burden on the official system. However, as more farmers buy high-value seed there is an increased risk of counterfeiting and this requires serious attention because of the risk to companies and farmers.
6. Countries should monitor the impact of their seed regulatory systems, preferably through a representative apex body that has oversight of the whole sector and can make recommendations at a high level in government. Several countries have also developed a seed policy to guide the development of the sector and it may be timely to review their effectiveness.
7. On the private sector side, national seed associations should play a key role in consultations with government and should have the authority to represent their members with a unified voice.
8. New technologies can play a role in helping the seed industry to adapt to changing circumstances. For example, the use of codes can enable farmers to check the authenticity of seed packages from their phones, and also obtain more information about varieties. Governments could enhance this facility by making the national variety list searchable online and with links to additional information.
9. This study has brought together information from many different sources within the region and may serve as a platform for further exchange of experience and best practice within the region.

LIST OF ACRONYMS

APSA	Asia and Pacific Seed Association
ASEAN	Association of Southeast Asian Nations
DUS	distinctness, uniformity and stability
EBA	Enabling the Business of Agriculture (World Bank)
ECO	Economic Cooperation Organization
ECOSA	ECO Seed Association
FAO	Food and Agriculture Organization of the United Nations
GM	genetically modified
IPPC	International Plant Protection Convention
ISF	International Seed Federation
ISTA	International Seed Testing Association
OECD	Organisation for Economic Cooperation and Development
OP	open-pollinated
PVP	plant variety protection
RAP	FAO Regional Office for Asia and the Pacific
SAARC	South Asian Association for Regional Cooperation
SAC	SAARC Agriculture Centre
SPC	Pacific Community
UPOV	International Union for the Protection of New Varieties of Plants
VCU	value for cultivation and use

1 INTRODUCTION

Access to quality seed of a diverse range of improved varieties is critical to securing sustainable agricultural production, enhancing livelihoods, and securing food and nutrition. Crop varieties need to adapt to local variations in growing conditions and their associated biotic and abiotic stresses, which change over time, driven by climate change, resource degradation, and the spread of pests and diseases. The potential for improvement relies – to a large extent – on exploiting the genetic diversity that is available within and between crop species to create new varieties that meet the requirements of producers and consumers.

The development of new varieties and the subsequent multiplication and marketing of quality seed requires substantial investment. Traditionally, governments in many Asian countries, and elsewhere, assumed that plant breeding and seed production was the task of the public sector. Seed laws and regulations were often highly restrictive, with any new variety requiring multi-location and multi-year testing for yield performance. This system worked in an era when there was a small number of varieties originating from public sector institutions.

Developments over the past three decades, however, have shown that the private sector can be very efficient in supplying farmers with quality seed of improved varieties of certain crop species. Countries that have created a favorable enabling environment have seen rapid growth in their private seed sector, which has benefited their smallholder farmers. The introduction of hybrid varieties of vegetables, maize, sorghum, and cotton has been a major driver of this transition in Asia. For some crops, such as vegetables and maize, private companies now dominate research and development as well as seed supply.

Old seed laws, generally designed with a few staple food crops in mind, are no longer appropriate when there is a large number of crops and varieties, often addressing specific production systems and market segments. Yet progress on reforming seed laws in the countries of the Asia and Pacific region has varied. At one extreme, there are countries with an unreformed and under-resourced regulatory system trying to hold on to controls in order to “protect the farmers”. At the other extreme, there are countries that have liberalized their regulations to allow private seed sector development while maintaining sufficient control to ensure seed quality.

This range of experiences prompts a systematic comparison of seed policies and regulations across countries of the Asia and Pacific region to inform policy decisions. The main areas of interest are the current laws and regulations that affect variety testing and registration, seed production and certification, seed quality testing and marketing, the registration of companies, and the means for enforcing all of these activities. Other areas of interest are access to, and use of, genetic resources in plant breeding programmes, the protection of breeders and/or farmers’ rights, and the use of genetically modified varieties.

The objective of this study is to provide up-to-date information on the status of seed legislation and policies in countries of the Asia and Pacific region, and their effects on the

development of the private and public seed sector, with a focus on changes that have occurred in the last decade.

National governments would benefit from a better understanding of how their seed legislation compares to that of other countries and the effect this has on the development of the domestic seed sector. Such benchmarking will assist with the sharing of experiences and provide a basis for more informed policy decisions. International organizations such as the Food and Agriculture Organization of the United Nations (FAO) would also benefit from a better understanding of the extent to which international treaties have been translated into national laws, the extent to which such laws and policies are actually implemented, and their impact all on stakeholders in the seed sector, both public and private. This study aims to fulfil these knowledge gaps and provide a platform for more informed discussion, which may also contribute to closer alignment of policies and regulations across the region.

After this introduction, Section 2 contains background information on the subject matter of the study, and the methods used are described in Section 3. The results from the questionnaires and other sources are presented in Section 4, together with brief comments. Section 5 provides a general discussion of the issues raised by the study, and Section 6 contains recommendations based on the discussion.

2 BACKGROUND AND CONTEXT

2.1 Historical overview of seed regulation

In traditional agriculture, farmers save their own seed or exchange seed within their community. The crops grown are highly adapted to the prevailing environment in which they have been maintained and selected for many generations. Depending on the crop, they are often genetically variable populations, commonly referred to as landraces. For staple cereal and legume crops, there is little or no differentiation between grain and seed, except in its final use. This remains the default system of seed supply in subsistence agriculture, particularly in more remote areas and for truly indigenous crops. It is now often referred to as the “informal seed sector” because it has no formal organizational structure and is not subject to regulation. It should be emphasized that the term “informal” is not in any way prejudicial and should not imply illegality. It is simply the system that farmers continue to use when the formal sector does not meet their seed requirements effectively, or may not even reach them due to limited infrastructure.

The concept of a more defined “seed trade” arose for three main reasons:

- the diversification of the crop portfolio grown by farmers due to the global spread of cultivated species and their adaptation to new environments or production systems;
- improvements in transport that enabled seeds to be grown in locations removed from their final place of use, if there was a technical or financial justification for doing this; and

- the emergence of systematic plant breeding as a practical application of the science of genetics, leading to new named varieties being introduced to the market.

In several countries these factors aligned early in the 20th century and gave rise to an organized seed trade. Farmers began to buy seed of named varieties from recognized local companies because they saw benefits from doing so, and they depended solely on the reputation of the seller, who they probably knew personally.

The problem with seed as a product is that the buyer cannot assess its quality or identity at the point of purchase, and any defects will only become apparent some time after sowing, often resulting in a serious loss of yield. Consequently, the purchase of seed carries an inherent risk, which is increased by the fact that seed is a living material and subject to deterioration over time. Therefore, a farmer who buys seed is exposed both to the natural biological loss of quality and the consequences of poor management or deliberate malpractice by the seller.

To address these concerns and protect farmers, governments introduced legislation to control the quality of seed in the market, with minimum standards for physical purity and germination for a range of crops. This in turn created a requirement for standardized procedures to assess these quality attributes and thus the science (or art) of seed testing was born. The co-evolution of trade and regulation took place independently in several countries but there was soon a need to coordinate these activities as trade expanded across borders. This led to the establishment of the International Seed Testing Association (ISTA) in 1924, with the slogan “Uniformity in Seed Testing”, which is still used today. It is no coincidence that the International Seed Federation (ISF), a representative organization for commercial seed trade, was established in the same year.¹

Early national seed laws were simple and were one of the first examples of consumer protection. Besides purity and germination, they usually designated certain serious weed seeds as “noxious” and established a requirement to label the seed container with some essential information, often in a standard format. The marketing of seed in a closed, labeled unit is a fundamental change from selling in open sacks, which is the normal practice in traditional markets that are one element of the informal seed system. Although the variety would normally be stated on the label, there was no guarantee that this name was correct or had any absolute validity; this still relied on the care and integrity of the seller. Nor did the stated variety name have any fixed point of reference, so there could easily be synonyms in the market, leading to confusion and possible fraud.

To address these weaknesses in identity and naming, certification schemes were devised, whereby the seed crop was inspected in the field and the resulting seed lot was followed through the post-harvest chain to the point of sale. The seed was then identified as being “certified” and the container carried a distinctive label that represented the whole process. Such schemes were originally voluntary, being organized on a self-financing basis by bodies that saw some advantage in providing greater reassurance to the buyer.

¹ ISF was originally established under the French name “Federation Internationale des Semences” (FIS) but this was officially changed to the English name in 2001 when it merged with the international plant breeders’ association, ASSINSEL.

The Crop Improvement Associations in many states of the United States of America (USA) were a classic example of this approach. Certification requires some control of generations so that the origin of the seed purchased by a farmer could be traced back from harvest to sowing. This gave rise to standardized systems of naming these generations and a more formalized seed lot numbering to facilitate record keeping between generations.² Seed certification was, therefore, an early example of traceability, a concept now widely used in many spheres of production.

Certification requires that each named variety can be recognized so that its authenticity and purity can be verified when the seed production field is inspected. To do this, there must be a description of all eligible varieties based on their morphological characters. When certification schemes began in the mid-20th century, there were relatively few varieties in the market and it was easy to make a practical description for field inspectors to use. However, with the increasing intensity of plant breeding that began in the 1960s, more detailed and standardized descriptions had to be devised.

This ultimately led to the testing of new varieties for their distinctness, uniformity and stability (DUS) using an agreed list of characters, and the establishment of an official list of the varieties that could be produced, certified and marketed.³ In some crops a further requirement may be added for the registration of the variety, namely confirmation of its value for cultivation and use (VCU) through a trials system with standard protocols for assessment of key agronomic and quality attributes. In other words, a new variety must be shown to be superior in some way when compared to those already in use. This is a more subjective evaluation and can be controversial because many different criteria other than yield may be relevant for farmers or consumers (e.g. taste, shape, color, shelf-life). The use of diverse production systems would add further complications and for these reasons, vegetable crops are not normally subject to VCU testing.

Both DUS testing and VCU trials are intended to support the orderly marketing of seeds by providing essential information about the varieties that are offered for sale, in terms of their identity and in some case their performance.

In addition to the physical inspection of seed crops, certification schemes include field standards to ensure the quality of the crop; for example, the previous history of the field, its isolation from other crops of the same species, and general conditions such as freedom from weeds. While certification was originally devised as a way to guarantee variety identity, it was logical to assimilate the existing seed quality standards. Certification has, therefore, developed into a more comprehensive package of quality assurance measures, for which the label is a small but essential token of the entire system of field and laboratory procedures. This requires a marriage of technical procedures with a detailed

² There are two systems of generation naming in common use: the Organisation for Economic Cooperation and Development system recognizes the term “basic seed” while the USA system uses “foundation seed” for the same generation. This can cause confusion but the principles of the systems are the same. In both cases the final generation sold to farmers is “certified seed”.

³ Although morphological examination for distinctness is the key requirement for confirming the uniqueness of each variety, uniformity within the population and stability between generations are necessary for the description to be valid. It is clearly more difficult to make a reliable description of a variety that is genetically variable or unstable.

system of record keeping, which has been greatly strengthened by the availability of computers and databases. Crop inspection reports can now be entered directly in the field and seed lot information can be accessed online.

As noted above, certification had its origins in voluntary systems, implemented by producers who wanted to enhance the quality and reputation of their product. This voluntary status continues in some countries. As governmental controls became more robust, however, particularly in Europe, certification evolved into an official system of quality control and was made compulsory for major crops. This places a considerable burden of technical and administrative work on the responsible agency and requires substantial resources. It was, therefore, necessary to charge users (mostly seed companies) a fee for the service, and this would normally be regarded as part of the cost structure in the final price charged to farmers. Alternatively, the responsibility for implementing certification activities may be delegated to a third party, which may then be responsible for the costs involved. Whether certification is voluntary or compulsory, and how the costs are covered, are policy decisions; but if compulsory, then resource implications must be recognized, otherwise the system may fall into disrepute due to weak implementation, or even corruption.

The evolutionary process described above has led to the key components of the regulatory framework that are used today, comprising variety registration, seed testing and the umbrella provided by full certification. Some other elements have been added to make the system more manageable; for example, the requirement for companies that process and sell seed to be officially registered, so that their activities can be monitored for compliance with the provisions of the law. This enforcement may also be applied in the market place through the random sampling of seed lots that are being offered for sale. These different mechanisms of quality control and enforcement are reflected in the questionnaires used to collect information for this study.

