

ENABLING ENVIRONMENT

Katrin Kuhlmann

1 – Introduction

In every country, laws, regulations and policies determine how fast a seed system can evolve; it is difficult to overemphasize how important the enabling environment is for scaling a seed system. It can be a critical factor that helps or hinders in achieving scale. The objective of this *Planning for Scale* brief is to examine the legal and regulatory system and its elements in the context of how to get better seed varieties to smallholder farmers. Available experience, data, and literature are noted, where possible, and context for further examination and deeper analysis is highlighted. Not only are the particular aspects of the legal and regulatory environment relevant to the discussion on scale, but the way in which legal and regulatory change is approached makes a difference as well.

The discussion below is not intended to provide recommendations for policy reform; this exists in abundance in other literature. Instead it is focused on the practical issues that directly pertain to scale. These include the roles of government in establishing and implementing appropriate laws and regulations (or changing laws and regulations where needed); promoting the public good and helping to leverage investment; and building institutions with adequate capacity and flexibility to work through laws and regulations, to create better functioning markets for seed. While the discussion is not prescriptive, it is comprehensive, since both the details of each element of the enabling environment, as well as the broader legal and regulatory system, are factors to consider in working towards scale.

Governments are not only seeking to identify those aspects of the enabling environment that need improvement, they also want and need strategies for how to work in the face of chronic underfunding, aging infrastructure, and limited resources. This requires thinking through each aspect of laws and regulations along the seed value chain, from breeding, to logistics, to adoption by the farmer; as well as understanding the bigger systems that surround these value chains, such as access to finance and larger markets.

A focus on implementation

The structure of laws and regulations are discussed throughout this brief, but their *implementation* is equally critical in determining whether smallholder

farmers have access to improved varieties of high-quality seed. The impact of good laws and regulations is often only as good as the ability of individuals and institutions to implement them on the ground. Implementation issues are often missed in discussions about improving the enabling environment, but they deserve particular focus. Several aspects of implementing legal and regulatory systems are woven throughout the discussion, and are summarized below.

Laws and regulations are not static. Building an enabling environment in which seed systems can reach scale involves a better understanding of how the needs of the market and the legal and regulatory structures that frame them interact over time. From this perspective, legal and regulatory change is partly about getting the language of the laws and regulations right and, importantly, also about developing a workable, living process. This process of developing a system around implementing laws and regulations works best when it is done as a true collaboration between public and private sectors.

The process for implementing laws and regulations requires complex tradeoffs related to:

- Using laws and regulations to act as incentives or catalysts to make something new happen (e.g. structuring regulations to encourage a type of activity and using tax incentives to encourage investment)
- Determining which services are needed and which a government will provide, and putting in place a system to deliver these services at scale (e.g. reducing the wait time for registration or plant variety protection)¹
- Contracting out or engaging private operators for some services (e.g. privately run or public-private laboratories)
- Maintaining standards but shifting enforcement strategies (e.g. truth-in-labeling)
- Developing and supporting a regulatory framework that reduces barriers, along with a more flexible process to work through questions as they arise (e.g. facilitating cross-border trade and streamlining application of standards)

In the implementation of the enabling environment for scaling seed systems, all five of these tradeoffs can arise, sometimes individually and sometimes in combination. How overarching seed legislation is structured will reflect a number of these elements, as governments determine how detailed the framework law should be, and how regulation can be used to work through

¹ These services are not always compulsory and may be provided on-demand.

particular aspects of the system. These five tradeoffs manifest themselves in different ways and will be interwoven throughout this brief, but a brief discussion of several aspects is warranted before discussing particular legal and regulatory issues.

Implementation tradeoffs in enforcement strategies for standards. The tradeoff between standards and the most effective enforcement strategy is a common challenge in implementing laws and regulations. Many governments maintain an extensive process for quality control and inspection before market activity can take place (many African countries follow this model) rather than less onerous ways of ensuring compliance, such as spot checks. Quality declared seed (QDS) and truth-in-labeling, discussed below, are also examples of how this tradeoff plays out, with standards in place but a shift in enforcement from *ex ante* to *ex post*, with a different degree of expense and burden incurred. This approach may be more scalable than current seed quality regulations in many instances.

Implementation tradeoffs in flexibility. The last tradeoff above is one of the most common in implementing laws and regulations, and involves actually reducing barriers in the market while building a process that allows regulators to work through problems as they arise. This becomes very important when the system has to serve highly heterogeneous users. Examples can be seen throughout the variety release process. Many authors have argued that a commonly implemented standard of performance cannot accurately reflect the value that different farmers gain from a variety of seed. First, agro-ecological conditions are diverse and differ from the average sites used in performance testing. This means that the reported standard of performance may be very different than farmers' experiences when the seed is grown in their fields. Second, farmers and the end markets they serve may place very different values on particular traits. Selecting varieties for release based only on yield performance may fail to account for the value markets place on storage properties, maturity, taste, and a host of other farmer and end-user desired attributes.

One model does not fit all

It is also important to consider that globally there are different approaches to setting up an enabling environment for seeds that have developed over time and in response to very specific aspects of market development. The United States and some other countries, including India, have established fairly open systems for regulating seed, based on the assumption that the market will demand and deliver quality. Europe, on the other hand, has developed a more strictly regulated system to encourage development of its industries based on both public and consumer needs. Sub-Saharan African countries are sometimes caught between these systems, and individual countries must determine the measures and practices that will best meet

their own needs. Yet, as in any legal and regulatory system, overregulating can sometimes create as many difficulties as not regulating enough. This is a balance that every country must strike on its own, and the challenge continues as regions seek to harmonize regulations. Harmonization can help to create more efficient markets and economies of scale in the long run, and is possible across borders, and even with highly heterogeneous users. As such, the regional elements of seed markets will be a focus in the discussion below.

The enabling environment has some homogeneous qualities, but application varies even within particular aspects of a system. Efficiency, clarity, and predictability in the design and implementation of laws and regulations are important attributes throughout the enabling environment if scale is an objective. Some flexibility in structures is also needed to make necessary changes and respond to stakeholders as laws and regulations are developed and applied. The successes and possible approaches discussed here are presented with explicit recognition of the heterogeneity across and within countries. As is true throughout this work, this brief provides a framework through which scale can be considered, but it does not attempt to prescribe one-size-fits-all solutions.

A note on data and metrics

Throughout the areas discussed below, a need for stronger metrics and data is highlighted, particularly with respect to measuring how laws and regulations are being implemented. Often metrics indicate whether laws or regulations are on the books (for example, the existence of a national seed policy or legislation), or whether infrastructure exists (for example, the number of seed-testing laboratories), but these measures do not adequately track progress toward an enabling environment that supports scale (Larinde, 2009). As noted above, the existence of legislation or seed-testing labs is a necessary step, but this alone does not indicate whether the demands of a growing seed industry are being met. Furthermore, differences in the ways seed laws are structured, or supporting infrastructure designed, can impact scale, and this type of nuance is not always noted.

The World Bank's Agribusiness Indicators in Africa project is making strides in metrics to track how well systems function, which is an important aspect of implementation. For example, one metric measures, on a scale of 0–5, how easy it is for the private seed sector to participate in the seed market; while another measures the how long it takes to register, test and obtain approval for both domestically bred and imported seed (World Bank, 2012). These metrics can shed light on costs (both to the national budget as well as to the users of the system) and can help identify priorities. However, there are many more potential metrics to evaluate, and many aspects of effective, transparent, and reliable implementation processes have yet to be fully captured. Tripp (1998) cites a now-dated report on the efficiency of Malawi's

seed system (Cromwell and Zambezi, 1993), noting that field inspections by the Seed Services staff account for 20,000 km of travel annually. A good 'enabling environment for scale' index might build on these metrics and include other measures of how effectively, clearly, and predictably laws and regulations are being applied.

2 – System-wide issues

Several aspects of law and regulation – including those related to establishing a business-friendly market environment, restrictions on investment, and input subsidies – are cross-cutting and relate to all of the more specific legal and regulatory issues that follow. Regional and international trade rules, while discussed in greater detail at the end of this chapter, are also relevant in a number of contexts and are presented briefly below.

Ensuring a business-friendly market environment

Getting improved varieties of seed to more smallholder farmers involves a wide range of activities and actors. In relation to seed and other inputs, including fertilizer, the ease with which new players can enter the market, for example smaller traders and retail dealers, is important (Gisselquist and Van Der Meer, 2001). While legal and regulatory systems often include a number of requirements related to who can enter the market and to what degree services and inputs are available, these measures can have the effect of reducing certainty and limiting the development of seed systems, rather than increasing quality and control.

Legal and regulatory measures can include licenses for particular types of business activity along the value chain, and registration requirements, including for those operating as a producer, seller, importer, or exporter. In some cases, different ministries may impose requirements aimed essentially at achieving the same goal, each time with different fees and procedures attached. Design and administration of a system for market entry will include decisions on the number and type of licenses required, the process for obtaining licenses, and whether licenses are automatic (or nearly so). Many of these requirements are enshrined in law and regulation, and solutions that support scale can involve changes in how these requirements are administered, including better legal and regulatory approaches, stronger institutions, and even technological solutions, sometimes in combination.

Norway's experience in streamlining business regulation is one example of how such requirements can be streamlined. Prior to reform, Norway had a decentralized process for business registration carried out by 97 district courts. In 1988, a centralized and computerized business registry was established outside of the responsibility of the courts. The registry was placed in

the same location as the two existing national registries (property and company accounts) to increase coordination. Reform led to a decrease in the average time to register a business (from as long as 1 year down to 4 weeks), an increase in productivity (4.6 to 6.6 cases processed per hour), and increased compliance (in 1980, 56% of businesses filed a company account, as compared to 97% in 2009) (World Bank, 2011).

Rwanda's experience in streamlining business registration provides another example. Before 2009, business registration was decentralized and required physical documentation. In 2009, Rwanda established an electronic single window system for business registration, reducing the average number of interactions required to register a business from 9 to 2, decreasing the average time for the process from 18 to 3 days, and reducing the average cost from 235% to 4% of income per capita (World Bank, 2013).

In addition to the ease of market entry, multiple requirements also affect competition in the market, whether in production, processing, or related services. Farmers need access to equipment suppliers for both small items (moisture meters, probes, pollination bags, packaging) and large items (processing machinery, cold storage solutions, cost-effective irrigation solutions, seed harvesting mechanization). Inputs like fertilizer, pesticides, machinery, and irrigation, tend to be heavily regulated. Predictability and clarity in regulation, and the allocation process for these inputs, can be particularly important, so that businesses know whether and when they can access the inputs they need.

In addition, a host of services in finance, information and communications technology (ICT), transport, and distribution (including wholesale and retail services) are also needed for well-functioning seed systems, yet laws and regulation can prevent these services from emerging in the market. In some cases, the way services networks are constituted, which may be expressly provided for in regulation, can impact how the market develops. For example, because inputs like fertilizer have historically been distributed by parastatals, input dealer networks have been slow to develop, making it more difficult and costly to get fertilizer into the hands of farmers. Building input dealer networks, such as the network that the Alliance for a Green Revolution in Africa (AGRA), together with International Fertilizer Development Center, and Citizens Network for Foreign Affairs, have successfully helped develop in Ghana, can be a significant contribution to achieving scale, and a more sustainable alternative than subsidies, discussed below (Byerlee et al., 2013).

