FDI Restrictions in the Indonesian Horticulture Sector: Implications of Horticulture Law No.13, 2010

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Chapter 1 Introduction

As Indonesia's population and incomes continue to grow at a swift pace, the demand for horticulture products is expected to follow suite. In light of this, the media and the government are growing increasingly concerned about instability and inefficiency in horticulture markets. To help stimulate growth and stabilize the horticulture sector, Indonesia introduced the Horticulture Law No. 13 in 2010 which had numerous provisions to increase regulation on the seed industry in particular. The most controversial of these provisions is the clause that regulates foreign direct investment. This investment provision restricts foreign equity in the horticulture sector to 30% for large firms, and 0% foreign ownership for all firms that are small to medium in size. This is largely believed to be motivated by a protectionist agenda aiming to protect the emerging domestic industry from the large multi-national companies.

Debate around the impact of the FDI restriction focuses around how the horticulture seed industry will react to this provision. The seed industry is an important stakeholder in the horticulture sector that drives the development of new innovations in the sector, but it is still to a large extent controlled by foreign companies, notably the Netherlands and the US.[1] While divestment by foreign seed companies could pave the way for domestic firms to rise, it also paves a way to significant disruption in the sector that could impede growth for years to come: the reduction in R&D driven by foreign equity, limiting access to proprietary genetic resources, and reduced private sector extension and marketing services. The success of the FDI restriction will ultimately hinge on the ability of domestic industry to fill in these key roles of foreign MNCs and foreign equity partners. However, the capacity of domestic industry to fill these roles appears to be lacking in many ways. One of the primary objectives of this study is to uncover how the FDI restriction will affect these key players and how it will affect the horticulture sector in terms of production technology and trade.

Studies on the impact of FDI in the horticulture sector are limited, and the few existing studies present somewhat conflicting results. Studies in India and Kenya found that less-restricted FDI policies are generally beneficial to the horticulture sector. Indonesian stakeholders (farmers, agriculture associations) appear to side with less regulation and have

[1] Source: http://www.thejakartapost.com/news/2014/04/07/editorial-the-seeds-development.html

petitioned a judicial review of the Horticulture Law to the Constitutional Court.[2] On the other hand, reports commissioned by the government, unsurprisingly found that FDI restrictions are helping development in the sector, citing a spike in the registration of varieties and domestic firms since the 2010 Horticulture Law was enacted.

The aim of this study is to synthesize different sources of information and analyze how the FDI restriction will impact the horticulture sector in Indonesia's unique context. This study will attempt to contextualize the findings from other countries, identify the likely consequences of FDI restriction on production technology and trade in Indonesia, and provide a set of simple salient points that can be used to inform the ongoing debate in Indonesia.

The method used consists of both analytical and qualitative work using secondary data and Focus Group Discussion. We approach the analysis of FDI on the horticulture seed industry in two components:

(1) A Review of existing knowledge as it relates to:
    a. International experience in the development of horticulture seed and planting material industry
    b. International experience in regulating FDI in the horticulture sector, specifically the seed industry

(2) Analysis of Indonesia's seed industry and the impact of FDI restriction
    a. Market concentration in the seed industry
    b. The role of FDI in the seed industry
    c. The potential implications of FDI restrictions
    d. Considerations for policy and program support

[2] Source: http://www.eurocham.or.id/index.php/about-us/news/140-restriction-on-foreign-investment-in-horticultural-seed-sector-is-constitutional

Chapter 2 Global Trends and Roles of FDI in Horticulture Sector : Lesson Learnt from International Experiences

This section presents lessons and insights from the development of vegetable sectors in peer counties, focusing on how FDI shapes the horticulture industries.

The general lessons against limiting FDI relate to:

(i) restricting FDI deprives domestic vegetable producers access to better quality seeds with higher sprouting ratios, shorter harvest times, higher outputs and higher profits;

(ii) restricting FDI tends to limit domestic seed companies access to innovative practices in plant propagation, plant breeding and biochemistry;

(iii) restricting FDI means the public and private research community may be deprived of access to key intellectual property, innovative technologies, scientific knowledge and training in new research capabilities for Indonesian scientists, public research centres, universities and companies;

(iv) restricting FDI can result in a less competitive domestic seed industry and lower overall quality and variety of crops, leading to higher horticulture imports and higher prices for Indonesian consumers;

(v) foreign seed companies will transfer their capital, research and knowledge to other ASEAN countries that are encouraging foreign investment, public-private partnerships and providing incentives to transfer research and biotechnology knowledge locally (eg, Viet Nam, India.

(vi) even those countries with the most liberalized seed trade and FDI have high proportions of saved seed relative to replacement seeds. The amount of saved seed depends upon several factors, including type of seed (varietal or hybrid), size of farm, ease of storage, disease and pest complex, and farmer's expertise. Farmers save seed for a variety of reasons, such as low cost, familiarity, performance under local conditions, and preferred attributes other than yield. Farmers purchase new seed from the market if they want to replace their variety or, for instance, the seed stock has deteriorated as a result of contamination.

(vii) two key horticultural policy issues requiring attention in Indonesia together with the FDI law are: (i) best practice and tradeoffs in seed registration procedures and

for seed development and certification systems (Registering seeds is complex and a long process, taking up to 1.5 years in Indonesia. Seeds do not need to be registered in Thailand and the Philippines); and (ii) seed import licensing procedures tend to be bureaucratic, complicated and favour a handful of business who are able to use their licenses to great private advantage,

2.1. Global trends in seed industry development

Accelerating development of the horticultural sector has been driven by population growth, urbanisation and increasing consumption of vegetables and fruits, which in turn has increased the demand for good quality horticulture seeds (Ayana et al. 2014). Estimates suggest that high quality seeds are needed by over 2.5 billion smallholder farmers that manage more than 500 million farms around the world to increase production, nutritional quality and adaptation to climate change (Tutwiller 2016).