2.2 Development context

Seed entered the arena of agricultural development in the late 1960s as a direct consequence of the Green Revolution, which had shown the benefits of using new high-yielding varieties in some major crops. The lack of a seed supply system was identified as a weakness in achieving the full impact of the gains being made by plant breeders in international institutes. In the following two decades, national seed projects were supported by donor agencies in the majority of developing countries in order to put in place the key elements of the formal seed sector that had evolved in countries with a more commercial agricultural industry. These projects were always implemented through the Ministry of Agriculture or a parastatal corporation that was effectively under government control.

On the regulatory side, projects tended to promote robust standards and procedures similar to those in higher-income countries, but which were often difficult or costly to implement in practice. Moreover, among the major self-pollinated crops such as rice, wheat and legumes, the percentage of seed handled by the formal sector remained small, unless subsidies were provided to encourage farmers to purchase. The impact of these

projects varied widely between countries, crops and locations but in general they did not become the “engine of development” to the extent that was originally expected.

This poor performance was often attributed to the over-dominance of government and the consequent lack of managerial flexibility, which is important for running a successful seed business. As a result, there were calls for greater participation of the private sector in seed supply and for the government to step back and focus its attention on creating a favorable environment for this transition to take place. This approach was successful in the crops that had commercial potential, notably those amenable to hybrid technologies, but much less so in the self-pollinating cereals and legumes, which are relatively unprofitable for the private sector and where the informal sector remained the main supplier of seed.

Experience over the past 20 years or so has shown that there is a continuing role for government to create an enabling environment for the private sector, and to intervene more directly in some crops, especially to facilitate the dissemination of new varieties arising from public research programmes. The current consensus in development is that the private sector should be encouraged to participate wherever that is financially viable but that governments cannot simply walk away because there will then be gaps in the seed supply system. Initiatives such as small seed enterprises can help to extend the reach of the formal sector by providing seed at moderate cost while seed producer groups – organized at the farmer level – can play a similar “semi-formal” role while still providing some quality assurance. These approaches are more relevant to cereal and legume crops, where formal sector penetration is still low in many countries. Such local initiatives may rely more on the reputation of the seller and that can provide sufficient reassurance at a community level, just as it did when the seed trade first developed.

Regulatory practices also came under scrutiny when the effectiveness of seed projects was reviewed. There were often cumbersome procedures that were a disincentive for the private sector, particularly in variety registration and release. Likewise, varieties already established and used in one country would often have to repeat the full testing process before being released in another country. These factors tended to slow down the introduction of new varieties or even encourage smuggling of high-value seeds, particularly of vegetables. The search for an optimal balance between private enterprise and official regulation continues and is one of the underlying motivations for this study.

2.3 Structure of regulatory frameworks

In this report, the term “regulatory framework” is used as an umbrella to cover all the legal instruments that impact on seeds and varieties used in agriculture. It can be broadly divided into primary legislation, comprising the laws of the country, and secondary legislation, comprising regulations and other measures that are used to implement those laws. Laws are considered and approved by the legislative branch of the state, while regulations may be approved by the executive branch of the state such the relevant ministry or a council of ministers.

Consequently, making a new law is a profound change, involving detailed scrutiny and debate in parliament, while regulations can usually be adjusted more easily to respond to changing situations and needs. Laws should be broad in scope and should establish the

main obligations and responsibilities, as well as providing the basis for the governance framework. On the other hand, regulations contain the technical elements that require greater flexibility while other instruments such as decrees and executive orders enable a ministry to deal with emergency situations (e.g. the control of pest and disease outbreaks).

It is a fundamental principle that secondary regulation does not alter the scope or purpose of the original law, and it follows that a balance is required in the distribution of the regulatory measures between primary and secondary legislation. More detailed technical procedures may be set out in manuals that can be recognized as official documents in the regulations but can be revised according to need. The legal documents should not be too cluttered with technical details.

The precise details of how the regulatory framework is defined and managed varies between countries and, in many cases, reflects historical influences. It is intrinsic to the need for legal security that procedures associated with primary law-making require time. However this may lead to a situation in which laws are inadequate to deal with changing circumstances. The need for new legislation across many different areas may lead to congestion in the schedule of the law-makers, and ministries then have to decide on their priorities. In these cases, it may be easier to amend the existing law rather than create a new one but this risks making the law less accessible and understandable. Many countries have seen the need to update their seed laws in recent years to reflect changes in the seed sector, but progress varies widely. This study will reveal the current status of laws across the region.

The scope of the regulatory framework has grown in response to the changing character and complexity of the seed industry. In addition to the original concern about seed quality, it may now include different aspects of crop varieties, certification schemes, company registration, the deployment of new technologies and even financial measures to support the seed industry. While the technical aspects of these laws still belong to the ministry responsible for agriculture, there are aspects that may fall in the remit of other ministries, such as environment or commerce.

2.4 Political and social context

From the time of the Green Revolution, seeds gained a political dimension, with conflicting views about the benefits of high yielding varieties and hybrids. These have been amplified by concerns about the use of plant genetic resources, the introduction of plant variety protection, and the use of genetically modified varieties, all of which have become the subject of intense debate among civil society organizations. Governments also are aware of the political sensitivity of seeds and have sometimes provided subsidies to win the support of farmers or to influence decisions about the crops they grow. This can, however, lead to an artificially high seed demand and consequent loss of quality due to poor supervision.

It is clear that some complex issues have to be resolved if the seed supply system is to be optimized in terms of technical efficiency and financial viability, while maintaining equitable treatment for all the main actors in the system, including farmers who are ultimate beneficiaries. It can be a challenge for governments to plan the right path,

particularly where the seed sector is evolving rapidly in response to changes in agricultural production. To address these issues, some countries have prepared a national seed policy to ensure consistency in decision-making among all the key actors. FAO has supported the drafting of seed policies in several countries, and based on experience gained, a “Voluntary Guide for National Seed Policy Formulation” was published (FAO, 2015).

While the purpose and management of laws is understood in all countries, the role of a seed policy may be less clear and may lead to confusion. For the purpose of this study, a policy is regarded as an umbrella covering all elements of the seed sector and reflecting the interests of all actors. It is intended to provide guidance for the development of the sector in a consistent way towards an agreed goal; on this basis, the policy is a document that is respected and implemented, rather than enforced. Laws must be in harmony with the policy and they add legal force to certain elements of the policy as outlined in the preceding sections. Ideally, a policy should precede the making of laws but in practice this is rarely possible because laws already exist before a policy is prepared. To provide legal recognition, the establishment and monitoring of a policy should be included when laws are being revised. In some countries general statements about the seed sector may be included in the early sections of the law.

The preparation of a national seed policy provides an opportunity for consultation among a range of stakeholders that is not generally done in the case of legislation. This inclusive process becomes more important as the seed sector diversifies and better coordination is required among the various actors. Diversification of the sector also prompts the need for an oversight body such as a national seed council or committee that can act as a guardian of the policy. This apex body should make recommendations for the strategic management of the seed sector, for which it needs sufficient authority and high-level access within the ministry. It should include representatives of the seed industry, farmers’ organizations and institutions involved in rural development rather than being weighted in favor of research institutes, as was sometimes the case in the past.

3 METHODS AND DATA

3.1 Questionnaire data collection

The study was implemented by means of questionnaires, one sent to the public sector and another to selected national seed associations and private sector members of the Asia and Pacific Seed Association (APSA). The two questionnaires were broadly similar, but some questions were intended to provide contrasting perspectives on the same topic, in cases where that is relevant or appropriate. Some questions requested information for different crops and the standard list used was rice/wheat, open-pollinated (OP) maize, hybrid maize, minor cereal grains, grain legumes, oilseeds, OP vegetables, hybrid vegetables, forages and pastures, perennial fruit crops/trees, roots and tubers.

For the public sector questionnaire, it was necessary to identify a key person in the official system with the knowledge and authority to respond on behalf of the public sector. This was done through contacts in ministries who could either respond themselves, or suggest

a more appropriate respondent. For some countries, the FAO representative office helped to identify the responsible person. The private sector questionnaire was sent to selected APSA members. Where possible, a diverse range of opinions was sought by sending to a local company, a regional or multinational company, or the national seed association.

The public sector questionnaires were dispatched to the selected respondents from mid-July onwards and by 31 December 2018, responses had been received from 20 countries. No questionnaire was received from India, the Lao People's Democratic Republic or Australia. Australia did not complete the public sector questionnaire because much of the content did not apply, but a detailed statement was provided. The private sector questionnaires were sent by the APSA Secretariat during September and by 31 December a total of 28 had been returned from 17 countries.

3.2 Geographical scope and country categorization

The geographical scope of the study was limited to countries in Asia and the Pacific, and roughly corresponds to the responsibility of the FAO Regional Office for Asia and the Pacific (FAO RAP), but included only those countries that have a significant formal seed sector. Kyrgyzstan was included because it is a leader in regulatory reform in Central Asia and an early participant in international organizations related to seeds. The study included 22 countries as shown in Table 1.

These countries are very diverse in terms of seed sector development, ranging from embryonic to fully mature. This can be seen as a positive aspect of the study because it provides a full spectrum of regulatory environments. To facilitate comparison and analysis, the countries are divided into two broad categories according to their stage of seed sector development as shown in Table 1, while recognizing that there is a continuum from under-developed to fully mature seed systems.

The category of “more-developed” includes Japan, Australia and New Zealand, which have a fully mature seed sector; the Democratic People’s Republic of Korea, Thailand, India and China, which have a highly developed seed sector that emerged in the early 1990s, and more recent players in the international seed trade, including Bangladesh, Indonesia, Pakistan, the Philippines and Viet Nam.

The category of “less-developed” includes Iran, Kazakhstan, Kyrgyzstan, Myanmar, Nepal and Sri Lanka, which have taken clear steps to strengthen their seed sectors, but still have very few seed companies with capacity in breeding research. Others in this group are Afghanistan, Bhutan, Cambodia, Lao People’s Democratic Republic and Malaysia, which are at an early stage of seed sector development, particularly with regard to private sector involvement. In these countries, the private sector focuses on seed trading and sales but produces little or no seed in the country, and does not conduct significant breeding research. The public sector is the main source of varieties of staple crops.

It was recognized that some questions invited opinions, which may have been difficult to answer objectively for public sector respondents if the questions implied criticism of the official system. Private sector respondents are less likely to be inhibited in expressing criticism of the system but may be primarily concerned about supporting their own commercial interests and, therefore, be less objective. Comparing the responses to some

questions within individual countries may point to a consensus view or highlight differences in perceptions about the regulatory system.

Because of the diversity of seed industries, some questions did not apply equally to all countries and this may lead to gaps or misunderstanding. In some cases, it was possible to interpret the responses in the context of the known agricultural or regulatory situation in the country. Further clarification was obtained through discussions with participants at the Asian Seed Congress held in Manila in November 2018, and from information provided by the private sector questionnaires.

Table 1. Questionnaire responses by country

Country	Number of public sector responses	Number of private sector responses			
		All	Local seed companies	Multi-national companies	National seed associations
More-developed:	11	20	9	7	4
- Australia ¹	1	-	-	-	-
- Bangladesh	1	1	-	1	-
- China	1	2	2	-	-
- India	-	4	2	1	1
- Indonesia	1	3	1	1	1
- Japan	1	1	-	-	1
- Republic of Korea	1	2	1	-	1
- New Zealand	1	1	1	-	-
- Pakistan	1	1	-	1	-
- Philippines	1	1	-	1	-
- Thailand	1	2	1	1	-
- Viet Nam	1	2	1	1	-
Less-developed:	10	6	1	4	1
- Afghanistan	1	-	-	-	-
- Bhutan	1	-	-	-	-
- Cambodia	1	1	-	1	-
- Iran	1	-	-	-	-
- Kazakhstan	1	-	-	-	-
- Kyrgyzstan	1	-	-	-	-
- Lao People's Democratic Republic	-	-	-	-	-
- Malaysia	1	2	1	1	-
- Myanmar	1	1	-	1	-
- Nepal	1	1	-	-	1
- Sri Lanka	1	1	-	1	-
Total	20	26	10	11	5

Notes: ¹ Australia provided a detailed narrative response, but not a completed questionnaire.

While the questionnaires provided a good overview of the regulatory frameworks in place, they could not provide sufficient detail to understand how well the system works in practice, particularly in those countries where consultation mechanisms not effective.