Restrictions on investment

Scaling seed systems depends upon the investment of capital up and down the length of the seed value chain. There are a number of challenging aspects related to agricultural finance, however, which are discussed in the

section below. Consider, for example, issues around land ownership and use. When small farmers find it difficult to hold legal title to land they may be denied access to credit; the absence of clear processes for administering land titles can prevent many small farmers from being able to show that they have the collateral needed to obtain financing. This, in turn, impacts their ability to adopt new seed varieties and other agricultural technologies.

For seed companies, getting clear access to the land needed to test and multiply seeds can be a significant hurdle. As a recent World Bank study notes, 'seed companies [can have] specialized needs for contiguous land areas to maintain seed purity and protect intellectual property' (Byerlee et al., 2013). For all stakeholders in sub-Saharan Africa, the system around land use and ownership can be quite complex and involve conflicting legal systems. This is discussed in greater detail below.

Other challenges to businesses and investors are found in limitations on foreign direct investment, unfavorable tax treatment, minimal capital requirements, and repatriation restrictions, all of which can limit investment and the pool of financing available to local businesses. Some countries restrict certain areas of investment to the nationals of that country, including transportation services, wholesale trade, and some agricultural exports. In other cases, caps on foreign participation exist in law or regulation. Currency issues, including repatriation limits and currency shortages, can also severely restrict access to finance.

Exchange rate risks are another important focus for both investment and ongoing operations. If local currency is not convertible, investors have a difficult time obtaining financing for cross-border transactions, and a country may not be as attractive as an investment destination. As a consequence of regulations, businesses may seek domestic debt (so that their debt is in the same currency as their local operations) or they may seek to limit capital investment. Policy-induced foreign exchange shortages can limit the ability of private seed companies to purchase high-quality equipment and supplies, as well as gain access to irrigated land. Such restrictions can create a situation in which demand for foreign currency far exceeds supply, and should be carefully considered in the context of scaling seed systems (Alemu and Tripp, 2010).

Access to information and communication technology

Information and communication technology (ICT) solutions can be a contributing factor in the adoption of new, improved seed varieties. ICT is being used in increasingly innovative ways, as discussed in other briefs in this work, and access to ICT does have legal and regulatory implications, although many other considerations impact farmers' access to ICT.

Many sub-Saharan countries have privatized their telecommunications operations, resulting in a wave of telecommunications-related foreign direct

investment in ICT financing. Despite enabling environment reforms, market impediments are still present. Access to ICT is largely incongruent across and within countries, however, with emerging markets such as Brazil, India, and China far ahead of many sub-Saharan African countries (World Bank, 2006). Regulatory improvements, such as rebalancing retail tariffs to reflect the differences in the costs of providing services; decreasing restrictions to open markets to new entrants; providing reasonable access to existing infrastructure of incumbent operators; establishing an effective interconnection regime; and increasing access to the radio spectrum at low costs for a wide range of service providers could make a difference in reaching scale. Policies to encourage competition and increase the number of providers can be particularly effective. For example, Grenada eased licensing processes in 2002, precipitating a rise in mobile phone subscribers from 45 to 860 per 1,000, from 2000–2004 (World Bank, 2006).

Regulatory requirements may also inhibit the spread of new ICT technology and innovation. For example, investment in the sector may be hampered by high taxation. In addition, government duties and taxes on the import, sale and use of cell phones continue to restrain access for rural populations and the urban poor, in the face of falling manufacturing costs (World Bank, 2006).

Input subsidies

Seed industry growth can also be hampered by government-sponsored input subsidy programs that are created to offset part or all of the cost of seed, fertilizer or other inputs. Input subsidy programs have many objectives, including increasing food security, fast-track adoption of new technologies, strengthening distribution and agro-dealer networks, and addressing post-emergency relief situations. However, implementation difficulties such as the tendency for subsidies to become politically entrenched and poor targeting skew results, causing market inefficiencies such as displacement of private sales and business environment uncertainty.

Rigorous impact evaluations conclude that input subsidies raise agricultural productivity substantially (Chibwana et al., 2010; Mason, 2012; and Awotide et al., 2012). However, subsidies are criticized for inefficiently drawing upon scarce public resources that could otherwise be used for other purposes (Mason, 2012; and Mofya-Mukuka et al., 2012); excluding those who need the support most (for example, smallholder farmers) due to poor targeting during implementation (Dorward et al., 2008; Minot, 2012; and Nyirongo, 2005); manipulation of voucher programs for political or financial gain (Mason, 2012; Pan, 2011; Crawford, 2006); and crowding out private seed enterprises from participating in servicing the market (Minot, 2012 and Nyirongo, 2005). Furthermore, input subsidies are not sustainable, and are politically difficult to remove once in place.

Inconsistent implementation of subsidies (i.e. providing subsidies one year and not the next year) can not only lead to immediate economic losses for seed businesses due to direct displacement of sales, but can also cause longer-term stunting of the seed industry by discouraging investments in business growth.

If and when policy-makers use input subsidy programs as opposed to other tools, then a number of best practices may be incorporated in their design, thereby making them so-called 'smart' subsidies. These include:

- Stating clear objectives (Longley, 2006)
- Having a clear exit strategy (Gregory, 2009)
- Targeting farmers that have the most need for assistance (Dorward, 2008 and Minde et al., 2008)
- Employing market-friendly solutions (such as input vouchers) that work in collaboration with existing private input supply networks (and possibly encouraging the establishment of new businesses) (Baltzer and Hansen, 2012; Minot, 2012; and Nyirongo, 2005)
- Promoting the use of high-performing seeds (such as hybrid varieties) that will generate greater economic returns (Chibwana et al., 2010).

Input subsidies are a popular tool, but if they are not used judiciously, the scaling they catalyze will not be sustainable and, in fact, they can have a slowing effect on scale in the long run. Clarity and consistency in their design and implementation are paramount to reducing uncertainty and further market distortions.

Regional and international trade

Larger markets present important opportunities for scaling seed systems. In drawing lessons from other countries about scaling seed, it is notable that domestic markets in sub-Saharan Africa are relatively small and a number of countries are landlocked, limiting access to larger market channels. The size of markets is a constraint to scale and makes laws and regulations governing regional and international trade key tools for scaling. For seed industries, regional and international trade rules and their implementation are important determinants of whether markets can be formed across both complementary and comparable ecologies, and among more heterogeneous participants as well.

Regional markets, discussed below, are particularly important to scaling Africa's seed systems. For seed, cross-border trade may be important for insuring adequate supply and long-term productivity gains. Yet movement of seed, germplasm, and data across borders can be a complicated process. This is mainly due to the number and complexity of requirements for allowing such trade to take place and the lack of harmonization in regula-

tions. Time spent at the border can make a major difference; if seeds are held up for too long, viability and germination may decline, diminishing or destroying their value (Brenton et al., 2012).

In any situation that involves cross-border trade, issues such as import/export policies, tariff and non-tariff barriers, and customs administration may arise. Predictability is particularly important when seeds, equipment, services, and even information moves across a border. These issues are discussed primarily in the final section on *Access to Markets*. Some aspects of regional seed harmonization, including processes around variety release, will also be included in the section below.

Two elements bear mention at the start of this discussion, however. Laws and regulations governing regional markets for seed are perhaps even more important for the food security issues discussed in this work than those governing export to far-off markets. In sub-Saharan Africa, various initiatives are underway for harmonizing law and regulation. Increased regional harmonization can create opportunities that draw in new market entrants and allow existing business to grow. In the seed systems of sub-Saharan Africa, regional harmonization is also critical because national borders cut across agro-ecological zones. For example, political borders separate 'food surplus areas in northern Mozambique and southern Tanzania from intermittently deficit markets in Malawi and eastern Zambia' (Haggblade, 2013). Regional harmonization can lower barriers for movement of seed varieties, cut regulatory costs, and improve phytosanitary controls among countries (Gisselquist, 2001).

Regional harmonization can have an additional effect of promoting simplification and greater transparency of procedures in critical areas, including export/import licenses, certificates of origin, standards, and sanitary and phytosanitary (SPS) regulations. In the agricultural sector in particular, the lack of harmonization is a primary impediment to increased agricultural productivity and economies of scale (Brenton et al., 2013), and the implementation of regional agreements could be a significant factor in scaling seed systems. This is a significant area for future study and focus.

While numerous instruments, such as regional trade agreements, exist to harmonize Africa's regional markets, implementation has been challenging. In part, this is because regional harmonization requires not only improved processes within and between countries but also national level changes in laws and regulations.

It is also important to note that not every trading partner is impacted in the same way by regional harmonization. Improvements in regional markets can benefit many stakeholders and strengthen markets overall, but regional harmonization can impact countries, industries, and market stakeholders differently.

Improvements to facilitate trade among the partners in a regional trade agreement will create gains in efficiency and predictability for all who are operating in these markets or crossing the border, but some gains will be limited to the countries in the regional trading block. For example, as the countries of the East African Community (EAC)² implement regional variety release policies, Kenyan seed will be able to move more freely into Tanzania, while seed from India will benefit from the improved procedures these changes have generated but will not be subject to the beneficial trade treatment Kenya and the other EAC countries enjoy. When well implemented, regional harmonization will generally be more comprehensive than measures at the international level, even though both will cover many of the same areas of market activity. For this reason, a distinction between regional and international trade is made, with issues in both contexts discussed.

Figure 1 – System-wide issues: summary of scaling solutions.

ENSURING A BUSINESS-FRIENDLY MARKET ENVIRONMENT

<p style="margin: 0;">SCALING GOAL</p>	<p style="margin: 0;">Reduce time and simplify process for market entry, licensing, and business registration</p>
<p style="margin: 0;">HOW TO DO IT</p>	<ul style="list-style-type: none"> → Change regulation, as necessary, and improve implementation to increase predictability and consistency in licensing and registration requirements, limiting the number and type of requirements to avoid duplication. → Where appropriate, use technology to reinforce regulatory change (for example, electronic business registry to accompany streamlining regulations around business registration). → Strengthen services networks for input dealers and remove regulatory restrictions on service sector development across the board (financial services, transport, distribution).

2 EAC members are Burundi, Kenya, Rwanda, Tanzania, and Uganda.

RESTRICTION ON INVESTMENT

SCALING GOAL

Remove restrictions on investment in order to open up investment capital up and down the seed value chain

HOW TO DO IT

- Establish processes to enable farmers to hold clear title to land and use land as collateral (covered in Figure 4 below).
- Reduce limitations on foreign investment, including unfavorable tax treatment, minimal capital requirements, repatriation restrictions, and sector-specific restrictions (transportation services, wholesale trade, and some agricultural exports).
- Remove policy-induced foreign exchange limitations to mitigate against exchange rate risks and increase investment potential.