At the suggestion of FAORAP, some member states of the Pacific Community (SPC) were approached through the SPC Secretariat because we had no direct contacts in the local administrations. It was not possible to obtain completed questionnaires from this region but some information provided by SPC is presented in Section 4.3.4.

3.3 Secondary data

3.3.1 Participation in international organizations

To complement questionnaires, data were also obtained on the activities of regional and global organizations involved in seeds. The extent of participation in these organizations is a good indicator of the stage of development of national seed industries and their engagement with the global seed trade. There are four main international organizations concerned with seeds and varieties:

- **International Seed Testing Association (ISTA)** promotes and facilitates the standardization of seed testing procedures, which are published in the ISTA Rules, and issues international certificates of seed quality to facilitate trade. We used data on the number of ISTA member laboratories in each country as reported on the ISTA website.⁴
- **International Seed Federation (ISF)** represents the interests of commercial (private) breeders and seed companies. We used data on the number of ISF members per country as provided by the ISF Secretariat. These may be either national associations or individual companies.
- **International Union for the Protection of New Varieties of Plants (UPOV)** promotes and supports the adoption and use of plant breeders' rights. For each country UPOV membership was checked, based on information obtained from the UPOV website.⁵
- **Organisation for Economic Cooperation and Development (OECD)** provides a system of certification for seed moving in international trade. Membership of the OECD schemes was checked from their "Guide to the Seed Schemes" published in 2018.

At a regional level, APSA aims to promote quality seed production and marketing in the Asia and Pacific region and organizes the Asian Seed Congress (ASC) every year, which is a major seed trading event. APSA members are mostly private seed companies and national seed associations. We used data on the number of active APSA members per

⁴ <https://www.seedtest.org/en/home.html>

⁵ Members of the International Union for the Protection of New Varieties of Plants (Status on 13 October 2017). Available at: <https://www.upov.int/export/sites/upov/members/en/pdf/pub423.pdf>

country as well as the number of delegates per country participating in ASC. These data were provided by the APSA Secretariat.

3.3.2 Seed initiatives of intergovernmental organizations in the region

There are four regional intergovernmental organizations in the Asia and Pacific region that have developed initiatives on seed and which were reviewed as part of our study.

- **Association of Southeast Asian Nations (ASEAN):** ten member countries comprising Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Viet Nam.
- **Economic Cooperation Organization (ECO):** ten member countries comprising Afghanistan, Azerbaijan, Iran, Kazakhstan, Kyrgyzstan, Pakistan, Tajikistan, Turkey, Turkmenistan and Uzbekistan.
- **South Asian Association for Regional Cooperation (SAARC):** eight member countries comprising Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka.
- **Pacific Community (SPC):** 26 member countries comprising American Samoa, Australia, Cook Islands, Fiji, France, French Polynesia, Guam, Kiribati, Marshall Islands, Federated States of Micronesia, Nauru, New Caledonia, New Zealand, Niue, Northern Mariana Islands, Palau, Pitcairn, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, United States, Vanuatu, and Wallis and Futuna.⁶

3.3.3 Other relevant data sources

Two other important initiatives that are monitoring the status of the seed sector in Asia and elsewhere are briefly reviewed as part of this study:

- **Enabling the Business of Agriculture** is a major global initiative of the World Bank Group to assess and rank the regulatory environment for agricultural businesses in 12 thematic areas, one of which is seed. The 2017 report includes 62 countries, 14 of which are part of our study (World Bank Group, 2017).⁷
- **Access to Seeds Index**, managed by the Access to Seeds Foundation, surveys global and regional seed companies to assess how well they are meeting the needs of smallholder farmers (Access to Seeds Index, 2019b). The 2019 index for South and Southeast Asia includes 13 countries, which are all part of this study.⁸

⁶ These are the members of the Pacific Community, which have fallen within the remit of FAORAP. Australia and New Zealand are also members but they are covered separately in the study.

⁷ See: <http://eba.worldbank.org/>

⁸ See: <https://www.accesstoseeds.org/index/south-southeast-asia/>

4 REVIEW OF RESULTS AND INFORMATION GATHERED

4.1 Summary of responses to the questionnaires

The questionnaire responses obtained have been organized in a series of tables, reflecting groups of questions on specific topics in the order that they appear in the questionnaire. A summary of comments is presented in this section and a more detailed discussion follows in Section 5. These summary comments are presented below. Answers that are country specific, such as the name of responsible organizations, could not be tabulated but could be incorporated later into a regulatory profile for each country, if that is considered useful.

4.1.1 National seed laws

Nearly all of the 22 countries in our sample have a seed law except Malaysia, which is currently preparing a seed quality law, and Lao People's Democratic Republic, which has taken no steps on this road yet. Australia abandoned any national legislation of this kind in 2002, although there are residual elements in some states. This is clearly a special case that will be discussed later as an interesting example of regulatory evolution. New Zealand, likewise, does not have a seed law as such but it does have agreed regulatory arrangements of equivalent standing.

The date of laws currently in force varies from 1966 (India) to 2018 (Bangladesh) but most countries have made a new law or an amendment within the past decade. Thailand has a 1978 Plant Law but there is a mechanism for updating it at intervals so this has not been a handicap. The two countries that have undertaken revisions most recently are Bangladesh and the Philippines, and these may be considered as useful examples for further study.

The core content of national laws is similar although with some minor variations, such as the registration of seed companies. The number of regulations required to implement the law varies widely according to customary practice; there may be one umbrella regulation covering all elements of the law (as in Myanmar), or many separate regulations, said to be 20 in China and 25 in Indonesia.

Only a few countries suggested specific improvements; this may be because there is a recent or current revision or because respondents were reluctant to express personal opinions.

Private sector respondents were asked whether the current seed laws in their country gave little, some or good support to the private seed sector. Respondents in the more-developed group were clearly more satisfied with their seeds laws than those in the less-developed group. Private sector respondents in Nepal, Malaysia, Sri Lanka and Myanmar felt that the seeds laws in their countries do not support the private seed sector sufficiently.

4.1.2 Plant variety protection laws

Responses from the public sector indicate that nearly all countries have a law intended to protect plant breeders' rights, the exceptions being Bangladesh, Nepal and Sri Lanka. We understand that Bangladesh has a draft plant variety protection (PVP) law in preparation.

Seven of the twenty countries that responded to the public sector questionnaire (and also Singapore) have PVP laws that follow the UPOV model, and have joined the Union (see also Section 4.2). A further eight countries have a PVP law that is not compatible with the UPOV Convention because it allows a more generous interpretation of the farmers exemption. In several countries, this is a highly contentious political issue, making progress difficult. Myanmar has a PVP Act that is currently under review by the UPOV Council and the same applies to Brunei Darussalam. We understand that in both cases, the national PVP laws were favourably considered by the UPOV Council.

4.1.3 Biodiversity laws

The responses to this question were incomplete. Six countries have passed a biodiversity law (or similar) in recent years, probably as a follow up to signing the Convention on Biological Diversity, while others have older laws, or none at all. Of the 17 public sector respondents that answered this question, 14 indicated that their seed laws included an element of biodiversity protection. Several countries did not respond, perhaps because this subject does not belong to their ministries of agriculture. Further research will be required to obtain a more complete picture of this legislation, and it could be useful to follow up on this. In practice, however, this does not impact directly on the seed sector unless there are some specific provisions in the law regarding genetic resources or agrobiodiversity.

4.1.4 Farmers' rights legislation and representation of farmers in decision-making

The concept of "farmers' rights" has mostly gained meaning and support in certain developing countries that have strong civil society lobby organizations. Among the countries with a more-developed seed sector, China, Indonesia and the Philippines indicated that farmers' rights are addressed in their seed laws, while for the less-developed group this included Bhutan and Myanmar. The exact understanding of farmers' rights may vary between countries and this may affect the responses made.

Farmers' rights may be included in the PVP legislation to redress a perceived imbalance but this makes it difficult to join UPOV, as noted above. The effectiveness of these laws in ensuring rights for both breeders and farmers justifies further study.

Public sector responses suggested that farmers are well-connected to their ministries of agriculture in 16 out of 18 countries, and are represented in policy decision-making. These answers, however, need to be interpreted with a certain amount of caution as they may not represent farmers' points of view and the mechanism of representation will depend on the political system of the country.

4.1.5 Seed sector policies and oversight

These issues may be considered as among the most important, given the need to achieve clear policy direction in countries where the seed sector is evolving rapidly. Conversely, they are not a priority in mature seed industries, or may be addressed through various consultation mechanisms but without a documented policy. This is the case in Australia and New Zealand.

A majority of countries (79 percent according to the public sector responses) report that they have a seed policy or equivalent mechanism, although in some countries these were old or were being revised. A similar number of countries also have a seed sector oversight body of some kind, generally with advisory status, but in five countries it also had legal authority (Indonesia, the Philippines, the Republic of Korea, Myanmar and Nepal).

Several countries mentioned that the meetings of this body were infrequent (on average less than twice a year), or had lapsed for some years. The National Seed Industry Council in the Philippines is an example of a body that is actively managing the seed sector.

Private sector responses showed that the private sector is represented in this oversight body in 74 percent of the countries, with Thailand, Myanmar and India being exceptions. Private sector representation in Indonesia was unclear because private sector respondents gave contradictory answers.

4.1.6 External support to the public seed sector

As expected, only a few countries had benefitted from significant international development assistance in support of the seed sector: Afghanistan, Bangladesh, Cambodia and Myanmar. In the Republic of Korea and Malaysia, external support was mentioned, but this was funding from the government to support special initiatives in the seed sector.

4.1.7 Genetic resources

Most countries have a national gene bank, although in some cases this may not amount to a national network of gene banks. Gene banks normally belong to the ministry of agriculture or the national agricultural research system.

Public organizations in several countries had undertaken activities to raise awareness of the Nagoya Protocol, although this awareness was higher in the more-developed group (75 percent) than in the less-developed group (40 percent). It would, however, be useful to know what has been done in this regard because all countries with active breeding programmes should, in principle, address this issue and make efforts to inform their breeders.

For 71 percent of the countries in the private sector survey, respondents indicated that the private sector had easy access to material held in public gene banks; however, access was clearly better arranged in the more-developed group (90 percent easy access) than in the less-developed group (25 percent easy access). Private sector respondents in Myanmar, Sri Lanka, and Malaysia and some (but not all) private sector respondents in India and Indonesia reported difficulties in accessing public gene bank material.

4.1.8 Access to and licensing of public varieties

This focuses on a key issue: the relationship between public breeding and private sector production. Most countries (80 percent in the public sector survey, and 75 percent in the private sector survey) report that there is a mechanism for transferring public sector varieties to the private sector for multiplication and marketing. There appeared to be opposing opinions about this between the private and public sector in some countries. For instance, some private sector respondents from China, Japan, the Republic of Korea and Nepal said there is no system of this kind, while their public sector counterparts said there is. This difference may arise because respondents focus on different groups of crops.

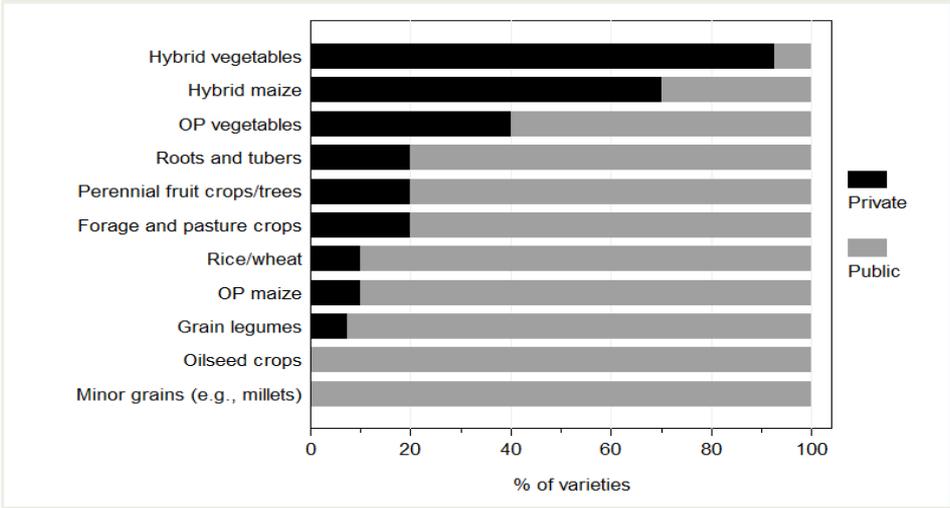
Asked to rank the access to public sector materials on a scale from 1 (very ineffective) to 4 (very effective), only 2 of 15 public sector respondents, and none of the private sector respondents, indicated that the system is very effective with the average score being about 2.8. Therefore, the general state of such mechanisms may be characterized as “effective”, although not perfect. The responses to this question were probably made in the context of staple cereal and legume crops because there is little effective breeding of vegetable crops in the public sector.

In very few countries was the income to research institutes from such arrangements considered to be significant. Effective licensing arrangements can be key in maximizing the impact of public plant breeding, and it would be useful to provide more guidance on this topic to the concerned parties within national seed systems.

4.1.9 Source of varieties and sources of seed

The public sector is the main source of new varieties for all crops except hybrid vegetables and hybrid maize, and to lesser extent OP vegetables (Fig. 1). It should be noted, however, that some countries have very few hybrid varieties registered. For instance, in Nepal only one hybrid vegetable variety (the tomato variety *Srijana*) is currently registered for use by farmers. The number of registered maize and vegetable varieties available to farmers is, in itself, an important indicator of the strength of the private seed sector in a country.

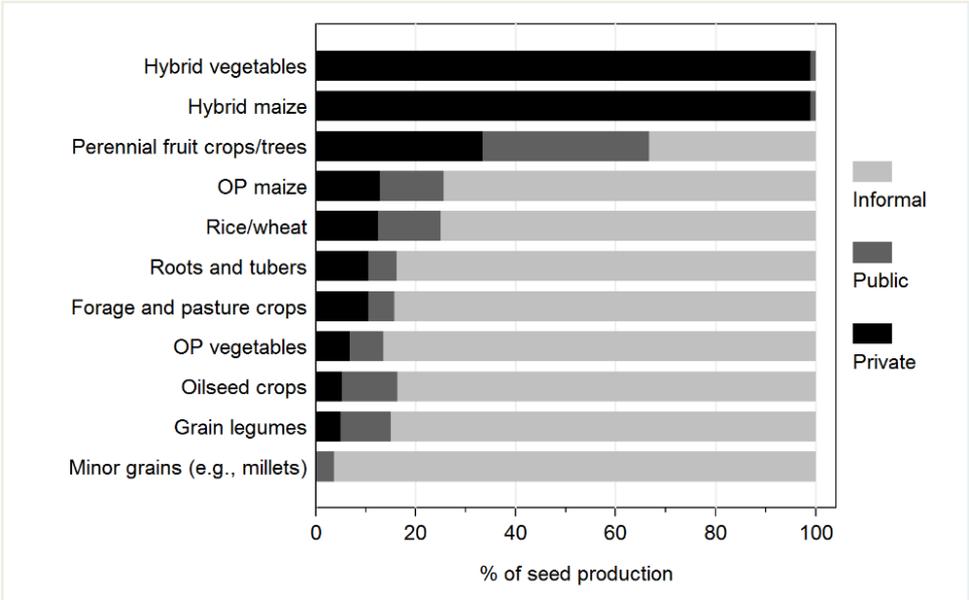
Figure 1. Percentage of new varieties originating from the private or public sector, by crop category



Notes: Based on public sector responses (19 countries; no data available for China). Respondents estimated the percentage of varieties originating from the public and private sector for each crop category. Values shown are medians (not weighted by country size or the number of varieties per country) calculated over all countries in the data and scaled to 100 percent.

Hybrid seed production, if done in a country, is generally handled by the private sector as shown in Figure 2. For fruit trees, which are mostly propagated vegetatively, the private and public sector are equally important. For all other crops, however, the informal sector is still the main supplier of seed, using varieties that originated from public breeding programmes.

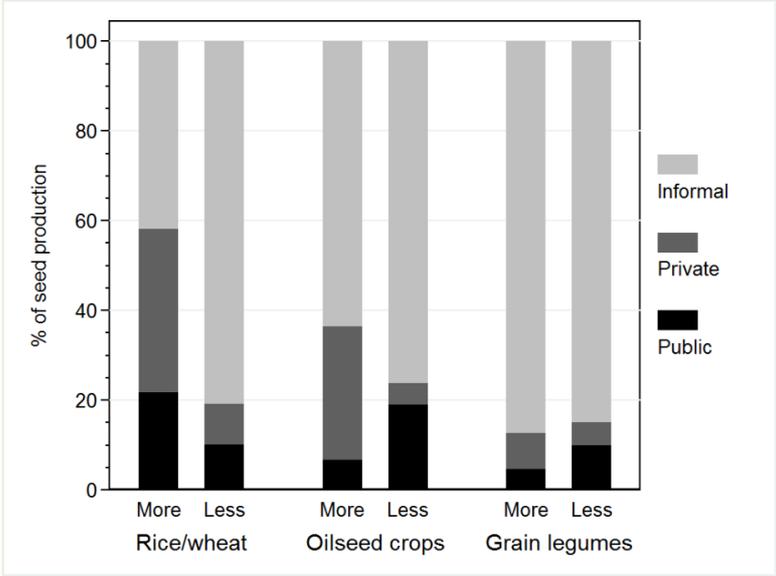
Figure 2. Percentage of seed produced by private or public formal sector or informal sector, by crop category



Notes: Based on public sector responses (16 countries; no data available for China, Kyrgyzstan, the Republic of Korea, or the Philippines). Respondents estimated the percentage of seed produced by the private, public and informal sectors for each crop category. Values shown are medians (not weighted by country size or the number of varieties) calculated over all countries in the data and scaled to 100 percent.

Public respondents in the less-developed group estimated that the informal sector contributed to about 81 percent of the seed production of rice/wheat in the group, while this was down to 42 percent in the more-developed group, with the private sector contributing about 36 percent (Fig. 3). This no doubt reflects, in part, the availability of PVP as well as the different purchasing habits of farmers. The private sector in the more-developed group also has a higher stake in the seed production of oilseed crops, contributing about 30 percent of the market. Yet, for grain legumes, private sector involvement is very minimal, even for countries with a more advanced seed sector. Overall, Figure 3 shows that the informal sector is the main source of grain legume seeds in all countries.

Figure 3. Percentage of seed produced by the private or public formal sector or informal sector for three common crops, by level of seed sector development



Notes: More=more-developed; Less=less-developed. Based on public sector responses (16 countries; no data available for China, Kyrgyzstan, the Democratic People’s Republic of Korea, or the Philippines). Respondents estimated the percentage of seed produced by the private, public and informal sectors for each crop category. Values shown are medians (not weighted by country size or the number of varieties) calculated over all countries in the data and scaled to 100 percent.

4.1.10 Variety registration, release and national listing

Most countries (72 percent according to the private sector survey) have a national variety release committee.

Public sector responses show that 90 percent of the countries have a national list of registered or approved varieties that is subject to regular revision, generally one or two times per year, following meetings of the relevant committee. Most countries (78 percent in the more-developed group and 50 percent in the less-developed) also said that this list is available online, but it is not clear if this is just a list of variety names or if it also contains some key information about the varieties.

All countries said that they would welcome a regional database of available varieties and their key attributes, which could stimulate the international trade in seed. It would, however, be a major exercise to develop and maintain this list, except possibly for a limited range of crops. Agreeing on a standard description sheet would be an essential first step.

The private sector questionnaires informed about the cost of variety registration to the private sector. The values varied widely from a few hundred dollars in Pakistan and Malaysia to several thousand dollars in India, Nepal and Sri Lanka. However, these data need to be interpreted with caution as the costs will vary by type of crop, and not all estimates may include the same cost categories. The same question asked to public sector respondents also gave very different answers.

4.1.11 Variety testing

Contradictory answers were given between private and public sector respondents regarding the requirement of DUS and VCU testing (Table 2), which may signal a lack of understanding of these concepts. There may be a misunderstanding about VCU testing because many countries have long-established national coordinated trials (or similar) for major crops but may not actually regard these formally as VCU. Likewise, there is very diverse requirement for DUS and VCU tests. Therefore, the data need to be interpreted with caution.

The data show much variation between countries in terms of compulsory DUS and VCU testing. Sri Lanka and Nepal appeared as countries that require DUS and VCU testing for nearly all crops, including vegetables. Bangladesh, on the other hand, indicated that these tests are only required for rice/wheat and for roots/tubers. The data suggest that many countries require DUS, and to lesser extent VCU testing, for most crops. It is, however, unlikely that compulsory testing can be carried out in practice for all vegetable varieties, unless there are very few candidates submitted for testing.

Most countries (72 percent according to public sector responses) carry out DUS and VCU at the same time, thus shortening the overall duration of testing, while a few retain the old model of sequential testing that can lead to long delays in approval and release.

Table 2. Compulsory distinctness, uniformity and stability (DUS), and value for cultivation and use (VCU) testing of new crop varieties

Crop category	Public sector responses (20 countries)		Private sector responses (16 countries)	
	DUS	VCU	DUS	VCU
Rice/wheat	74	75	77	70
OP maize	58	55	48	45
Hybrid maize	63	55	63	60
Minor grains (e.g. millets)	53	30	55	45
Grain legumes	63	55	52	48
OP vegetables	63	40	38	28
Hybrid vegetables	53	25	63	45
Perennial fruit crops/trees	63	45	30	27
Roots and tubers	63	50	54	48
Oilseed crops	53	40	57	52
Forage and pasture crops	47	35	39	39

Notes: The data for the public and private sectors are not directly comparable because the two samples comprise different countries.

According to the public sector responses, approximately half of the countries allow a fast-track registration of varieties already registered elsewhere. This practice appears less common in larger countries as the respondents from China, Indonesia, and Japan indicated that their country has no such mechanism. Furthermore, public sector respondents from only two countries (New Zealand and Bhutan) said that they can accept VCU data from other countries, which is a practice that can also speed up variety

registration. A minority of countries (37 percent) said that they accept VCU data provided by the applicant themselves, and this was higher for the more-developed group (56 percent) than for the less-developed group (20 percent).

In all of these matters, there are probably variations in the detailed procedures between crops. For example, data submitted by the applicant may be accepted for vegetables but not for major cereal crops; likewise, presenting such data may reduce the number of testing seasons required, rather than eliminate the requirement altogether. There may also be variations in the conduct of trials; for example, applicants may be able to carry out their own VCU trials but only following an official protocol and subject to inspection by a committee. All these arrangements help to reduce the burden on official testing systems and increase participation by seed companies in the variety registration process.

4.1.12 Seed trade

Nine out of 20 respondents (45 percent) in the public sector survey said that their country has a “one-stop shop” system for seed imports. Sixteen countries, including all but one country in the less-developed category indicated that a license is required to export seed, Kyrgyzstan being the exception. High-income countries such as New Zealand, Japan and the Republic of Korea do not require such export licenses because they are significant producers of seed for the global trade.

The requirements for export licenses may vary between crops. For instance, governments may want to monitor or restrict the export of seed of staple or strategic crops but is pleased to support commercial exports of vegetable seed.

There was a wide spread of responses regarding the extent of unofficial trade and this could generally be explained in terms of geography and the ability to control trade across borders. For instance, China reported unofficial trade as non-existent, whereas Cambodia and Afghanistan reported this as very substantial.