ACCESS TO INFORMATION AND COMMUNICATION TECHNOLOGY

SCALING GOAL

Increase access to ICT (including mobile phones, data, and other technology) needed for scaling seed systems

HOW TO DO IT

- Rebalance retail tariffs to lower phone service costs.
- Remove restrictions on ICT services providers and ease licensing requirements.
- Lower taxation on ICT across the board and eliminate or reduce import duties and taxes on mobile phones and other key ICT.

INPUT SUBSIDIES

SCALING GOAL

Focus on 'smart subsidies' that could improve agricultural productivity without distorting the market

HOW TO DO IT

- Focus subsidies on specific, short-term, catalytic interventions capable of encouraging market-driven, sustainable value chain growth.
- Ensure clarity and consistency in design and implementation, with a clear exit strategy.
- Establish clear objectives, such as promoting the use of high-performing seed.

**SCALING
GOAL**

Encourage regional harmonization among complementary and diverse geographies to increase transparency and efficiency at the border

**HOW TO
DO IT**

→ Simplify and create greater transparency in procedures in critical areas, including export/import licenses, certificates of origin, standards, and sanitary and phytosanitary (SPS) regulations (see also Figures 3 and 5 below).

3 – Seed laws and regulations

A country's seed laws and accompanying regulation cover a number of aspects related to ensuring that high-quality seeds are available in the market (such as variety release, certification, seed testing, marketing of seed, and governmental and parastatal control over the process). Other areas are covered by different laws and regulations, but have a direct impact on the availability of high-quality seeds in the market. While model seed laws have been developed (see, e.g. Harries and Cortes, 2009), each country will have to develop a process for establishing and implementing appropriate seed laws and regulations. Although a number of countries are actively working through the legal and regulatory frameworks to put in place seed laws and regulations, as of 2010, the Africa Rice Center reported that only a quarter of African countries had passed a seed act and specific seed regulations (AfricaRice, 2010).

Variety release

A country's system for releasing new seed varieties into the market is considered by many to be one of the greatest constraints to scale³. Variety release processes are often lengthy and complex, with many considerations to balance. They include national performance trials, on-farm trials and quality control measures, as well as formal government approval processes through national variety release committees. But the establishment and implementation of variety release processes directly affect how well and quickly new seed varieties get into farmers' hands and therefore deserve greater focus in the context of scaling seed systems.

The length of variety control processes is often cited as a constraint to a seed system's ability to provide the right seed varieties to farmers. The resources needed to navigate the process, as well as the time lags and uncertainty involved, introduce hurdles for organizations working to supply seed.

3 Much of the material in this section covers vegetatively propagated crops as well as seeds, with some distinctions explicitly noted.

Often each stage in the variety release process requires interaction with different government and parastatal actors. Even with clear laws and regulations, the variable implementation of these processes means that it is not possible to predict exactly what will happen until things unfold in practice. The exact amount of time needed to work through the various steps can create uncertainty. The World Bank estimates that it can take between two and three years to introduce new seed varieties in sub-Saharan Africa (Brenton et al., 2012), while other reports indicate that the process can take even longer (Coulson and Diyamett, 2012).

Figure 2 below shows the differences in the time it takes to release a maize variety for a number of countries in sub-Saharan Africa. In addition to the lag encountered in variety release processes, it can often take several years before newly released varieties are made available to farmers. This is because seed producers will not invest in commercial multiplication of new varieties until their release has been approved. The lengthy, unpredictable process constrains the ability of companies or other commercial operators, and shapes the industry by creating the need for financing, market forecasting and flexibility that cannot always be met by smaller enterprises.

Experience has shown that the timing can differ based on how decisions are made at each step along the way, and a real-time, public-private process to work through these steps may be one way to increase implementation and achieve scale.

	Actual time to seed release			Time from release to time seed is available to farmers in significant quantities
	Mean	Min	Max	Mean
Kenya	3.1	1.5	6.0	2.4
Malawi	3.0	2.0	7.0	1.9
Tanzania	2.2	1.0	3.0	2.0
Uganda	2.2	1.0	4.0	2.1
Zambia	2.1	1.0	3.5	2.5
Zimbabwe	2.2	1.0	3.0	2.4
South Africa	2.0	2.0	2.0	2.5
Ghana	2.0	2.0	2.0	2.0
Nigeria	63.0	4.0	3.0	0.03

Figure 2 – Variety release timeline for maize in selected countries in years.
DTMA Seed Sector Survey 2007/2008.
Source: Setimela et al. (2010)

Quality control standards within the variety release process deserve particular attention. A significant portion of the time spent in the variety release process involves field trials, product tests, and inspections. Quality standards related to DUS (distinctness, uniformity, and stability) and VCU (value, cultivation, and use) are often required. For example, releasing a new variety may involve several years of DUS trials, and it may not be clear how many trial seasons will be needed. As noted above, trials can be costly for companies and can create cash-flow challenges, particularly when a significant gap exists between the trials and actual sale of the product on the market. For many companies, incurring significant costs while the payoff in sales to the consumer is several years down the road may not be viable. Aligning fees for testing and release trials to account for the fact that it may be years before the company will earn revenue from the release is one possible solution.

How testing is done, where, and by whom will significantly impact the ability to reach scale. Smaller farmers often do not have proper access to testing because of where testing is conducted (often in centralized locations, located far from where they farm). Decentralized testing with multiple sites may be an effective tool for reaching scale. Administering quality (and licensing) control at point-of-sale outlets, if used, and other accessible locations, including at farmers' cooperative distribution sites, could make a tremendous difference.

The choice of who is authorized to conduct the testing can also be a significant factor. Overall, the most successful testing regimes are those that are flexible, affordable, and timely. While public sector bodies are often involved in testing, they have capacity and resource limitations that make it difficult to deliver timely, flexible services. In many cases it is quite common, for example, for legal and regulatory frameworks to require mandatory testing by the national agricultural research systems (NARS). The NARS have many other functions central to their organizational mandates, including maintaining plant breeding programs, so their capacity to also carry out mandatory testing may be challenged. While governments sometimes expressly mandate that these functions be carried out by the public sector, allowing for private sector testing services could be another legal and regulatory option that deserves greater study.

Some countries may require an additional step of registering new seed varieties, which can bring additional testing procedures. In some cases, basic data provided by the plant breeder will be sufficient, although in other countries several years of field observations may be required to determine that a new variety meets DUS standards.

Relaxing rules on testing and eliminating some variety release controls may also streamline the process without compromising on quality standards. For example, reducing the number of required field trials, or establishing a reli-

able schedule for meetings of variety release committees (these meetings are sometimes subject to change with little or no notice), may improve the efficiency of the process. We have good evidence from countries that have successfully streamlined the variety release process for some crops, including wheat and maize (Byerlee et al., 2013).

While a significant factor, timing is not the only challenge. There is an overarching need to reevaluate the assumptions on which variety release procedures are based. The functional goals of the system regulating which varieties are approved for release must be balanced in a way that considers the incentives created by the system and the practical implications for stakeholders in the seed system. As noted above, looking deeper at the qualities of a product that are important to farmers (such as maturity, taste, and other end-user needs) could be a stronger guide. The costs of *not* being able to access varieties, and the delays in getting new varieties to farmers, could be accounted for in a reevaluation of variety release regulations. As currently designed and carried out, variety release processes contain incentives for the plant breeding agenda that could be better designed to serve the market and needs of small farmers if they were more demand-driven. All of these factors will weigh into whether a variety release process is capable of contributing to scale.

Often, improved varieties of seed that could meet the demands of small-holder farmers are available in another market where they have already been released and approved. Crossing borders can be a necessary step in increasing supply of improved varieties. Import restrictions and requirements, therefore, present an added challenge, and improvements in this area, particularly at the regional level, can be a factor in achieving scale.

The ability to share data across borders is becoming increasingly important in the seed industry. There are challenges due to the diversity of agro-ecologies, but there are also opportunities that have not yet been explored sufficiently. Openly sharing data that was relied upon in a variety approval process in one country can speed up, and scale up, the approval of new varieties in another. When entirely new data is required, the variety release process can slow down significantly, keeping the seed of improved varieties off of the market or delaying its entry (Quinn et al., 2011). It is important to note the limitations of sharing data as well. Plant variety protection (PVP) data, for example, can sometimes be used from country to country (and is a benefit of belonging to the Union for the Protection of New Varieties of Plants (UPOV) as discussed below), but variety registration data requires more thoughtful processes to ensure quality standards are maintained while at the same time limiting the amount of resources spent in recreating data. Establishing clear standards around the data needed to register varieties, and streamlining the process for registration, will also improve the functioning of seed systems.

Sharing data is one element of a larger, but separate, discussion about the merits and feasibility of regional variety registration. Overall, there are different approaches to regional variety approval, which include: '(1) Member government[s] agree[ing] to waive controls for some or all crops; (2) A list approach, with each country automatically accepting varieties approved in another country [that are] on [the] list, without further testing; (3) Agree upon a regional body that will test or approve new varieties following a list of crops' (Gisselquist, 2001). These approaches are being rolled out and implemented in different African regions. The EAC and the Southern African Development Community (SADC)⁴ have approved a common catalogue, and the EU uses this model as well. The final approach above was applied in Central America and proved to be unwieldy (Gisselquist, 2001).

In eastern and central Africa, the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) has been working to harmonize seed policies since the 1990s (Nyachae, 2007). Work originally began in three East African countries (Kenya, Tanzania, and Uganda) and has been extended to Burundi, the Democratic Republic of the Congo, Eritrea, Ethiopia, Rwanda, Madagascar, and Sudan. Focus has been on harmonizing seed laws, standards, and regulations in the region in the areas of variety evaluation, release and registration; seed certification; SPS regulation; plant variety protection; and seed law and regulations (Minde, 2006). Regional systems for reciprocal variety approval are being strengthened and more fully implemented and have the potential to transform previously fragmented seed markets.

Notably, ASARECA has focused on data collection and analysis, which is always a difficult area and one in which much more work is needed. ASARECA reports that efforts in the region have increased consumer surplus in Kenya, Uganda and Tanzania by 41%, 423% and 1,150% respectively. Similarly, producer surplus for seed maize growers in Kenya and Uganda respectively increased by 270% and 203%, but decreased by 28% in Tanzania. Overall, the implementation of the harmonized seed policies will translate into a gain in welfare of about US\$128 million for the three countries. Given that these three countries account for only 44% of the region's seed maize industry, the total welfare gain for the entire ECA region can be estimated at US\$727 million (ASARECA, 2012). IFPRI also reports that the harmonization process in East Africa has helped to streamline variety evaluation, release, and registration processes, as well as reduce the number of sanitary and phytosanitary (SPS) restrictions, and the time needed to receive a SPS certificate, and simplify export and import documents. Increased seed volumes are being traded as a result (Minde, 2006).

4 SADC members are Angola, Botswana, Democratic Republic of the Congo, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia, and Zimbabwe.