Phytosanitary controls were considered by most countries to be “quite effective” and again the exceptions could mostly be explained by differences in the strength of border controls. It was encouraging that most countries had engaged in discussions about phytosanitary arrangements, reflecting the various initiatives by regional organizations, including APSA. The publication of ISPM 38 was regarded as a very positive development and awareness of this should be promoted.⁹

4.1.13 Certification schemes and labelling

All countries in the public sector survey except China said they have a certification scheme of some kind but there was wide variation in the number of crops covered by these schemes and the extent to which they are compulsory or voluntary. Fifteen out of 18

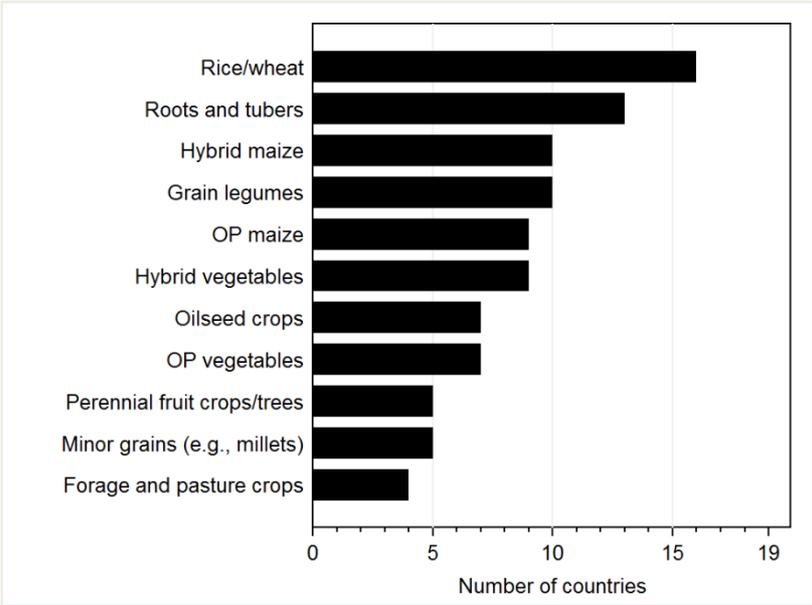
⁹ ISPM 38 on “International Movement of Seeds” was published by the secretariat of the International Plant Protection Convention (IPPC) in 2017 and is now being promoted to all national plant protection organizations and other concerned parties. It is considered an important step in improving the implementation of phytosanitary laws and regulations in order to facilitate the trade in seeds. (ISPM stands for “International Phytosanitary Measures” – the series of documents published by IPPC.)

countries said that there is a charge for using these schemes but the charge generally covered only a part of the actual cost; therefore, the provision of certification is regarded as a service to promote seed quality. In Australia, the entire quality control system has been delegated to a separate authority and receives no government support.

The requirement for certification varied by crop, as could be expected. Figure 4 shows that it is generally compulsory for the major cereals (rice and wheat), as well as for roots and tubers (e.g. potatoes and cassava). It is less common for vegetables, although half of the countries in the sample do require it for this crop as well. It is notable that countries with a more advanced seed system do not require seed certification as much as countries with a less advanced seed system, as shown in Figure 5, for a range of crops. For example, the certification of vegetables is uncommon in countries with a robust seed system, with Indonesia being the sole country in this group requiring vegetable seed to be certified. This may either mean that other countries are over-regulating seed supplies, or they are trying to address existing problems of low seed quality, or both. In fact, vegetable seed moving in the international trade is rarely subject to certification, and the OECD scheme for vegetable seeds is used to a very limited extent. Trade is done mostly on personal knowledge between the seller and buyer and may be supported by an ISTA certificate.

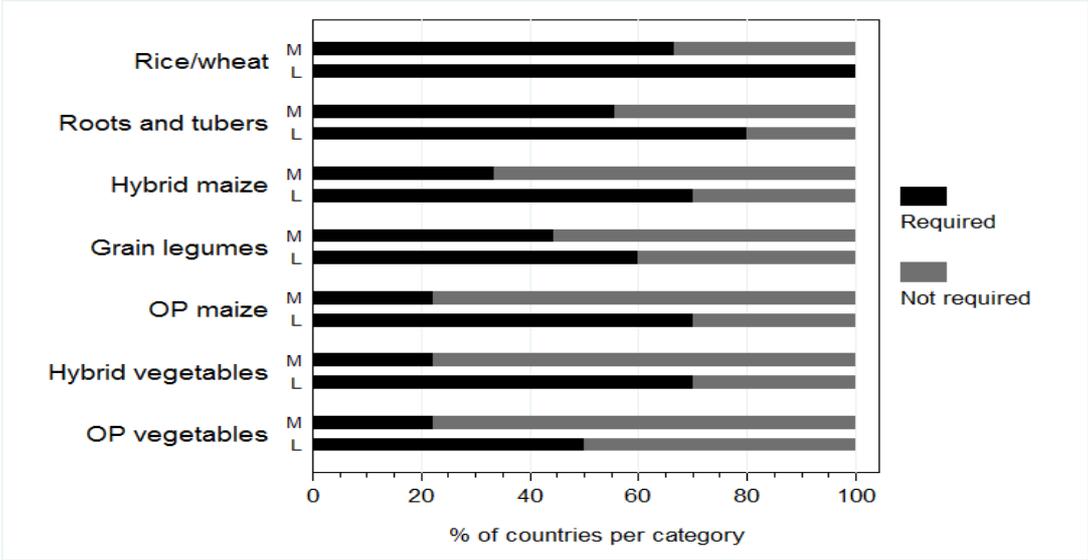
The questionnaire did not reveal the details of how well certification is implemented at a field level but most respondents said that the regulatory system required more resources, which implies that in these countries implementation is not as good as it should be. However, it must also be recognized that enforcement can never be complete, and this prompts consideration of alternative approaches, which are discussed in Section 5.

Figure 4. Number of countries that reported compulsory variety certification, by crop category



Notes: Based on public sector responses from 19 countries (no data were available for China).

Figure 5. Percentage of countries with advanced and less-advanced seed sectors that reported compulsory variety certification, by crop category



Notes: Based on public sector responses from 19 countries (no data were available for China). M=more-developed seed sector; L=less-developed seed sector.

4.1.14 Seed quality control

Sixteen of the 20 respondents in the public sector survey said that they have an effective system of seed quality control in their country, although this may mean that the system exists, rather than specifically knowing its effectiveness; this may be difficult to determine objectively without a detailed survey of farmers. In the countries with a more-developed seed sector, 70 percent of respondents said that the responsible agency was adequately resourced, but this was only 10 percent for countries in the less-developed group, which suggests a relationship between the level of seed sector development and the capacity of national authorities in charge of seed quality. This may also reflect differences in the allocation of responsibilities, as discussed in Section 5.

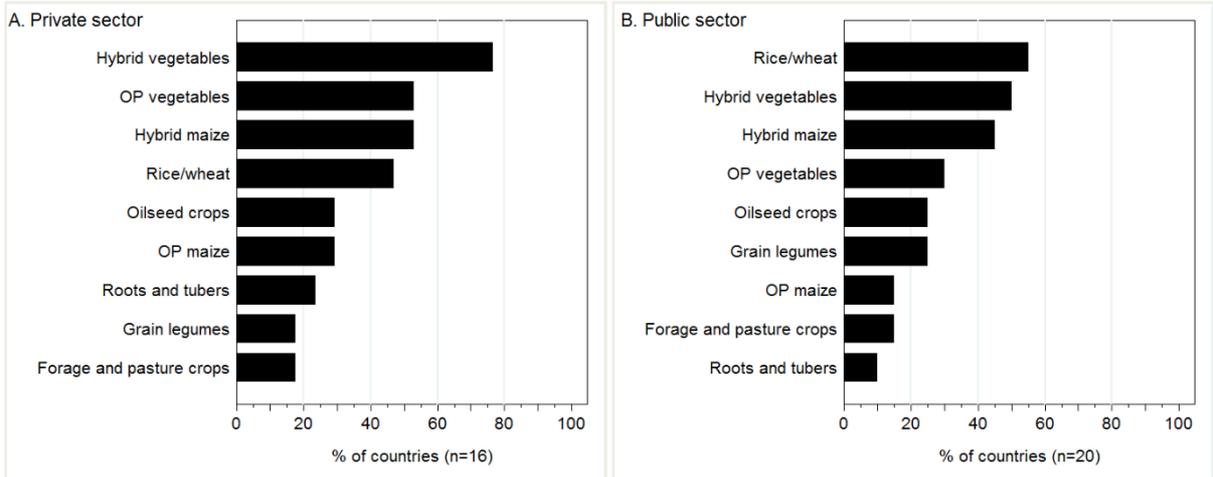
All respondents in the public sector survey said that “fake seed”¹⁰ was a problem to some extent in their country. Large problems with fake seed were reported by public sector respondent from Bangladesh, Myanmar, Kyrgyzstan and Malaysia. Private sector respondents also reported large problems with fake seed in Thailand, Viet Nam, Cambodia and Indonesia.

According to private sector respondents, fake seed was most prevalent in hybrid vegetables, OP vegetables, hybrid maize and rice/wheat as shown in Figure 6 (left

¹⁰ The term “fake seed” has come into use in recent years to denote the deliberate misrepresentation of seed, for example by applying a treatment to grain or by using packages similar to those of reputable companies.

diagram). Public sector respondents also listed these four crop categories as most affected by fake seed (right diagram). Problems with fake seed in hybrids reflects the fact that these seeds command higher market prices and are, therefore, more attractive to fraudsters. Fake seed in rice and wheat may refer to the fact that some seed traders may package grain as certified seed.

Figure 6. Number of countries reporting problems with fake seed, by crop category, according to private sector (diagram A) and the public sector responses (diagram B)



4.1.15 Biosafety and genetically modified crops

The majority of countries have biosafety laws or regulations in place and this may result from the attention given to this issue in the 1990s when genetically modified (GM) crops first became available. Seven countries have GM varieties registered for use by farmers. GM cotton varieties are registered in Bangladesh, China, Myanmar and Pakistan, and GM maize is registered in Japan, the Philippines and Viet Nam. Other GM food crops include papaya (China, Japan), soybean (Japan) and eggplant (Bangladesh). The introduction of GM eggplant in Bangladesh is a significant development within the region because it is the first deployment of a GM trait in a vegetable crop. There is anecdotal evidence that this variety is being smuggled into India. One-third (30 percent) of the countries reported the unofficial use of GM crops by farmers in their country.

4.2 Participation in international organizations

As noted earlier, the extent of participation in international organizations that deal with seed is a good indicator of the status of seed industries and this was used as a basis for the categorization as “more” or “less” developed that has been used to interpret the questionnaire results. This participation is summarized in Table 3. Regarding the OECD Seed Schemes, only Australia, India, Iran, Kyrgyzstan, Japan and New Zealand are members, and among these, Australia and New Zealand are by far the largest users, both being major exporters of agricultural crop seeds.

Table 3. Participation in various international organizations

Country/territory	Active APSA members ¹	Asian Seed Congress delegates ¹	ISF members ²	ISTA member labs	UPOV member
More-developed (total):	406	1 039	24	60	6
- Australia	13	26	4	6	1
- Bangladesh	17	40	-	4	-
- China	109	256	4	7	1
- India	107	232	4	18	-
- Indonesia	10	24	1	3	-
- Japan	43	109	3	7	1
- Republic of Korea	27	81	1	2	1
- New Zealand	8	13	3	4	1
- Pakistan	38	69	1	1	-
- Philippines	9	79	2	4	-
- Thailand	23	103	1	4	-
- Viet Nam	5	10	-	-	1
Less-developed (total):	22	32	12	5	1
- Afghanistan	1	-	-	1	-
- Bhutan	-	-	-	-	-
- Cambodia	-	-	-	-	-
- Iran	4	6	12	1	-
- Kazakhstan	-	-	-	-	-
- Kyrgyzstan	1	2	-	1	1
- Lao People's Democratic Republic	-	-	-	-	-
- Malaysia	4	7	-	-	-
- Myanmar	3	5	-	-	-
- Nepal	2	1	-	1	-
- Sri Lanka	8	13	-	1	-
Total	428	1 070	36	65	7

Notes: ¹ Average 2017–2018. APSA (Asia and Pacific Seed Association) members are mostly companies or national seed associations.² ISF (International Seed Federation) members may be national seed associations or individual companies. ISTA = International Seed Testing Association; UPOV = International Union for the Protection of New Varieties of Plants

4.3 Information relating to intergovernmental organizations in the region

The activities of four intergovernmental organizations in relation to seeds are summarized in this section.

4.3.1 Association of Southeast Asian Nations

ASEAN initiated a Seed Council in 2013 and a second meeting was held in 2017. It seems that this council is mostly research-oriented but has not yet formulated a work programme.

4.3.2 Economic Cooperation Organization

ECO had a significant involvement in matters relating to seeds and varieties as part of an FAO-funded project that ran from 2012 to 2015. This organized regional consultation on seeds supported the activities of the ECO Seed Association, which held a series of annual trade gatherings, mostly supported by Turkey. The project also facilitated the preparation of two key documents:

- the Regional Seed Agreement, which provides a formal basis for collaboration between member states at the governmental level; and
- the Regional Seed Strategy, which provides a guideline for countries to follow in order to align their seed sectors more closely in future, with the eventual goal of harmonization.

The Agreement was finalized in 2015 and rests in the hands of the ECO Secretariat but has not been signed by a sufficient number of countries to become effective. This does not appear to be the result of any major objection in principle, rather a lack of priority among government representatives who would be authorized to sign.