SADC has also developed a common variety approval framework that includes a harmonized approach in variety testing, tests for agricultural value, a regional variety catalogue, seed certification, and a reduced quarantine pest list (Van der Walt, 2007). If well implemented, this will mark a significant improvement over requirements for independent approvals, which could take 3–5 years to complete and threatens to keep the market fragmented with limited investment in developing new seed varieties. The new SADC seed protocol allows for regional seed approval if a variety is approved by at least two member states (Opperman, 2011).

The Economic Community of West African States (ECOWAS)⁵ has also approved a common variety release system, which is in the process of being worked through and put into practice. Member states of the Common Market for Eastern and Southern Africa (COMESA)⁶ will soon debate a new seed registration law. All of these regional efforts hold great promise and could greatly contribute to scale, particularly as implementation receives greater focus and as different stakeholders become more engaged.

Certification

Certification systems are a way of ensuring genetic purity, genetic identity, and origin of seed, helping to ensure the supply of quality seed to the market. Different approaches, sometimes in combination, are often used. These can include centralized certification schemes and alternative approaches, such as Quality Declared Seed (QDS) standards (discussed below). Because of their connection to the supply of quality seed, and because they involve intricate, multi-step processes, the choice of certification systems and their implementation have major impacts on the ability to scale seed systems.

Centralized certification processes are relatively common, particularly in sub-Saharan Africa. Certified seed must generally meet fairly stringent requirements for control quality and purity, and governments will often regulate the process for certification. Certification schemes are sometimes criticized because of their cost and complexity (See Bentley et al., 2011). Other criticisms of centralized certification systems include concerns that they are not practical or feasible for small farmers (who are not of a size and scale to be able to afford the fixed costs and may be unable to access larger markets as a result); may not be used by farmers of all sizes due to the time, cost, and complex steps involved; or may not deliver sufficient benefits relative to costs.

There are a variety of alternatives to the centralized system model (with a mandatory *ex ante* framework for ascertaining seed quality). Some systems

5 ECOWAS members are Benin, Burkina Faso, Cape Verde, Gambia, Ghana, Guinea, Guinea-Bissau, Ivory Coast, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo. See e.g., Cortes 2009.

6 COMESA members are Burundi, Comoros, Democratic Republic of the Congo, Djibouti, Egypt, Eritria, Ethiopia, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Sudan, Swaziland, Uganda, Zambia, and Zimbabwe.

verify seed quality through *ex post* enforcement of standards. 'Truthfully labeled' seed is one possible alternative. Within this regulatory framework, laws specify which claims must be included in a seed label relating to seed quality, and the seed seller is held responsible for ensuring that the seed meets those claimed standards. Bentley et al. (2011) note that truthfully labeled seed 'may be a more feasible way forward with more emphasis on branding and trust in source'. South Africa's seed certification is governed by a 'truth-in-labeling' framework, which shifts enforcement from before market release, instead using mechanisms to ensure the quality of seed as it enters the market. In South Africa, the South African National Seed Organization (SANSOR) monitors voluntary certification, holding seed to strict requirements, and SANSOR requires a guarantee that the seed meets the varietal purity and quality certified on the labels they provide (SANSOR, 2013).

QDS discussed in more detail below, is a further alternative sometimes used in conjunction with other models. QDS can offer a quality control mechanism for use particularly in areas of the seed system where the implementation of centralized certification systems is not feasible (for instance, in the local production of seed by smallholder farmers and producer groups) (Coulson and Diyamett, 2012). QDS regulations may include crop-specific requirements for field standards, facilities, field inspections and seed quality.

The tradeoffs discussed above in the context of implementation are particularly apparent in the decisions about how certification systems can be designed and implemented.

Overall, the *ex ante* certification processes can be very expensive, both due to official and unofficial or unanticipated costs. These costs may dissuade producers from obtaining proper certifications, or the costs can be passed on to the consumer, making seeds more expensive. A certification system that requires *ex ante* mandatory approval of all certified seed involves field inspections and laboratories available to test for seed purity, viability, and quality. Limited resources available within the certification authority can sometimes lead to lengthy delays in field testing. Additionally, finding a qualified laboratory to conduct sampling and testing, generally conducted in accordance with the International Seed Testing Association (ISTA) rules, can be a hurdle for some farmers. Timing is critical in inspections, so that the crop does not sit for too long (waiting for an inspector to come), which could increase the risk of exposure to insect, disease, or moisture damage. If final certification takes too long, a crop may also not be ready to deliver to customers. These transaction costs, and the need for networks to implement certification, can favor large enterprises and keep out smaller ones.

Third party seed certification, which is typically conducted through public-private partnership models, often requires legal and regulatory change but can expose seed systems to greater scale. Changing regulation to permit

third-party certification and testing has made a notable difference in expanding the number of market entrants in Peru, for example. Before the 1990s, Peruvian seed certification was mandated by the SDCCS (Sub-direction of Seed Certification and Control), a branch of the Ministry of Agriculture, and private seed certification and testing were not allowed. Following a regulatory change to allow for third-party certification, the parastatal seed certification agency was replaced by a public-private partnership model of departmental seed committees, or CODESES, which has helped encourage the growth of small seed enterprises in Peru. The CODESES perform field inspections for their certification services, seed testing, and some seed processing and storage; they also provide technical advice to help small farmers clean and bag their seed and apply fungicide. Because of this regulatory change, the number of private seed companies in Peru has increased dramatically, from three in 1990, to 35 after four years, and to 80 after two decades (Quinn et al., 2011).

Certification can also impact predictability in accessing foundation seed (which can be developed from public or private breeder seed), although a country's laws and regulations may also limit the distribution of foundation seed explicitly. Commercial seed cannot be developed for sale to farmers without clear access to foundation seed, so a system that allows seed companies to bulk parent seed themselves, could be one step in the legal and regulatory environment that acts as a wedge for opening up scale. The relatively long time horizon involved in seed development is another factor to take into account.

In certification, as is true elsewhere, regional efforts are a factor in scale, and can lead to simpler, better-coordinated certification standards if well implemented. Through ASARECA, seed certification standards were developed, based on the rules of the Organisation for Economic Co-operation and Development (OECD) and ISTA, for the following ten crops: maize, sorghum, beans, groundnut, soybean, wheat, Irish potato, rice, sunflower, and cassava (Nyachae, 2007).⁷ Since 2010, an initiative of COMESA's Alliance for Commodity Trade in Eastern and Southern Africa (ACTESA), the COMESA Regional Agro-inputs Programmes (COMRAP), has been working on harmonization of variety release and certification requirements for twelve crops, including: maize, rice, groundnuts, cotton, beans, millet, and sorghum. This would lower costs by not requiring seed that has already met requirements in one country to 'jump through all of the same hoops again.' (Tripp, 2005; in Brenton et al., 2012). Additional regional reforms, such as harmonized seed certification standards and seed certification accreditation (Central America and MERCOSUR are examples of regions in which such reforms have taken place), are also being rolled out in African regions, including the EAC,

⁷ The technical working group on certification met in September 2003 and September 2005, to develop these standards for Kenya, Tanzania, and Uganda, and in 2006 standards were developed for Rwanda.

SADC, and ECOWAS. If certification requirements are too restrictive, they can limit the quantity of seed available on the market. One way to maintain certification while still allowing for larger market development, however, would be for countries in a region to accept each other's certified seed (Gisselquist 2001).

Truth-in-labeling laws

Many countries use truth-in-labeling laws to govern seed quality, including India, South Africa and the United States. As noted above, truth-in-labeling laws dictate which information must be declared on seed packaging when the seed is sold. In some frameworks these labeling requirements can be coupled with minimum standards, but in many they are not. Quality control in these systems is primarily derived from the market; rather than a government defining acceptable quality standards, consumers define acceptable quality standards through their informed purchase choices. Some systems offer exemptions for the exchange of seed among farmers. For example, the United States' seed law allows unlabeled exchanges, but only if the seed is not advertised in any way (McDonald et al., 1997).

Quality declared seed

QDS systems are sometimes implemented in the parts of a seed system that centralized certification does not reach, for example certain crops (vegetatively propagated crops), less formal parts of the sector, or places where regulation is weaker. While the overall objective and purpose is the same as a centralized regulatory framework for certification, direct comparisons of the systems are difficult because they are often not implemented in the same places. Still, weighing the differences between centralized certification and QDS can help to define the appropriate roles for each in scaling a seed system. Some experts stress that QDS can be more easily implemented under limited resources (McEwan et al., 2012). Others point out that not all farmers will certify seed through centralized systems, particularly in vegetatively propagated crops, due to outright and indirect transaction costs (Bentley et al., 2011). QDS systems also contain a 'truth-in-labeling' component with requirements for labels to display defined aspects of seed origin, purity and quality.

QDS guides, appearing only in the last decade, have been issued for a range of crops; see, for example, general guidelines from the Food and Agriculture Organization of the United Nations (FAO, 2006), and those specifically for vegetatively-propagated crops (FAO, 2007). These guidelines note several components of the QDS framework, including the designation of varieties eligible for QDS certification, the registration of seed producers who are held responsible for the quality of the seed, and labeling requirements. The guidelines available for QDS advise ex ante enforcement that is

supervised by the government. For example, it is noted that inspections must be made of at least 10% of the seed fields registered for the production of quality declared seed (FAO, 2006).

Because of the shift in enforcement, QDS systems can be an easier and more affordable mechanism for farmers. They can also put less strain on the limited resources of government agencies. QDS inspection schemes with certification exist for grain crops and potato in sub-Saharan Africa, and operational procedures for sweetpotato are being developed in Tanzania (McEwan et al., 2012).

While QDS standards and seed certification requirements aim to address some of the same issues, we have noted that they are different approaches with different degrees of government control over the process, which has created tensions as some governments have tried to maintain maximum control over quality standards and seed certification. Although QDS standards are often looked to as a more efficient and predictable alternative to centralized seed certification, it may be too soon to fully determine their impact in Africa. Tanzania's Seeds Act of 2003, established QDS alongside the centralized certification process, allowed for a more active role of the private sector in seed systems, and established an independent seed certification body, the Tanzania Official Seed Certification Institute (TOSCI). The World Bank reports that it can still take up to three years to get quality certified seed on the market (Van Manen et al., 2012), but it will be important to monitor whether QDS standards may result in more efficient processes as they continue to be implemented.

In order to sustainably increase seed quality and quantity of indigenous vegetable seeds in the formal sector in East Africa, CAB International (CABI) formulated and implemented three farmer-led seed enterprise (FLSE) models from 2009–2012: the private sector seed company-mediated model, i.e. contract model; the research mediated model; and the QDS model. In the contract and research mediated models, a private seed company or an agricultural research institute, respectively, distributes foundation seed to farmers, whereas in the QDS model, farmers who follow their national certification agency's regulations can become registered to produce seed. In the contract model, the seed company covers the cost of crop inspections and oversees farmer registration. In return, farmers agree to sell their seed back to the company that originally provided it, discouraging the traditional practice of saving seed. All three models have shown success in their trial phases. The contract model has worked well in countries with strict regulations, while the research-mediated model presented a good alternative for farmers unable to enter into contracts with private seed companies. Where seed regulations are weaker, the QDS model can be useful, although consistent marketing may be necessary to generate income. CABI and the Kenya Agricultural Research Institute (KARI) are scaling up this work throughout East

Africa, and will apply the relevant models elsewhere in Kenya, Burundi, Rwanda, Uganda, and Tanzania (Karanja et al., 2012).

The sections on certification, 'truth-in-labeling' laws, and QDS above give some insight into different models for assuring the genetic purity, genetic identity, and origin of seed. The discussion has intentionally avoided recommendations that advise one system over another as a single framework that can best support scale in seed systems in sub-Saharan Africa. In part, this is because available evidence on costs is not sufficient and also varies greatly across countries. For centralized certification systems, these costs include implementation expenses incurred by government agencies, for example: the amount spent by the certification authorities on staff, equipment, travel, labs, and administration. Additional costs are incurred by seed producers in the time spent navigating the certification process, lost profits due to delays, or crop loss caused by the certification process. Still further costs are incurred by consumers of seed who do not benefit from having certified seed available, because the limitations of centralized seed certification systems may prevent it from reaching throughout a seed system.

Alternative certification systems also need better costing to determine their role in fostering scale in seed systems. For truth-in-labeling systems that incorporate *ex post* enforcement mechanisms we also need better evidence of costs. Truth-in-labeling systems require that consumers can access channels for reporting false labeling claims, and government resources to investigate the claims and perhaps prosecute. The question of access to compensation for falsely labeled seed is also a component in the design of truth-in-labeling systems.

Evidence of the effectiveness of systems is also needed, including measurements of whether increases in the quality of seed reaching smallholder farmers' markets are warranted by the costs of the systems in place. Additionally, discussions about optimal regulatory frameworks for seed certification that support the scaling of seed systems will benefit from considering combinations of seed certification systems that may best serve the diversity of crops, varieties and geographies comprising smallholder farmer markets for seed.

Packaging and labeling

Packaging and labeling requirements are common beyond the 'truth-in-labeling' aspects discussed above. Beyond requirements for labeling certified seed according to a country's seed law, regulations on package size, cleanliness and type of packaging are common. Additional labeling requirements can be numerous and may include variety, name and origin of product, initials of national designated authority, official lot information (number, month and year of harvesting), date of packaging, class, tuber size (for vegetatively propagated material) and declared average net weight

at packaging. One solution (in addition to 'truth-in-labeling', discussed above) to complex labeling requirements is to allow the labeling of seeds that have met minimum laboratory standards (germination and purity), thereby allowing companies to do their own tests.

Size of packaging can be an issue in cross-border trade, since bag size requirements can vary from country to country. Regional packaging requirements are becoming more prevalent. For example, the seed potato law of the EAC specifies: 'The package shall not be more than 50kg, shall be clean and allow for aeration and which conforms to the regulations in the destination country. The reuse of packages shall not be allowed.' (EAS, 2011).

Even with regional efforts to harmonize packaging requirements, differences persist. Farmers must not only be aware of different standards if they are trading across borders, but some regional standards have yet to be implemented, creating the need for repackaging at the border, for example, which can increase transport costs.

Marketing

Marketing of seeds is also often subject to regulation, which can limit the quantity of seed available to farmers. As in other areas of law and regulation, differences exist in how to approach marketing regulation, including marketing services.

In Europe, seed marketing is limited to seed of specific registered varieties that conform to EU standards. Similar marketing standards are being developed through African regional organizations, including ECOWAS. As discussed above, ECOWAS is in the process of implementing plant seed marketing, quality control, and certification regulations to increase regulatory harmonization between member states. ECOWAS developed the West African Catalogue of Plant Species and Varieties, which indicates which seed varieties can be marketed within the region (OECD, 2012).

In other markets (including the United States), marketing regulations are not applied, and local seed varieties can be marketed without restriction (Louwaars et al., 2011). Again, this is an area that should be studied with thought given to how to balance regulation with scale of the market.

Intellectual property rights

Intellectual property rights (IPRs) are an important, albeit controversial, topic that cannot be left out of any discussion on scaling seed systems. While not governed by seed law and regulation, IPRs are critical to seed systems. It must be said, however, that compared to the importance of other laws, regulations and policies in this brief, IPR discussions sometimes take up a com-

paratively disproportionate amount of time and energy among policy-makers. In an increasingly global market, ownership rights and liability concerns call for approaches to IPRs that first serve the interests of African farmers and seed businesses as well as governments, NARS, international agricultural research centers (IARCs), and multinational seed companies (which own innovations that, if adapted to the needs of African farmers and made accessible, could stimulate a jump in food production). This section will focus on flexible arrangements for IPRs that can balance these considerations and drive inclusive seed systems forward as a key factor in achieving scale.

Often IPR protection and enforcement are introduced in the context of attracting foreign investment or supporting the growth of national companies. These are certainly areas in which discussion of IPRs is relevant, but understanding the strategic use of IPRs is also important for public sector organizations. Taken out of the tempest of ethical and moral arguments that seem to characterize this field, IPRs can be a business tool, used to strategically work towards goals, even those of the public sector.

National governments are looking for strategies that will allow them to put in place legal standards that are in the best interests of the many stakeholders involved. Governments are also looking to understand the resources involved and options for managing the implementation of these laws, including the use and enforcement of IPRs.

In seed systems, IPR frameworks impact smallholder farmers in several ways. Primarily, IPRs play a role in influencing the seed that is available to farmers. IPRs can govern ownership of, and access to, germplasm and therefore shape decisions in plant breeding, foundation seed production and the production of marketed seed. IPRs can also influence the quality of seed available to farmers through the role trademarks and branding play in encouraging investments in higher quality goods.

Because research and development (R&D) is one of the first steps in ensuring sufficient supply of the right variety of good quality seed, agricultural researchers in both the public and private sectors are on the frontlines of developing IPRs to regulate use of their innovations. In most countries in sub-Saharan Africa, R&D in agriculture is still predominantly within government organizations. The International Food Policy Research Institute (IFPRI) cites a gradual shift, however, with 73% of full time agricultural researchers working in the public sector in 2008, down from 82% in 1991 (Beintema and Stads, 2011). Governments are increasingly leveraging private sector resources and creating new forms of collaboration in this area, and striking the right balance on IPRs will play a critical role as these relationships evolve.

As an example, consider the public sector goal of getting a variety out to as many smallholder farmers as possible. This may call for a public breeding

center that has carried out the R&D to license the variety and enable a seed company to make the investment necessary to produce and distribute the seed. Giving away the variety, or insisting on a form of license that allows every user the same access may, in some cases, result in a much-diminished impact on smallholder farmers. Many public sector organizations understand the importance of some form of preference in licensing now, including royalty-free licenses, but there is still a large need for training and sharing knowledge.

It is important to note that IPRs are covered by an array of international fora, from regional and bilateral trade instruments (such as ARIPO, the African Regional Intellectual Property Organization) to multilateral negotiations at the World Trade Organization (WTO) and the World Intellectual Property Organization (WIPO). A range of other United Nations bodies focus on IPRs as well, including the World Health Organization, and the United Nations Educational, Scientific and Cultural Organization (UNESCO). UPOV, which was established by the International Convention for the Protection of New Varieties of Plants (which has been thrice revised), is an intergovernmental organization with over seventy country members that establishes intellectual property protection for plant breeders. Many countries follow UPOV standards in establishing plant breeders' rights (PBRs).

Trademarks, PBRs, and, to a growing extent, patents have become common forms of intellectual property right protection for seed, including in Africa where PBR protection is becoming more widespread. Trade secrets also play a role. Patent protection for seed is particularly contentious and will have implications in Africa as the debate continues to play out. While the reproduction of seed by farmers and use of patented materials for further breeding can be strictly prohibited under patent protection (for example, in the United States), Europe and other countries are exploring limitations on these protections.

PBR protection is required by the WTO Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs), but this protection is *sui generis*, meaning it is up to the countries to decide the form it will take. Most countries do follow UPOV's standards and pass domestic legislation to implement plant variety protection (PVP). Ghana and Tanzania, for example, had PBR legislation approved in 2012 that conforms to UPOV 1991 (UPOV, 2012). PVPs share some attributes with patents but are a different form of IPR often cited as important for encouraging private research and transfer of technology. Since many countries in Africa and other developing countries are just beginning to implement PVPs, it is still too early for sufficient impact evidence. However, the evidence we do have indicates that PVPs tend to be used most (and encourage growth most as a result) in particular sub-sectors of seed, often those that are deemed more commercially viable (including those for export crops). For example, Kenya's PVP filings are more than 60%

for flowers. Other than maize and wheat varieties, any of the crops that would normally comprise a national priority for food security, make up less than half of a percent of PVP filings in Kenya (PLUTO, 2013; UPOV, 2005).

Licensing and royalty agreements are becoming more common in Africa and can bring benefits to the parties involved if carefully crafted. They can help regularize sales and create an ongoing system for royalty payments that lasts through market ups and downs; and having stronger IPR protection with balanced licensing and royalty arrangements can also lead to an increase in improved genetic material (Van Wijk, 1996). The CGIAR Consortium of International Agricultural Research Centers has endorsed the granting of limited exclusivity for commercialization, through limited exclusivity agreements, on the basis of projected impact among smallholder farmers (CGIAR, 2012).

In Argentina, where PBRs have been in place for some time, some evidence is apparent that IPRs have facilitated variety exchange and promoted partnerships between seed enterprises, and between companies and research facilities (Domingo, 2004). The Chinese experience has been interesting as well. After China implemented its PVP law in 1999, the number of new varieties available on the market increased substantially, as did the number of breeders (including private breeders). Maize and rice have been the most common crops to benefit, but titles for wheat, soybean, Chinese cabbage, oilseed rape, pear, peanut, watermelon, and other crops have also been granted. Royalties also increased significantly. Estimates from the Ministry of Agriculture in late 2004 suggest that the 502 new protected varieties planted on over 42.7 million hectares had accumulated almost 2 billion Chinese RMB for the holders of breeders' rights (UPOV, 2005).

Of course, enforcement of IPRs is also a significant issue that deserves greater attention. Counterfeit seed is prevalent in sub-Saharan Africa, presenting a danger to farmers and reducing profitability in the market. Many governments tend to focus resources elsewhere, leaving counterfeit seed production largely unchecked. For example, in some markets standard seed bags are required, which are easily replicated by counterfeiters. Grain is often purposefully mislabeled as seed (Tripp and Mensah-Bonsu, 2013). These challenges are difficult for any government to overcome, but there are models for addressing counterfeiting, and finding solutions will become more and more important as markets move faster and technology continues to evolve.

Figure 3 – Seed law and regulation: summary of scaling solutions.