The Strategy is an advisory document that is intended to assist with the implementation of the Agreement by promoting convergence in national seed sector policies and management. It could be regarded as an umbrella guideline for the region comparable to national policies. Although this has not come into use, many of the principles and proposals contained in the strategy would be applicable in other regions or groupings. It could be revisited for that purpose.¹¹

These initiatives lost momentum after 2015 when the FAO-ECO project ended, but it is understood that a similar project is now in preparation and this may reactivate the valuable work that was done previously by country representatives from across the region.

4.3.3 South Asian Association for Regional Cooperation

The SAARC Agriculture Centre (SAC), based in Dhaka, has been active in seeds for several years. This began in December 2009 with a major regional workshop on “Quality Seeds in SAARC Countries” held in New Delhi at which, all countries presented the status of their seed activities on a series of topics, including production, processing, quality control and marketing. Following from this meeting there were three publications:

- Recommendations of the Regional Workshop (2010) (a short summary);
- Quality Seed in SAARC Countries (2011). This is effectively the Proceedings of the Workshop and contains much detailed information on each country, although it is now ten years old (Huda and Saiyed, 2011); and

¹¹ Available at:

http://www.fao.org/fileadmin/user_upload/reu/europe/documents/ECO_Seed_project/Regional_Seed_Strategy_Final_E.pdf

- SAARC Seed Outlook (2012) is a further distillation of the status and future prospects in the member countries at the time; the executive summary provides a useful checklist of issues in the seed sector (Saiyed, 2012).

SAC has made a number of other interventions in seeds, including:

- planning a seed bank for genetic resources (this will surely be problematic given the large number of member countries);
- establishing a seed forum for future collaboration between member states; and
- facilitating meetings and initiatives within the region, among which the most notable was a protocol agreed to between Bangladesh and India in 2013 to enable the exchange of rice varieties, which gave rise to the “Seeds Without Borders” initiative, summarized below.

The Seeds Without Borders initiative was facilitated by the International Rice Research Institute, and signed first between Bangladesh and India, with Bhutan, Cambodia, Myanmar, Nepal and Sri Lanka joining the initiative later. The Agreement allows varieties registered in one country to move more easily to another country and, thus, to become available to farmers much more quickly. In practice it may also reduce the “illegal” trade that may have existed previously when seed of unregistered varieties moved across those borders in response to demand from farmers. The status of this agreement (also referred to as a Treaty) is not entirely clear but a Seed Policy Workshop was organized in Cambodia in 2017 to inaugurate it. It would be useful to find out what progress has been made since that time and to what extent it is now being used by the seven participating countries.¹²

4.3.4 The Pacific Community

Regional bodies, including the Pacific Community have done intermittent work on seeds over the years. There was a regional meeting in 1996 and arising from that a draft regional seed policy was prepared in 1999, but the fate of this document is unknown. Recently, there has been a revival of interest, with a Seed Forum held in July 2018 and a concerted effort to gather information for that. This work is continuing under the banner of the Pacific Seeds For Life initiative, which was launched at the Pacific Islands Forum meeting but organized by SPC.

As noted previously, questionnaires could not be sent to these countries because there is no indigenous formal seed sector and none of the states has yet developed their own regulatory framework. Seed trade in the Pacific Islands region is essentially limited to imports of vegetable seed and small-scale production of some crops on government research stations. It would be efficient if minimum seed quality standards could be prepared and agreed for the region, as proposed in the draft seed policy document.

¹² Information about this initiative only came to light at the very end of the study and there has not been time to follow up on the details, which may already be known to other interested parties in the region. Though developed originally for rice, it is said now to embrace several other non-hybrid crops.

4.4 Information from other surveys in the region

4.4.1 Enabling the Business of Agriculture

This is a major global initiative by the World Bank Group to assess and rank the regulatory environment for agricultural businesses in 12 topics, one of which is seed. The objective is to obtain globally comparable information that can be used by policy-makers to improve the business environment in their countries. A 2017 World Bank Group report covered 62 countries, and the next report, due out in 2019, will extend this to 100 countries. It should be noted that Enabling the Business of Agriculture (EBA) spans the full range of economic development, including some high-income countries.

There are similarities between the data collected for EBA and the present study, particularly with regard to variety registration procedures and seed quality control, although there are differences in emphasis. We understand, however, that EBA data were collected only from private sector practitioners, not from regulatory authorities.

4.4.2 Access to Seeds Index

The purpose of the Access to Seeds Index is to survey global and regional seed companies in order to assess how well they are meeting the needs of smallholder farmers. It is timely that the regional report for South and Southeast Asia was released in November 2018 so the information is up to date. It covers 13 of the countries within the scope of this study, extending from Afghanistan to Indonesia, but does not include Central Asia, Malaysia or the high-income economies of East Asia. A global report covering all regions was published in January 2019 (Access to Seeds Index, 2019b).

The Index ranks 24 seed companies based on a number of different criteria and produces a final overall ranking of their performance in the smallholder sector. This information is interesting but not directly relevant to our present study. The summary profiles of each country, however, do contain information about the number of companies operating in each market and the type of activities they carry out (Table 4). This is supporting evidence for the two categories of countries that have been used in this report.

The six key findings of the study are:

- 1) seed companies are present throughout the region but reach only 20 percent of the smallholder farmers;
- 2) six countries are considered as seed hubs in the region because they have a range of companies with vertically integrated business activities, in ranked order these countries are India, Thailand, Indonesia, Viet Nam, the Philippines and Bangladesh;
- 3) vegetable seed is a key business driver, legumes are under-represented;
- 4) for the majority of crops, the newest varieties are less than three years old, and regional companies do more to release public research varieties;
- 5) hybrids dominate – regional companies extend the availability of open-pollinated varieties; and
- 6) most seed companies sell package sizes tailored to the needs of smallholder farmers.

The dominance of vegetables and hybrids is to be expected among the companies that trade across borders whereas national companies that are selling cereal and legume seeds in their own domestic market were not included in the study. The finding about the life of varieties shows how important it is for national testing systems to move quickly, otherwise a new variety may already have been superseded by the time it is released. In this case, farmers would never have access to the latest varieties.

Table 4. Number of companies included in the Access to Seed Index that are involved in different activities of the seed value chain

Country	Breeding research	Variety testing	Seed production	Seed processing	Seed sales	Farmer extension
More-developed:						
– Bangladesh	3	9	4	2	23	6
– India	17	17	26	15	26	14
– Indonesia	8	8	8	4	21	9
– Pakistan	2	9	4	1	22	3
– Philippines	6	7	7	4	18	5
– Thailand	10	11	12	6	21	6
– Viet Nam	6	10	8	5	21	5
Less-developed:						
– Afghanistan	0	0	0	0	9	0
– Cambodia	0	4	0	0	12	3
– Lao People’s Democratic Republic	0	2	1	0	11	1
– Myanmar	0	5	3	1	14	3
– Nepal	1	5	2	1	18	1
– Sri Lanka	0	7	1	0	19	2

Source: Access to Seeds Index South and Southeast Asia (2019a). *Note:* Although there are only 24 companies in the index, the country reports provide data for more companies.

5 DISCUSSION

5.1 Overview of seed industries in the region

The status of seed industries varies widely across the region. There are countries that are at the earliest stages of development while others are fully mature. Through a unique combination of historical influences, recent political changes, donor interventions, institutional arrangements, and fundamental differences in agro-ecology, each country presents a distinct seed industry profile in terms of public–private sector relationships. This diversity is also reflected in the regulatory landscape of countries. For this reason, direct comparison of countries on the basis of the questionnaires alone is difficult; more in depth discussions would be required to understand how each national system works in detail. However, the responses to questionnaires and information gathered from other

sources do provide a substantial platform from which experience can be shared and recommendations made.

Seed industry development generally corresponds to the status of agricultural development, but there are exceptions. For example, Malaysia has a very advanced plantation sector, but has only recently started to give emphasis to food crop production and is now putting in place the legal framework to support that. Lao People's Democratic Republic is also at an early stage of development but it has a very traditional agriculture in which the formal seed sector has made little impact so far, except for the use of imported vegetable seed to supply urban markets and meet the growing demands of tourism. To assist the government in planning the seed sector, FAO supported the preparation of a seed policy in 2017.

Myanmar is also at an early stage of seed industry development but it is an important agricultural country with substantial export potential. For this reason it has received intensive support from donors in recent years, including strengthening the regulatory framework that will help to establish a more organized seed industry and attract investment. At the other end of the spectrum, Australia, New Zealand and Japan have long established seed industries that are fully mature, while several other countries have progressed rapidly towards that position in recent years, notably China, India and the Republic of Korea. In the past, Bangladesh, Pakistan, Thailand and Viet Nam have received substantial support for seed sector development but they are now evolving in their own way.

Seed sector development is strongly influenced by the predominant agro-ecology and crop portfolio of the country. The availability of hybrid varieties, notably in maize, cotton and many vegetables, provides commercial opportunities that stimulate rapid development of the private sector whereas rice, wheat and legumes are much less attractive for the private sector. For this reason, and other technical considerations, the seed industry is strongly segmented into different crop groups and these require different treatment in terms of government intervention and regulation.

There is also wide variation in the extent to which countries participate in the regional and global trade. Those in the most-developed group are actively involved in export and/or import, depending on their comparative advantage for production and their domestic seed requirements. In these countries, the strong research base, mostly in the private sector, is able to create new proprietary products that may find markets regionally or worldwide. The Access to Seeds Index study confirmed that this drives the seed trade in the region and also accounts for the attendance of over 1 200 participants at the Asian Seed Congress each year, mostly for the purpose of conducting business.

Countries in the less-developed group are generally self-sufficient in seed of staple crops but rely on imports for much of their vegetable seed requirements and other proprietary varieties because they lack a domestic research base and/or production capacity. It is very difficult for countries to change their market position because the substantial investment required now inhibits "new entrants". Moreover, there are very few examples of public sector varieties entering the world trade because the owners (mostly the national agricultural research systems) lack marketing experience even if they have a good product.

Despite this wide range of seed industry development within the region, the shift of emphasis from the public to private sector can be observed in almost every country. This applies to plant breeding, seed production, and even in some aspects of regulation, and is occurring globally, not just in Asia. For a variety of reasons, governments are doing less and the private sector is doing more, and the issues arising from this transition are a major theme in this study. All stakeholders would claim a shared goal of improving seed supplies to farmers but opinions may differ on how to reach this goal.

5.2 Status of seed legislation

Most countries in the study have a seed law or similar regulatory arrangements, except Malaysia, which is currently preparing a Seed Quality Act, and Lao People's Democratic Republic, which has no legislation of this kind yet.¹³ These are special, but very different, cases as noted in the preceding section. Australia does not have a seed law as such but there is a framework of standards and procedures managed by a devolved authority set up to regulate the industry by agreement between the key parties. The origins and operation of this unique system are summarized in Box 1. This can be considered an example of regulatory evolution in which the government has withdrawn completely from both direct involvement and financial support, leaving the industry players to manage the system. Although this came into existence as a result of financial constraints and policy changes, it has worked well for a mature seed industry in which all parties have similar standards of conduct. New Zealand has a somewhat similar arrangement, although with a different institutional structure.

All other 21 countries have a conventional law that covers the main components of the seed sector, although with some variations in content. This may be the original law that is still in force, an amendment of that law using the same general structure, or a completely new law. The core purpose of this legislation is to establish quality standards for seed that is offered for sale and thus provide "consumer protection".

It is noted that the legal department of FAO (LEGN) maintains a list of all documents it has received from member countries, with links to a soft copy of the original. This large resource (known as FAOLEX) includes references to legislation related to seeds and varieties.

Although minimum standards of seed quality are generally used, some countries may allow the alternative "truthful labelling" concept under which the seller can declare quality attributes on the seed container, although this does introduce greater risks. In a few countries, plant variety protection (PVP) has been included in the seed law, although as a form intellectual property, this is a fundamentally different type of legislation. In the Republic of Korea, the original 1997 Seed Act included PVP but this was separated by the passing of two new Acts in 2013. Section 5.4 provides more information on PVP legislation

¹³ In Malaysia, the Seed Quality Bill (a draft Act) is under active discussion in the ministry and should be passed within a year or so, depending on the parliamentary schedule. According to the title, we understand that it focuses mostly on quality issues rather than other components of the seed industry.