VARIETY RELEASE

SCALING GOAL

Simplify variety release processes to reduce length of time, avoid duplication across borders, and ensure variety release standards are more reflective of market needs

HOW TO DO IT

- Harmonize (and implement in partnership with multiple stakeholders) processes for regional seed variety release by waiving controls for some crops, establishing a positive list that does not require further testing, or agreeing upon a regional body to test and approve varieties.
- Permit sharing of data and germplasm across borders.
- Base variety release on number of attributes, not only on yield, establishing clear standards around the data needed to register varieties and streamlining the process for registration.

CERTIFICATION

SCALING GOAL

Lower costs of certification schemes, regardless of form, and match to market needs and goals of ensuring genetic purity, genetic identity, and origin of seed

HOW TO DO IT

- Amend processes for certification to reflect users' needs, including by lowering costs (for government agencies, seed producers, and consumers), reducing time needed to complete certification and making certification services accessible to smallholder farmers.
- Legally provide for third-party certification and testing where the option does not yet exist.
- Expand regional certification efforts to lower cost by allowing countries to accept each others' certified seed and eliminating requirement to go through additional processes if seeds have been certified in one country.

'TRUTH-IN-LABELING' LAWS

SCALING GOAL

Simplify certification with focus on branding and trust through 'truth-in-labeling' frameworks

HOW TO DO IT

- Change law and regulation where needed, and shift enforcement to ex post.
- Provide channels for reporting false labeling claims, and government resources to investigate the claims and perhaps prosecute.

QUALITY DECLARED SEED

SCALING GOAL

Reduce cost of centralized certification and make process easier for farmers by allowing for QDS schemes

HOW TO DO IT

- Amend laws and regulations as necessary to allow for QDS schemes.
- Use QDS to ensure purity and origin when certification not available, for example for certain crops (vegetatively propagated crops), in less formal parts of the sector, or places where regulation is weaker.

PACKAGING AND LABELING

SCALING GOAL

Eliminate number of requirements and simplify packaging and labeling requirements

HOW TO DO IT

- Harmonize packaging and labeling requirements across borders, including for packaging size.
- Eliminate fees on packaging material such as import tariffs that drive up cost.
- Allow labeling of seeds that have met minimum laboratory standards (germination and purity) and allow companies to do their own tests.

MARKETING

SCALING GOAL

Reduce restrictions on marketing in order to increase the availability of higher quality seed

HOW TO DO IT

- Simplify regulations on marketing (including for marketing services) and match to goals of improving market.
- Implement regional harmonization measures on seed marketing (typically of specific registered varieties that conform to regional standards, making implementation of regional standards critical and interconnected).

INTELLECTUAL PROPERTY RIGHTS

SCALING GOAL

Establish IPR regimes that effectively balance public and private interests and encourage research and transfer of technology

HOW TO DO IT

- Implement licensing and royalty agreements that allow for some exclusivity/exemption from royalty payments to encourage private sector participation in the market.
- Implement laws and regulations to increase the use of IPRs, including plant variety protection laws, and evaluate to ensure that impact reaches across crops.
- Improve capacity to control counterfeiting (link to packaging above) with a particular focus on keeping counterfeit seed out of the market.

4 – Access to Finance

Access to finance is critical to scaling seed systems. Stakeholders up and down the seed value chain, including seed producers, agro-dealers and farmers themselves are impacted. Problems in accessing finance can influence the ability of seed systems to supply seed to smallholder farmers, as well as the ability of smallholder farmers to adopt improved varieties of seed. The role access to finance plays in fostering scale is considered in-depth in *Planning for Scale Brief #5* (exploring savings, credit and insurance), while this section focuses particularly on the enabling environment.

Laws and regulations governing access to finance often do not get the attention needed in policy discussions relating to food security. The International Finance Corporation (IFC) has called the topic of access to finance a 'policy orphan' that somehow falls through the cracks in the system (IFC, 2011). This is in part because responsibility for legal and regulatory frameworks may be divided between many agencies and institutions (e.g. Ministries of Finance, Agriculture, Trade, and the Central Bank), and in part due to the complex nature of the agricultural sector that differs significantly from other areas of investment.

Laws and regulations can be significant factors in ensuring that seed producers, agro-dealers and smallholder farmers can access credit. Improving access to credit may involve improvements to banking laws, financial contract laws, procedures to effectively enforce these contracts and incentives to invest in agriculture while protecting the welfare of multiple stakeholders (IFC, 2011). Banking regulations can hinder lending to the agricultural sector by implementing loan collateral conditions that cannot be met by farmers. Branch banking regulations and reporting rules may create multiple charges for banks that are passed along to the customer (Making Finance Work for Africa, 2012). As discussed below, non-collateral loans or alternative collat-

eral options may be a solution, yet particular attention must be paid to whether provisions in these agreements and their application turn out to be excessively strict.

Smaller-scale commercial farmers and emerging medium-sized farmers, often grouped as small-to-medium enterprises (SMEs), or the *missing middle*, tend to make up a neglected sector in access to finance. In particular, deals between US\$200,000 and US\$5 million suffer from a financing gap. These enterprises often have difficulty obtaining financing because they need too much money for a microfinance loan, but the amounts are still small enough that commercial banks perceive greater risk and are sometimes unwilling to lend. Current government intervention into financial institutions tends to be focused in areas that will not help close the *missing middle* finance gap, including lending quotas, interest rate ceilings, and subsidized interest rate funding, which may produce short-term results instead of long-term benefits, leading to unbalanced incentives and insufficiently allocated resources (IFC, 2011). State-owned agricultural finance (or development) banks, created to improve agricultural finance, have generally had poor track records and have lacked prudential regulation and supervision, leading to credit misallocation, high losses, and the need for recapitalization (Making Finance Work for Africa, 2012).

India's experience has been noteworthy, although the model may be difficult to implement elsewhere due to cost and differing circumstances. Between 1969 and 1990, India implemented the largest government-led bank expansion undertaken in any single country, opening approximately 30,000 banks in rural areas where no formal credit or banking institutions existed before. All banks were required by law to open branches in unbanked rural locations. Burgess and Pande (2005) use economic analysis to show that opening branches in unbanked rural locations was associated with a reduction in rural poverty. They also show that the bank expansion was associated with increased savings and credit services, as well as increased agricultural output. While many countries, to differing degrees, are providing for greater competition in the financial services sector (which is increasingly called for in contractually binding services agreements as part of trade agreements and WTO negotiations), which can help deliver an array of services, this example is illustrative of the type of financial services needed but often not provided in a way that will serve the needs of small-holder farmers. Applying this test to different aspects of the financial services sector in different countries, provided by both public and private actors, could present interesting questions in thinking about scale.

Incremental solutions, such as shifting resources to help facilitate financing in the agricultural sector by increasing accompanying capacity building and training programs for farmers (discussed in more detail below), for example, could be of particular value in the seed sector. Another potentially effective

solution is giving credit-granting licenses to private providers. In 2010, Ghana was able to increase access to credit by giving an operating license to a private credit bureau, and creating a centralized collateral registry (World Bank, 2013).

Bank lending can also be limited by gaps in information, a common issue when it comes to the absence of reliable, accessible, data about the agricultural sector (Coates et al., 2011). In many countries, SME access to finance can be improved by developing an information infrastructure that establishes credit registries, provides a mechanism for credit checks, improves collateral registration and repossession capabilities, and supports financial technology with specific legislation (Beck et al., 2009). In Malawi, for example, the government was able to increase access to credit information by passing a law that created a private credit bureau (World Bank, 2013). Overall, banks need to better understand the agricultural sector in order to lend to it, which requires the collection, compilation, and dissemination of data about the market and value chains, for both banks and members of the agriculture community; this could be one way in which scale could more easily be achieved.

Credit guarantee schemes (CGSs), which lower the risk of borrower default because a guarantee provider (usually a donor, foundation, national government, or multilateral development institution) assumes some of that risk and shares it with the bank, are becoming increasingly popular, but they alone are not likely to solve access to financing challenges. CGSs, which include partial credit guarantees (PCGs) and risk sharing facilities (RSFs), can help solve the difficulty many SMEs often have obtaining loans because their expected risk is too high. However, unlike alternative approaches to facilitate SME lending – which include capacity building efforts, improvement of credit scoring systems, credit bureau establishment, and regulatory reform – credit guarantees are often considered a ‘band aid solution’ because they do not directly reform the banking system or bank behavior. Longer-term goals might be better met through regulatory reform and better tailoring bank services to SMEs (Hansen et al., 2011).

Collateral requirements and restrictions on land ownership

Many companies also face difficulty accessing long-term financing from banks because of collateral requirements, which many businesses cannot meet due to the legal and regulatory structure around collateral, particularly in places like sub-Saharan Africa. Banks prefer to lend to larger, more established businesses with less risk and often require 125% of collateral for an investment.

A well-functioning collateral regime would be characterized by a wide range of allowable collateral (immovable and movable); the establishment

of clear priority among security interests; efficient collateral registries with publicly-recognized priority interests; and effective enforcement of collateral in the case of default, including both seizure and disposition (IFC, 2011). However, many of these systems have not yet been fully established through laws and regulations in sub-Saharan Africa.

In 2008, Ghana took action to overcome the lack of collateral issue for SMEs by passing the Borrowers and Lenders Act and concurrently implementing a collateral registry at the Bank of Ghana, which went into effect in 2010. These measures increased the use of moveable assets as collateral, thus substantially increasing the number of loans and other financing mechanisms by banks and non-bank financial institutions (World Bank, 2013). The collateral requirements imposed by many banks tend to disallow moveable assets, and many African countries do not provide a clear avenue for possession of the most common form of immovable collateral through restrictions on private ownership of land.

Establishing clearly recognized, defined and enforceable rights for owning and using land could encourage more investment and better protect rights of traditional users and small farmers (Byerlee et al., 2013), as well as have a significant impact in achieving scale. Clear and transparent documentation and legal rights for land ownership and use would improve the situation (IFC, 2011), but this area of law and regulation is exceedingly complex, both from a practical and a political economy standpoint.

The challenge for scale hinges partly on whether rules and processes around access to land are transparent, consistently applied, and predictable. This will impact the supply of high-quality seed, as land must be made available to test new seed before releasing it into the market, and demand for seed, with decisions farmers make about how to use their land linked to accessibility of land and related inputs as well. It is also a primary factor in accessing finance as noted.

Land ownership and use is a complex area, particularly in sub-Saharan Africa, where a strong historic and political context surrounds land use. In many countries in sub-Saharan Africa, a dual-tenure system of formal legal and communal approaches continues to exist, creating substantial uncertainty around land use and tenure (North, 1990; Besley and Persson, 2011). While land reform is underway in many places, it has moved forward in different ways and at differing paces. Some countries have leaned toward privatization and individual land tenure, with accompanying registration and titling systems, while others have transferred all ownership of land to the state. Throughout sub-Saharan Africa, however, the historic customary land tenure system often still remains in place, and it is often unclear how this system will intersect with the formal legal systems that have been erected to take its place as laws, regulations, and land processes are applied.

Many African countries maintain restrictions on ownership of land, including particular restrictions on ownership by foreign nationals and women. The system for registering land can be complicated, costly and slow, involving a number of steps and officials. Steps and costs associated with land registration include legal fees, property valuation processes, surveyor fees, transfer fees, title searches, consent to transfer, stamp duties, and agent's commission. These costs can vary widely. For example, a 2006 report asserts that the cost of buying and selling property in Uganda is 'moderate' (Global Property Guide, 2006). For many small-scale farmers and women, securing formal titles to land may be exceedingly difficult, if not legally prohibited.

From the legal perspective, functional systems for administering land ownership and use will need to balance historic and political realities with the needs of smallholder farmers. With better systems for securing use and ownership rights to land, farmers could take advantage of new opportunities along value chains, ranging from increasing production to obtaining higher quality seeds. Public-private processes for administering land rights and handling disputes could also be part of the solution.

Fortunately, some incremental steps are possible, and creative solutions, including those involving information technology, have been used with success to increase formal property rights and lower costs. Ethiopia, for example, has managed to provide titles that recognize inheritable use rights by both husband and wife to millions of farmers at a manageable cost of only US\$1–2 per plot (Byerlee et al., 2013).

In addition, processes to formally recognize customary land tenure systems can facilitate more effective land dispute solutions. As one example, Samoa (where over 80% of the land is owned via a customary land system) established village councils through legislation that recognized customary land claims and have the power to bring those claims to the Land and Titles Court. The Land and Titles Court was then given the power to determine land status: customary, freehold, or public. This formal recognition of customary law by the Samoan government is an effective system for peacefully resolving land disputes, dealing with a longstanding challenge (Corrin, 2008). Approaches to resolve land questions through balancing customary and formal systems, and alternative mechanisms for resolving disputes are being tried in sub-Saharan Africa as well, and these approaches deserve particular attention in scaling up any sort of agricultural development, including seed systems.

Alternative approaches to address finance and collateral challenges

A number of alternative approaches are being tested to deal with the collateral challenge discussed above, and open up other avenues of get-

ting financing to farmers. While there is not a silver bullet solution, several approaches bear mention. In all cases, legal and regulatory issues play a direct role and should be given consideration.

Increasing use of leasing financing. Leasing financing occurs when an entity pays to lease equipment until the full price has been paid, upon which the entity is then given ownership of the equipment (in some situations, the entity leases the equipment indefinitely and the lessor never relinquishes ownership). In many developing markets, lessors rarely have to provide collateral for the leased equipment and typically lease with the intent of owning the product, so the lessor pays for maintenance (Van Manen et al., 2012). This type of financing provides a more flexible option to traditional collateral lending models, because the lessor already owns the equipment and can more easily repossess it in the event of default, although some courts consider possession to be legally binding (thus court procedures may be required to repossess leased machinery) (IFC, 2011).

Strengthening producer organizations and cooperatives. Producer organizations and cooperatives also provide a viable alternative for accessing credit, distributing seeds and other inputs, and providing training (see below), and they can lower transaction costs and more efficiently reach a larger number of small farmers (IFC, 2012). Yet, these structures also face limitations. In some countries, including Ethiopia and (to an extent) Tanzania, cooperative financing institutions or cooperative banks exist and could be expanded, but these institutions are not present or sufficiently strong in every market.

While it is important to have law and policy specifically regulating coops, the legal and regulatory framework around coops can be complex or sometimes not detailed enough with regard to agriculture (Theron, 2010), and many countries maintain legal requirements that may be difficult for coops to meet. Some of the issues that arise in other contexts also hold true with coops. Particular attention is needed on how registration requirements are construed and applied (affirmative approval to operate or a statutory waiting period may be required); how cooperatives are taxed; and the role of different stakeholders, including government. Customary law must also be considered, particularly with respect to the participation of women in coops (Theron, 2010).

As with other forms of financial services, examining laws and regulations in the context of how coops function (and generating more data on this point) could help identify pathways to scale. Coop structures are also grappling with how to adapt to new, more market-based models with incentive structures that appropriately reflect risk (Chambo, 2009), which may also open up other opportunities for financing that area in a way that is better suited to farmers' situations. A number of countries, including Ethiopia, Tanzania, and Uganda have established institutions that are responsible for education and

training. (Theron, 2010). Collaboration between the public and private sectors will be particularly important in assessing how coops can be used to scale seed systems.

Other issues. Greater attention should also be paid to contractual models and approaches to negotiating contracts. Binding, enforceable contracts can be used as collateral, bringing lenders into value chain contracts with farmers and agribusiness companies (IFC, 2011). Reliable contracts under which both parties understand their rights will help facilitate financial services transactions (and all other transactions as well), but in many cases contracts are unbalanced and one party does not understand the terms of the contract, weakening the transaction. Often, farmers do not have access to qualified, experienced legal counsel with understanding of both the sector and market in which they are operating, who can offer services at affordable rates. While legal services are sometimes brought in to assist, deep experience in agriculture and a particular market are important, since agricultural laws and regulations have their own complexities and different legal jurisdictions work in very different ways. Among other things, training lawyers, both within and between countries, and deepening understanding of contractual terms and their context, could help improve legal services and ensure greater financing options for farmers.

Finally, while improving capacity building will have implications across all of the issues discussed in this brief, there is one particular aspect related to adoption and financing. Building the capacity of both financial institutions and companies is an aspect of increasing access to finance that can have a significant impact, and linking capacity building directly to financial transactions has become more common. Financial institutions could benefit from training in how to work with the agricultural industry, and farmers could benefit tremendously from increased capacity in financial literacy, record keeping, and general access to financial services (Making Finance Work for Africa, 2012). In particular, seed business managers must be able to make financial decisions about their businesses, especially because capital requirements can be high, lead times are so long, and sales revenue units are many but small. Greater resources for targeted training from both the public and private sectors, including well-designed extension services, could help adoption reach scale, and different models exist for how to link training with financial services and adoption of improved varieties of seed.

Capacity building that is directly tied to financial services can be beneficial in a multitude of respects. In Ethiopia, for example, widespread adoption of Quncho, a new, high-yielding tef variety, resulted from an approach that integrated institutional, technological innovation, and training and coordination among stakeholders at every stage in the process. The process for release involved farmers and consumers in the decision-making process, from the start through participatory variety selection and participatory plant

breeding. Stakeholder engagement (i.e. research centers, administration at the local and district levels, farmers, farmers' cooperatives, cooperative unions, seed grower associations, public seed enterprises, private agro-processors, and NGOs) and training continued through adoption of the variety. Agricultural extension and training programs were tied to seed loans, which contributed to the adoption of the variety (Assefa et al., 2011). As a result of the success of the program, trials are underway to expand production to neighboring regions and possibly international markets.

Figure 4 – Access to finance: summary of scaling solutions.

CHALLENGES IN ACCESSING FINANCE

SCALING GOAL

Address financing gap, particularly for 'missing middle,' in agriculture and increase farmers' ability to adopt high-quality seed through opening up channels for financing

HOW TO DO IT

- Establish and implement legal and regulatory framework to increase access to finance in the agricultural sector, including through prudential banking laws, financial contract laws, and other procedures to create incentives to invest in agriculture while protecting stakeholders.

COLLATERAL REQUIREMENTS AND RESTRICTIONS ON LAND OWNERSHIP

SCALING GOAL

Ensure equitable access to land ownership and use and provide for clear and simple ways to use land as collateral

HOW TO DO IT

- Establish mechanisms to facilitate use of land as collateral, such as national collateral registries, with clear, publicly-recognized priority interests.
- Reduce cost and number of steps in land registration.
- Provide titles that recognize inheritable use rights.
- Better administer land rights and handle disputes through effective public-private processes.
- Integrate processes to formally recognize customary land tenure systems into the legal and regulatory framework.

ALTERNATIVE APPROACHES TO ADDRESS FINANCE AND COLLATERAL CHALLENGES

SCALING GOAL

Open up other avenues of getting financing to farmers in light of collateral challenges

HOW TO DO IT

- Explore legal and regulatory approaches to create supporting structures or alternative financing models, including establishment of private credit bureaus and leasing financing.
- Strengthen cooperative laws by simplifying registration requirements, relaxing taxation, and examining the needs of different stakeholders and how they are reflected in law and regulation.

5 – Access to markets

Many cross-border trade regimes around the world contain laws and regulations that impact seed trade, and some of these have been discussed above. Many challenges to cross-border trade do arise, however. Laws, regulations, and other government policies and programs, such as those relating to import and export, SPS standards, and customs, will can have an impact on whether farmers can take advantage of the market opportunities that trade can bring (World Bank, 2008).

Historically, many countries have had a period during which imports and participation of foreign seed companies were restricted, e.g. India, Pakistan, Turkey (Pray and Ramaswami, 1991), but opening up to trade has often led to gains in the local market. For example, in 2000, Bangladesh liberalized imports of hybrid maize seed from Thailand and other countries. Yields increased 200%, and production went from 10,000 to about 1 million metric tons in 2009, helping to sustain a rapidly growing poultry industry (Byerlee et al., 2013).

Ultimately, too many restrictions on cross-border seed trade can impact the development of mutually beneficial ties between national, regional and world seed markets. Tariffs or taxes on trade are just one aspect of cross-border trade. While governments sometimes worry that lowering tariffs at the border will have a detrimental effect on revenue collection, fewer restrictions at the border can have positive effects on the domestic market. For example, according to the World Bank, Senegal, which has lower import tariffs and taxes, is more competitive in rice and produces more varieties at a lower cost than some of its neighbors, which apply import tariffs and taxes upwards of 40% (Byerlee et al., 2013). Introduction of new varieties in rice has

generated significant gains for smallholder farmers, who tend to be predominantly women, who can then sell their surpluses (Kane, 2013).⁸

Transport and distribution

In many markets, weak transport infrastructure, including the legal and regulatory system supporting transport, tends to be a significant factor in how far and fast seed can move. Delays in transporting food and agricultural inputs can be extensive and can lead to spoilage, additional warehousing or port payments, and the need to maintain extra inventory. It is often assumed that delays in transport are largely a result of weak infrastructure networks, but, in fact, legal and regulatory bottlenecks and poor trade facilitation account for a significant portion (up to 75%) of transport delays (Harmon, Simataa and Van der Merwe, 2009).

Access to transport services is one of the most critical aspects of the agricultural value chain and has a direct connection to laws and regulations. Transport services can cover a range of activity (including rail, air, road, pipelines, and trucks), all of which are often heavily regulated and can be critical to agricultural development. Agricultural goods are highly responsive to quality of transport services, with a 10% improvement in transport and trade-related infrastructure expected to increase agricultural exports of developing countries by 30% (Moisé et al., 2013).

Transport services often face restrictive regulation, and transport cartels and monopolies are still common across sub-Saharan Africa. Lack of competition can drive up transport costs and cut into profits for smallholder farmers. In addition, incentives to invest in modern trucking and logistics are not always strong enough to encourage adequate private sector activity. For example, countries in West Africa may be able to halve their transport costs within 10 years if they adopt policy reforms that spur more competition within the region (Brenton et al., 2012).