We understand that a seed law is currently being prepared in Lao People's Democratic Republic.

in the region. On the other hand, China has absorbed some of its PVP legislation into the revised version of the Seed Law

Box 1. Australia – A case of self-regulation by the seed industry

Australia has a federal system of governance, and responsibility for agriculture rests with the six states. Historically, each state had its own seed legislation and provided services such as seed testing and certification. Funding pressures gradually put these services under threat and an alternative solution was sought that would satisfy all concerned parties, particularly in providing access to Organisation for Economic Cooperation and Development (OECD) certification for exporting seed, but without financial support from public funds.

After intensive consultation among all concerned parties, the Australian Seed Authority (ASA) was established in 2003 as an independent self-funding body, owned and run by the industry on behalf of its members. It has a constitution and operates under a license from the government that is renewed every five years, subject to performance reviews. ASA is managed by a board of directors, through a chief executive officer and an assistant executive officer.

Routine operations of seed certification and the testing of varieties and seeds are provided by (currently) three agencies, under contracts with ASA. Certification service providers may be either the states or private companies, and they are paid by the users who are mostly seed companies or growers. As part of their contract with ASA, these certification service providers are required to maintain accreditation with a third party accreditation agency. ASA is the National Designated Authority for the OECD Schemes and the Designated Authority for the International Seed Testing Association. It has no direct involvement in plant breeders rights or phytosanitary matters, which are handled by other government agencies at the national level.

At the request of the industry, ASA has developed a range of standards and procedures to support the seed industry, including seed certification and quality standards, criteria for variety registration, a national variety list and various technical manuals. The ASA board receives advice on these standards and procedures from its technical advisory committee, made up of certification service providers and representatives of the seed industry. These standards can be revised and updated as necessary through consultation within the seed industry, driven by the technical advisory committee, but must always take account of international obligations because Australia is a significant producer for the global seed trade.

The strength of this system is that it is focused on the needs of the industry and makes no demands on government funding. Regular reviews conducted by the national Government show that ASA enjoys strong support from all key stakeholders.

5.3 Revision of legislation

The seed sector has developed rapidly in the past 20 years as the private sector has become much more active, particularly in vegetables and hybrid field crops. The number

of companies involved, and the number of varieties available, has increased dramatically, leading to stronger competition both in breeding and in the market place. Whereas the public sector was once the main provider, it has been eclipsed in those crops that have strong commercial potential. Likewise, the regulatory system that was established to deal with a trickle of varieties from the national agricultural research system is now confronted with a steady stream from companies, both domestic and foreign. This presents a challenge for regulators who, on the one hand wish to retain some control of the market and prevent malpractice, but on the other hand have limited resources at their disposal for this expanding task. It is for this reason that many countries in the region have decided to update their regulatory frameworks. Some have completed this process, some are doing it now, while others are still using old laws that are no longer suitable for the present trading environment, and this creates problems for the private sector as explained in Box 2 for the case of Nepal.

Box 2. Nepal – A case of overregulation

In Nepal, much of the seed available to farmers is of unregistered varieties, and much of it is reported to be of low quality. The porous border with India makes it difficult to control seed imports and there have been examples in the past where poor quality seed was distributed to farmers who then protested with the Ministry of Agriculture. To address this problem, the ministry has instructed public sector organizations – the Seed Quality Control Centre (SQCC) and the National Agricultural Research Council (NARC) – to control more tightly the quality of seed in the market.

As a result, NARC is the sole organization in the country authorized to develop and release crop varieties, it is also the sole producer of breeder seed, and it is the only organization allowed to conduct variety verification trials necessary to register a new variety. The national system produces one or two new vegetable varieties per year and has so far developed and released just one hybrid tomato variety, and one hybrid maize variety. This contrasts markedly with the number of varieties available in other countries and seriously limits farmers' choice. Moreover, there is evidence of illegal importation and the sale of seeds with incorrect variety names.

Nepal is an example of an overregulated seed system in which the public sector retains its mandate to do research and develop new varieties, while the role of the private sector is to multiply seed and sell to farmers. This has given the public sector a virtual monopoly over variety development, testing and release, but it lacks capacity to do this effectively and it has reduced the incentive for the private seed sector to invest in new varieties. Relaxation of requirements for variety release or registration and delegation of responsibilities to the private sector — especially regarding variety development and testing — is likely to increase regulatory compliance and stimulate private sector investment in the seed sector.

Some other factors prompt a review of legislation. For example, the emergence of fake seed as a deliberate criminal activity is a serious threat to farmers and to the legitimate seed industry. It demands much stronger penalties than would be applied for simply selling substandard seed.

China is an interesting case in that the first seed law passed in 2000 was substantially revised in 2015 to reflect changes in the structure of the industry (details are shown in Box 3). The Philippines is currently revising its law that was passed in 1992 while Bangladesh is reviewing all regulatory instruments relating to the seed sector and passed a new Seed Act in 2018.

In India, the original Seeds Act (1966) was updated with new regulations a few times but is in need of more substantial revision. A new draft of the Seeds Act (a Bill) was prepared in 2004 and was actively discussed at that time but it then slipped off the agenda of legislators and has remained in the background ever since. However, this does not seem to have been a major impediment to the continuing growth of the seed industry in India. Other countries in South Asia also suffer from slow regulatory processes; for example, in Nepal, regulations to implement the 1998 Act were only passed in 2013, while in Sri Lanka no regulations have yet been made under the 2003 Act. Pakistan amended its 1976 Law in 2015 but we understand that the effect of this was to extend regulation rather than to introduce flexibility.

Box 3. China – A case of devolution of government control

Under the previous centrally planned economy there were state-owned seed companies in every county, region and province, said to be about 2 700 in total. The first Seed Law passed in 2000 was intended to reflect the ongoing transition to a more competitive market-based system. A rapid development of the domestic seed industry occurred and foreign companies entered the market but there was still a significant level of control.

With continued development of the seed industry, both the government and companies considered it necessary to revise this law, which was done in 2015. The main changes made include:

- a reduction in the number of crops that have to be registered nationally –from 28 to 5, namely wheat, rice, maize, soybean and cotton;
- the devolution of responsibilities to stakeholders but more severe penalties for misconduct;
- simplified procedures for moving varieties between regions;
- simplification of the certificates required by seed companies; and
- a greater focus on labelling and post-control.

There is a provision for seed certification but this is not widely used in practice. Some aspects of the existing plant variety protection regulations were absorbed into this law. The law also contains some policy guidelines intended to support seed industry development.

The responsible body for seeds at national level is the Seed Management Bureau, while enforcement is done mostly by Seed Management Stations at the county level. Likewise, companies can be registered at the national, provincial or region and/or county level, depending on the scale and complexity of their operations.

The key lesson is that the government saw the need to revise the original law after just 15 years in order to reflect changing circumstances in the industry. In so doing, it reduced the intensity of control and devolved some of the responsibility.

5.4 Status of variety protection legislation

Plant variety protection (PVP), also referred to as plant breeders rights, entered into the legislative arena in 1961 when the first UPOV Convention came into effect. Since that time, the convention has been revised three times: in 1972, 1978 and 1991. Countries may join UPOV if they have a national PVP law that is substantially in conformity with the requirements of the 1991 Convention.¹⁴

As of December 2018, eight countries in the region are members of UPOV as listed below and with their year of accession shown in brackets: Australia (1980), China (1999), Japan

¹⁴ Comprehensive information about UPOV can be found on their website at www.upov.int.

(1982), Kyrgyzstan (2000), the Republic of Korea (2002), New Zealand (1981), Singapore (2004) and Viet Nam (2006). Myanmar and Brunei Darussalam have both prepared draft PVP laws that are currently under review by the UPOV Council, the governing body. A further eight countries have PVP legislation that does not meet the requirements of the convention, or have not applied to join, these are Afghanistan, Cambodia, India, Indonesia, Malaysia, Pakistan, the Philippines and Thailand. In general, the lack of compliance relates to the scale and interpretation of the exemption given to farmers who wish to save seed of a protected variety. This is a fundamental issue for UPOV because large-scale seed saving may lead to unofficial trade in protected varieties without any payment of royalties.

Countries that have a UPOV-compliant law also have a reasonably effective mechanism for enforcement of rights that meets breeders' expectations for protection, otherwise the system has no value for them. It is not known how well PVP works in the countries that are outside UPOV and it would be interesting to make a comparative study of that. In India, the PVP law (2001) specifically incorporates farmers' rights, which is a more complex concept to implement and would be an interesting subject to study. The PVP law is used by companies in Indonesia for their non-hybrid vegetable varieties, and apparently with a warning stated on the packet.

5.5 The need for regulation

There is still a general acceptance that seeds and varieties *do* need some form of regulation because of the special nature of the product and the serious consequences for farmers if seeds do not grow, or if the variety is not as expected. As noted in Section 2.1, seeds were one of the first items to benefit from consumer protection. Certification schemes were introduced to provide additional reassurance for farmers through the label but they are used mostly for the main cereal crops and very little in the vegetable seed trade.

The questionnaires confirmed that in most countries, except those in the most-developed group, regulatory agencies need more resources to do their work properly. However, the enforcement of seed quality by random spot-check sampling in companies or sales outlets can never be fully effective. Moreover, there may be a risk of malpractice if relatively low-paid officials have considerable authority when carrying out enforcement activities in commercial companies. The challenge for regulatory agencies is to allocate their resources in the most efficient way. This can be achieved by transferring more responsibility to the producer or supplier and making more use of all available information from other sources to avoid duplication of effort and save time.

5.5.1 The role of self-regulation

Regardless of regulatory requirements, all responsible companies have quality assurance systems to protect their reputation. In practice they often have internal standards that are above the minimum legal requirement; this is emphasized in their literature and is represented by their brand image and logo. This approach is an essential element in modern marketing and almost all commercial seed is now sold under a brand name, which probably carries equal weight with farmers as an official certification label.

Companies with their own proprietary varieties are concerned about maintaining control of these, preferably by using hybrid technologies whenever these are available, thus generating regular income to support their investment. In non-hybrid crops, and even if no PVP system is available, conventional registration of varieties should confer some degree of protection to the original producer or owner by linking the variety explicitly to the breeding company in the national variety list.

With the widespread use of smart phones, modern technologies can also play a role in protecting purchasers and companies through the use of “scratch numbers” and QR codes on packages that can link the buyer to a process of verification. There is scope for sharing and improving these mechanisms among stakeholders.

5.5.2 Costs of regulation

Regulation incurs a cost and it is assumed that the benefits outweigh these costs. When the government was the main player in the seed sector, the provision of regulatory services was part of the official budget and the cost was not considered in detail. Even if charges were applied, they were small and the revenue usually went back to the government, rather than enabling the agency to maintain some funds and become partially self-financing. The results of this study show that in most countries the charges made for certification do not make a major contribution to running costs. In principle, the emergence of a more commercial seed industry enables costs to be shared with seed companies who can also take on some of the work in house and under official supervision. This can be applied through the licensing of company laboratories and the conduct of variety trials under agreed protocols.

With the much larger number of varieties coming to the market, particularly in vegetable crops, it is unrealistic for the government to undertake all this work, often with limited resources. The likely consequence of this is a slow congested system that may lead companies to bypass the official system and market directly. If this unofficial trade becomes normalized, it may encourage unscrupulous traders to exploit the system with poor quality seed and unknown varieties. The study showed that countries with uncontrolled land borders all experience this problem to a significant extent.

5.5.3 Regulation and information

Regulation is normally perceived as a control activity arising from laws and that is the starting point for this study. However information gathered for regulatory purposes, particularly with regard to variety registration, can have practical value to farmers. Most countries indicated that their national variety list is available online but it is not known if this is really a resource that farmers and extension workers can access and search. Given the prevalence of smart phones, there would be a possibility for companies or breeders to enter essential information about a variety on a standard form for each crop and for this to be uploaded to a website. Moreover, for vegetable crops this could become the means of registration on payment of a fee and there could be a requirement for the company to grow demonstrations of the variety at specified locations. This approach would greatly reduce the pressure on the official testing system, allowing them to maintain the website in good order and carry out monitoring visits. Implementing a

system of public comparative trials (e.g. at field days) and publishing data from them would further enhance compliance and encourage reputable companies to participate.