How the transport sector is regulated within countries and across regions can make a significant difference. According to a recent World Bank report, 'the critical issue [in improving transport] is regulatory reform that delivers more modern and competitive transport services' (Brenton et al., 2012), supporting the contention that regulation of transport services is a factor that should be considered in the context of scale.

A number of other legal and regulatory issues impact the ability to establish efficient seed delivery systems. Limitations on trucking and movement along

8 In 2010, a Feed the Future initiative introduced a high yielding rice variety in southern Senegal, a lowland region where irrigation is sparsely available. This new variety, called New Rice for Africa (NERICA), was developed in Cote d'Ivoire, and offers yields of 4 tons per hectare, four times the yield of traditional varieties. The number of producers using NERICA seed increased from 112 in the pilot group to over 7,000 by 2012 (Kane 2013).

roads, multiple checkpoints along transport routes, and other issues are well chronicled. Roadblocks are also often cited as one of the most significant non-tariff barriers to trade. This is especially true for agricultural products where delays can lead to spoilage and crop loss. On August 22, 2013, the Transport Minister of Tanzania, Dr. Harrison Mwakyembe, announced plans to reduce the number of checkpoints on Tanzanian roads, with the goal of reducing the number of checkpoints to three per road in order to ease truck transport (Kisanga, 2013). The solutions to overcoming these challenges are becoming more and more evident, and a number of good examples exist in the focus countries and more broadly. These measures are discussed in greater detail below in the context of trade facilitation.

Good distribution networks are also an essential component of moving seed within countries, and, again, this is an area covered by laws and regulations that relate to how well seed systems function and can be brought to scale. Senegal has focused considerably on its distribution network, and over 400 distribution centers (seccos) were already available to farmers in the mid-1990s. In neighboring Niger, despite its relatively large size (more than six times the area of Senegal), only twenty centers existed. Based on survey results, this difference in formal seed distribution networks contributed to disparities in seed availability. A Senegalese farmer would have to walk an average of 12km to purchase seed, while a farmer in Niger would have to travel an average of 62km (Ndjeunga et al., 2006).

Sanitary and phytosanitary standards

SPS regulations are also a significant factor in cross-border trade. Weak implementation of SPS measures can contribute to significant increases in the price of food staples, increasing costs between 12% and 25% or even significantly higher in some cases (Moïsé et al., 2013).

Controls will include testing at the border, strict requirements for SPS certificates, and post-entry quarantine measures. ISTA certification is often needed for cross-border trade. While global SPS harmonization is not likely, with significant differences in countries' SPS regimes, one of the more significant issues that can be addressed is increasing coordination and predictability in the *administration* of SPS systems between trading partners. This can include greater certainty in how testing will be done at the border, notification or release of test results, risk profiling, simplification of paperwork, and outsourcing to qualified labs.

Lack of capacity and personnel to implement SPS standards can be a significant factor, and addressing this gap can be an element in reaching scale. Some countries have addressed this challenge through better internal coordination. For example, under its National Agricultural Standards Development Plan, China set up agricultural product quality inspection centers

around the country to streamline the SPS inspection process, and simplify the previous system of administration which involved ten government ministries, each with its own standards (Dong and Jenson, 2004). Such measures can improve administration of the system overall, simplifying trade both within a country and across borders.

A number of regional harmonization efforts in seed have been discussed above. Issues also still tend to arise around SPS and related processes. For example, many countries do not consistently recognize the inspection processes and SPS regimes of neighboring countries, despite regional trade agreements requiring this type of treatment (World Bank, 2008). Permits for seed export and import are often not routinely granted, due only in part to SPS controls, but SPS issues could be dealt with to achieve significant gains at the regional level. For example, in 2010, Malawi implemented a risk-based inspection regime and post-destination clearance program for pre-approved traders that have reduced delays in clearing goods (World Bank, 2013).

There are improvements underway, however, such as the COMESA Green Pass, a commodity-specific SPS certification scheme that was initiated in 2009 to facilitate the movement of food and agricultural products. Clear guidelines for putting the Green Pass system into practice have not yet been developed, which has hindered its implementation. COMESA is seeking support from the Standards and Trade Development Facility to conduct a study on how to operationalize the system (FAMIS, 2012).

Farmers and seed companies in the region have a great deal to gain from regional harmonization in SPS. Options might include getting experts together to pare down the list of pests and diseases for which controls exist to include only those that: '(1) exist in some of the countries but not in others; and (2) represent an economic threat. When this is done, seeds for many crops [could] be moved from one country to another without phytosanitary certificates, while seed for other crops [could] be traded with phytosanitary controls for a reduced list of realistic threats' (Gisselquist, 2001).

Knowledge of regional requirements is another crosscutting issue, and many businesses simply do not know enough about the existence or content of the regional requirements they must meet. In many cases, regional authorities also do not have the information they need to fully implement standards or comply with international best practices. In both cases, better data could be collected and disseminated, including through technological solutions.

Regional harmonization efforts are encouraging and could present significant opportunities for scaling seed systems throughout sub-Saharan Africa. Implementation challenges have come up in all cases, however, and additional efforts will be needed by both the public and private sectors to make sure these programs work in practice.

Trade facilitation

Trade facilitation has also become an area of increasing focus, particularly at the regional level. Trade facilitation efforts between countries are often across borders and increase cooperation between neighboring countries with regard to border measures. Some helpful practices have evolved, such as single-window border crossing systems and data streamlining that are helping facilitate the efficient movement of seed across borders.

Delays at the border caused by complex and sometimes inconsistently applied customs procedures can greatly inhibit the ability of farmers to access seed. Numerous checkpoints along the transport routes that connect landlocked countries to ports contribute to delays, running up costs and hampering trade (Kuhlmann and Ritterspach, 2011). An additional day's delay due to transport and customs issues can cause exports of time-sensitive agricultural goods to decrease by 7% (Christ and Ferrantino, 2009).

Border crossings are excessively complicated. Interestingly, a recent World Bank study notes that trader organizations have been a particularly effective way to press for easing border crossings. In Ghana, a grain trader association negotiated with border officials to adhere to border regulations in return for expedited border crossing procedures for its trucks (Byerlee et al., 2013).

Axle load regulations, which often differ among countries, are increasingly being addressed regionally. In May 2013, the East African Legislative Assembly (EALA) passed a bill to restrict vehicle overloading and reduce transport costs by harmonizing axle load regulations (with a maximum axle load limit of 56 metric tons) in all five states of the East African Community. The EAC estimates that businesses and governments in the region will save one billion US dollars annually as a result (Otthieno, 2012).

Successes have been recorded, and incremental improvements can sometimes have a big impact. For example, at the Kabanga border crossing, which separates Burundi from Tanzania, working hours for officials on both sides have been synchronized. Burundi has also improved communication systems between authorities at the border posts and in the main customs office in Bujumbura (World Bank, 2012). The EAC and COMESA have agreed to develop a common transport policy, although national policies will need to be changed accordingly.

Many countries in sub-Saharan Africa are taking steps to streamline border-crossing procedures, including through One Stop Border Posts (OSBP), making them more efficient and less susceptible to inconsistent application. The EAC recently implemented the OSBP model to facilitate regional trade. The Malaba border post, which separates Kenya and Uganda and lies along the Northern Corridor route to Mombasa, was the first OSBP project in the region.

Joint railway border posts were initiated in 2006, and road transport reform began in 2008. Survey results show that average crossing times dropped from 24 hours to under four hours; prior to the reforms, over half of the containers and trucks crossed in 48 hours or more, whereas after the reforms all trucks but one crossed in under six hours (Fitzmaurice and Hartmann, 2013).

Another OSBP was established along the Northern Corridor on the Uganda-Rwanda border, at Gatuna-Katuna in 2010. In 2012, the Rwanda Revenue Authority (RRA) and the Uganda Revenue Authority (URA) signed an agreement to implement joint surveillance at the border post, and savings are estimated at US\$4 million (Mugisha, 2012).

The electronic single window system (ESW) is another tool that can be used to facilitate border crossing. ESW allows traders to submit documents to a single location online before reaching the border. As a result, traders do not have to go to a multitude of offices to attain the permits and licenses they need, and less time is spent at the border with less paperwork, making operations more efficient, transparent, and predictable.

In August 2012, the Rwanda Revenue Authority (RRA) implemented the Rwanda ESW, an electronic clearing system designed to streamline the import process. The system allows traders to submit documents online through a webpage accessible by the key stakeholders: the RRA, the Rwanda Development Board, the Ministry of Health, the Bureau of Standards, and Magasins Generaux du Rwanda (MAGERWA). The Rwanda ESW uses the Asycuda World platform, a customs and border management system developed by the United Nations Conference on Trade and Development (UNCTAD) (Ojulu, 2012).

Figure 5 – Access to markets: summary of scaling solutions.

TRANSPORT AND DISTRIBUTION	
SCALING GOAL	Reduce time and cost to market and increase competition through better transport and distribution services
HOW TO DO IT	→ Improve regulation around transport and distribution services, with a focus on encouraging market entry and competition.

TRANSPORT AND DISTRIBUTION

SCALING GOAL

Simplify and harmonize regional administration of sanitary and phytosanitary standards (SPS) to improve access to markets

HOW TO DO IT

- Streamline regional standards and improve SPS administration, (e.g. by implementing measures to reduce the list of regulated pests and diseases at the regional level).
- Cross-reference with improvements in regional variety release systems (discussed above).

TRADE FACILITATION

SCALING GOAL

Reduce cost and time for crossing borders through improved trade facilitation

HOW TO DO IT

- Strengthen customs laws and regulations, and their administration, including by synchronizing working hours for customs officials.
- Standardize axle-weight requirements within regions, and implement common transport policies.
- Shift to electronic enforcement measures to increase predictability, such as the Electronic Single Window system.
- Increase efficiency through One Stop Border Post approaches that can reduce paperwork and red tape.

6 – Conclusion

All of the legal and regulatory issues discussed above are part of the intricate system for bringing seeds to market, getting them to farmers, and moving them within markets. While these issues are distinct and involve different considerations as laws and regulations are developed and applied, all elements of the legal and regulatory system of a country or region must work together.

Better understanding of the systemic aspect of seed laws and regulations, as well as deeper dives into the different specific, often very technical areas that make up this system, is something that deserves further analysis. Generating more data on current legal and regulatory systems, challenges with implementation, and the market costs and benefits that should underpin legal and regulatory decision-making would be of tremendous value.

As noted at the outset, true public-private collaboration can help develop effective legal and regulatory systems in an ongoing, real-time way that neither the public nor private sector could do alone. Better mechanisms for

collecting and sharing data between public and private stakeholders, as well as other stakeholders who work to help facilitate this connection, could be one critical aspect of bringing legal and regulatory systems to scale. Ultimately, laws and regulations can play a tremendous role in how well markets work, and the issues discussed above will be important considerations as seed systems are improved and brought to scale.

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