5.6 Overview of seed policies

The concept of a national seed policy is relatively new. India was probably the first country in the region to take this step (in 1989) and this initiated dramatic changes in the seed industry that have benefited agriculture and the economy, as India is now a significant exporter. The policy was revised and updated in 2002 to take account of subsequent developments. Bangladesh and Sri Lanka prepared policies in 1990 and 1997, respectively. More recently, FAO assisted several countries with developing a seed policy, including Afghanistan (2012), Myanmar (2015), Cambodia (2017) and Lao People's Democratic Republic (2017). These documents generally set out a medium or long-term vision for the development of the seed sector and may be considered as rather "theoretical". Governments may, therefore, feel the need to prepare a strategy or action plan to facilitate monitoring of the policy, typically done by an apex body such as a national seed council.

Given the experience in formulating seed policies in this region and elsewhere, it could be timely for FAO to review the use and impact of these documents within national systems. The last such meeting was held in 2011. Because policies by definition embrace all aspects of the seed sector, this would also provide an opportunity to review the overall status of seed programmes and industries at a time when there is renewed focus on this subject.

5.7 Enabling a public-private sector dialogue

When national seed programmes were essentially a public sector activity, the ministry could follow any course of action that it felt necessary without the need for consultation. Policy changes could be made according to political, economic or social priorities as perceived at the time, sometimes with short-term objectives. With the emergence of diverse seed industries in most countries, it is necessary to have greater consistency in decision-making in order to gain and retain the confidence of entrepreneurs and investors. This is especially important for investment in research and development, which has a planning horizon of at least ten years.

There should be a forum for consultation between the public and private sectors and for this dialogue to work effectively, there must be representatives with experience and authority on both sides. From the government side there should ideally be a focal point within the ministry that handles all matters related to seeds and has a broad view across the whole sector, not only for quality control. This could be a seed secretariat or "seed wing" as in Bangladesh. From the industry side there should be a strong representative association that is able to speak with a unified voice on behalf of its members. In the past, the government side was often heavily weighted in favor of scientific institutes that had little involvement in seeds. It would be better to represent a broader range of interests, for example representing rural business and finance.

Having a forum for consultation can play a vital role in building trust between the public and private sectors. In the past there were often stereotypic perceptions on both sides;

the private sector being seen as being only concerned to make money and the public sector as being obstructive and out of touch with reality. In this climate it is difficult to make progress.

5.8 The prospects for regulatory harmonization

Harmonization of regulations to support the movement of seeds within defined geographical regions has been under discussion for many years but progress has been slow. The European Union (EU) provides a positive experience but it is a special case because legislation is harmonized across many different areas of government. Moreover, from a small nucleus of six original member countries, the EU has gradually expanded to 28 and all new members must accept existing regulations as a condition of joining.

Experience in Africa, even among closely related countries with similar agro-ecologies, has not been encouraging, despite many years of discussion. Even when there has been agreement at a political level, problems may still arise at the physical borders and that can be very harmful to seed consignments in transit. The countries of Central Asia that were members of the former Soviet Union would also benefit from harmonization and that was a motivation for the Regional Seed Agreement and Strategy described in Section 4.3.2 The situation in Asia will be more complicated as a result of the diverse political and legal traditions, and the lack of a common language.

The two main targets of harmonization are in minimum standards of quality for seed lots and the acceptance of a common list of varieties. These can be brought together in the concept of a regional certification scheme with agreed standards and procedures for a range of crops. A uniform labelling format would then enable seed containers carrying the required label to pass freely. However, a fundamental principle of such free movement is that the standards applied in each participating country are the same. In other words, the regulators in country A must be confident that tests carried in country B are of equal rigor to their own. If there is variation between countries in that respect, either real or suspected, then confidence in the system may be quickly lost. The ISTA Orange International Certificate and the OECD seed certification schemes are both designed to assist international trade and they depend absolutely on maintaining this confidence in the procedures used by all participating countries.

The variation in procedures for variety testing shown in this study emphasize the problems that would be faced in trying to establish a regional scheme. In addition, the slow legal process observed in some countries would apply to the changes in domestic law that would be required to bring the scheme into existence. This could lead to a patchy adoption and implementation. In practice, it would require agreement at governmental level to drive this process forward and that would imply the involvement of the regional associations already mentioned in Section 4.3. As noted in that section, the SAARC Agriculture Centre has been quite active in seed issues, while ASEAN has not.

Despite this negative prognosis, there are measures that can and should be taken to facilitate trade and these are among the issues addressed in this study, particularly with regard to variety testing and registration. They include:

- reducing the period of testing for a variety that is already registered and/or in common use in another country with similar environments;
- allowing information from other countries with similar agro-ecology to be submitted to the registration authority as evidence of commercial use and agronomic performance;
- requiring the importer of a new variety to grow one or more trials to demonstrate performance and for these trials to be available for official inspection; and
- providing a system of online registration of varieties (with some key information) that can be used by the importer on payment of a small fee.

These are all changes in procedures that might be accepted without the need for major amendment of national seed regulations.

Minimum seed quality standards for the major crops are similar across many countries and it would be an interesting exercise to collect and compare these, to see how much (or little) variation actually exists. However, most vegetable seed is now moved and sold in sealed containers that protect seed quality and the standards imposed by companies are generally well above the legal minimum.

Although most of the international trade is in vegetable seeds moved in small quantities, a different situation may prevail with cereal and legume seeds. These may sometimes be transported in bulk across land borders to solve local shortages in areas with similar environments, or simply as a commercial sale. Where this kind of trade is foreseen by neighboring countries, it is possible to make a bilateral agreement for specific crops varieties between the respective administrations. The International Rice Research Institute's Seeds Without Borders initiative – pioneered by Bangladesh, India and Nepal – is a positive step on this road and it was apparently adopted within the existing regulatory framework of the participating countries. There may be useful lessons to learn from this experience, depending on the extent to which it is being used in practice.

To summarize, true harmonization will be impossible to achieve across this diverse region but a convergence of standards and procedures would be beneficial, and a more realistic goal. If sharp differences between regulatory regimes occur at land borders, it is likely that an illegal trade will develop and that can pose a much greater risk to farmers than a regulated trade to which all parties willingly subscribe. The guiding principle should be that regulations are framed in a way that encourages the players in the market to lean towards compliance rather than seeking evasive routes around the system.

5.9 Role of national seed associations

As already noted, national seed associations play a key role in representing the private sector in discussions with the ministry. Ideally there should be one such association that can speak with a single voice but in some countries (e.g. India and Indonesia) different perspectives and priorities may lead to there being more than one, although hopefully without major disagreements between them. The establishment of a national association is an indicator of maturity because it recognizes that there is a shared interest in developing the market, even though companies are in strong competition for business. It

is fundamental to the success and sustainability of a seed association that it is supported financially by its members who see the benefit of the services provided. This requires a critical mass of committed companies to provide sufficient finance to employ a member of staff.

National seed associations can play a valuable supporting role in regulation if they expect all members to follow an agreed code of conduct, and with the sanction that those who default will be investigated and face sanctions. This creates a climate in which reputable companies wish to stand up for good practice and that in turn increases their credibility in negotiations with government. Pakistan has experience in this respect because of the very large number of seed companies that are registered, while only a small proportion of these are regular suppliers or have any technical capability.

5.10 Licensing of public sector varieties

Much of the discussion in this report has focused on the special issues that arise from the expanding trade in vegetable seeds and hybrid varieties coming from the private sector. However, unless there is a strong PVP system, public sector breeding programmes still provide the majority of the varieties in the non-hybrid crops that are the staple food crops in most countries of the region. This raises the question of how these varieties are transferred to the private sector, which is the preferred channel for multiplication and marketing. This can be done in different ways, for example by the straight purchase of early generation seed by companies or by offering licenses for a company to take over responsibility for the variety and exploit its commercial potential. This is a quite sophisticated area of business in which public research institutes may lack experience but it is important that their varieties are exploited quickly and effectively. Moreover, there should, if possible, be a financial return to the breeding institute to support their work and incentivize breeders. The responses in the questionnaires indicate that although such arrangements do exist, they are not always effective and do not generate much income. This is another topic that would benefit from the sharing of experience, both within the region and from other parts of the world where variety licensing has been practiced for many years.

6 RECOMMENDATIONS

1. With the growth of the regional trade in vegetable seeds and hybrid crops, it is essential that regulations are adjusted to reflect the characteristics of these crops and how they differ from cereals and other field crops, for which most national regulations were originally designed. The rapid turnover of vegetable varieties means that in a slow testing system, farmers may never have the latest varieties, unless they are obtained through unofficial channels.
2. Specifically, any requirement for VCU testing of vegetable varieties places an immense burden on testing authorities and is of doubtful value due to the many assessment criteria that may be required. Information of this kind would be better obtained from agronomic validation trials conducted by the breeder or importer.
3. Emphasis on enforcement and over-regulation may be counterproductive because it may lead suppliers to use unofficial supply channels and that introduces other

- risks. It is better if the regulations encourage companies to lean towards compliance.
4. To achieve harmony between all parties, it is essential that there is an established forum for regular consultation between all stakeholders in the public and private sectors. In some countries there is a tendency for these arrangement to lapse over time but both parties should ensure that they are maintained and function effectively. On the ministry side there should be single office or secretariat responsible for seeds and with expertise in all aspects of the subject, including development in new technologies.
 5. On the private sector side, there should be a strong national seed association that can speak with authority for its members and likewise expects them to maintain good standards of conduct in their businesses. It is an absolute priority for national associations to develop a culture of professionalism in the seed industry and to isolate those who engage in opportunistic trading for short-term gain. APSA could share the experience of its member associations to collect examples of good practice.
 6. Modern communication technologies should be used wherever possible to facilitate and strengthen regulation at moderate cost. One example is the use of security codes on seed packages to confirm their origin and contents. Another example is enabling national variety lists to be searched online for information. These initiatives will require collaboration between regulators and companies but will benefit both parties. This is another topic in which the sharing of experience within the region would be helpful.
 7. Although regional harmonization of regulations will be very difficult for many reasons, opportunities for bilateral and subregional agreements should be investigated and pursued wherever possible. This applies particularly to the mutual recognition of variety lists between countries that share a common agro-ecology. This will reduce the amount of testing required, accelerate access to innovations and facilitate trade. It should also reduce the scope for illegal traffic. In the short to medium term, convergence of standards and procedures is a more realistic goal.
 8. A national seed policy can be a useful tool for managing the development of the seed sector, especially during a time of rapid change. Consistent policies are essential to provide confidence for investment both in research and production capacity. FAO has supported the development of a seed policy in several countries in Asia and the Pacific, and elsewhere, and it may be useful to review how well they have worked in practice.
 9. For the many crops in which the public sector is the main source of varieties, it is important to find the most effective means to transfer materials and to ensure their rapid commercialization. At the same time, the implementation of effective PVP systems will encourage private investment in non-hybrid crops of all kinds. It would be useful to know how effective national PVP systems are across the region, both for preventing piracy and for generating revenue to breeders. Here again the sharing of experiences would benefit all parties.
 10. Despite the rapid development of the commercial sector in the more profitable crops, especially hybrids, the informal sector remains the default source of seed for self-pollinating cereals, legumes and oilseeds, in which the private sector has little interest. Legislation and policies should recognize the role of the informal sector

and should not alienate traditional seed supply channels, rather they should be linked to the formal system to improve the flow of varieties and the availability of quality seed.

11. It is clear that progress on many of these key issues in the seed sector, both regulatory and commercial, will depend on a better understanding between the public and private sectors. Collaboration between FAO and APSA, each with their own spheres of influence, may be very productive in promoting this dialogue and in helping to share experience at the regional level.

REFERENCES

- Access to Seeds Index.** 2019a. *Access to Seeds Index 2019 South and Southeast Asia*. (also available at www.accesstoseeds.org/index/south-southeast-asia/).
- Access to Seeds Index.** 2019b. *Access to Seeds Index 2019 Global Seed Companies*. (also available at www.accesstoseeds.org/index/global-seed-companies/).
- FAO.** 2015. *Voluntary Guide for National Seed Policy Formulation*. Rome. 60 pp. (also available at www.fao.org/3/a-i4916e.pdf).
- Huda, M.N. and Saiyed, I.M., eds.** 2011. *Quality seed in SAARC countries: production, processing, legal and quality control and marketing system*. Dhaka, SAARC Agriculture Centre.
- Saiyed, I.M., ed.** 2012. *SAARC Seed Outlook*. Dhaka, SAARC Agriculture Centre. 152 pp.
- World Bank Group.** 2017. *Enabling the Business of Agriculture 2017*. Washington, D.C. 270 pp. (also available at <http://pubdocs.worldbank.org/en/929581534213514304/EBA17-Full-Report17.pdf>).

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