The seed chain includes three core components; (i) research and plant breeding; (ii) seed multiplication, and (iii) marketing and distribution. The market value of the seed chain has increased three times between 2000 and 2014, reaching around USD $50 billion. The global seed market is highly concentrated and mergers and acquisitions is a major growth strategy of the global seed companies. North America and Europe account for more than 50% of the global market (Mordor Intelligence 2015).

Today, three companies, Bayer-Monsanto, ChemChina-Syngenta, and DowDupont, control and sell around 59 percent of the world's patented seeds and 64 percent of all pesticides: an oligopoly market on a global scale. The global concentration in agricultural inputs is not limited to seed companies. The 10 largest pesticide firms control 90% of the global pesticide market, 10 companies control 76% of the animal pharmaceutical sales, and 10 animal feed companies control 52% of the global animal market (Liano et al 2016)

The industry consolidation and potential penetration into domestic markets raises challenging public policy issues for emerging economics, including the role of FDI as well as how to address trade-offs between competition policy, equity, efficiency, productivity and the broader national goals of food security, biodiversity, sustainability and climate change.

It is not clear how the on going consolidation will affect smallholder access to the agricultural innovations. Smallholders tend to be cautious about adopting improved seeds due to higher costs, lack of access to seed sellers, lack of information about the benefits of improved seeds or other risks (IFPRI 2016). A 2016 IFPRI study examined how global and regional seed companies dealt with the smallholder seed adoption issues issue in four regions (Latin America, western Africa, eastern Africa, and South and Southeast Asia). The study finds that private sector commitment to increase access of improved seeds to smallholder farmers is strong, however, the presence of those foreign and regional companies does not necessarily mean that the seeds are actually accessible to farmers.

Additionally, farmers also need to be facilitated by knowledge, finance, markets and supportive policy both for farmers and seed companies (Tutwiller 2016). Therefore, this calls for a strong government policy that regulates both foreign and domestic investment in a way that improves smallholder farmers' access to improved quality seeds to increase farm productivity and finally to increase farmers' incomes.

In general, the seed industry operates differently in the higher income countries compared with the emerging economies. For example, research and development, seed multiplication and the marketing and distribution activities are more commercial operations in the high-income countries.

In the emerging economies, research, plant breeding and marketing/distribution (extension) tends to be carried out by the public sector and by farmers' themselves (farmers' seed systems). Scientific plant breeding is and has been a public sector responsibility. Plant breeding is viewed as a public responsibility, a pathway and contributor to rural development, poverty reduction and national food security. Similarly, seed production and distribution systems are mechanisms for technology transfer rather than commercial operations.

More recently, some countries, including Indonesia, have stimulated commercial seed supply through encouraging public private partnerships and the development of domestic seed enterprises, opening up their seed markets to foreign investors. For example, unlike horticulture, Indonesia encourages FDI in three of its five highest priority crops, rice, corn and soybeans. Two of the world's largest multinationals, Bayer/Monsanto and Syngenta continue to expand in Indonesia. Bayer/Monsanto enlarged its Crop Science plant in Surabaya (seeds and crop protection) in 2015, establishing a new Seed Growth Center. The

Seed Growth Centre enhances corn seeds with plans to include rice seeds (Bayer, 2016). The crop protection technology focuses on producing varieties more resistant to diseases and extreme weather and aims to extend seed distribution to ASEAN countries.

Syngenta opened a new corn seed processing plant in Pasuruan, East Java in 2011. The initial investment was US$26 million with the capacity to process 5,700 metric tons of seeds. Syngenta reports that 'the Center contracts more than 15,000 farmers, who supply corn for processing. The processing plant estimates that participating farmers' net incomes will increase by 12-16%, as compared to what they would receive for normal commercial planting of corn and rice.' Brawijaya University (2016) reported that Syngenta interviewed 250 agricultural undergraduates for 100 new positions for the corn processing plant.

Seed Sector Trade in ASEAN

During 2009 to 2014, seed imports in ASEAN countries increased by 59% to $263.3 million, with Vietnam ranking as the top importer with a total of $85 million, ahead of Thailand ($39.8 million) and the Philippines ($38.5 million). However, Myanmar's import figures were exceptional, as they increased dramatically from $1.1 million to $18.1 million between 2009 and 2014; Malaysia also had spectacular import growth during the same period, with imports in 2014 trebling from 2009 to $16.7 million.

The ASEAN countries themselves provide seeds for the region, with the exception of the Philippines, which imported nearly $17.3 million worth of maize seeds from South America and $8.6 million from South Africa. The top crop group imported by ASEAN countries was maize seed, worth $107.5 million, an increase of 31% from 2009; in second place were vegetable seeds, which increase by more than 68% to $71.7 million.

Of the $156.6 million of imported seeds in Asia, 66% came from ASEAN countries, which was eight percentage points higher than in 2009 (58%). Thailand was the leader in the ASEAN market with $86.3 million in seed revenues, considerably ahead of Indonesia ($5.4 million) and the Philippines ($4.8 million). The USA supplied 8.2% of the ASEAN market for seeds, just ahead of Argentina (7%), South Africa (3.8%) and the Netherlands (3.2%).

Indonesia has experienced significant seed import growth – imports jumped by 54% to reach $22 million in 2014 and were mainly composed of maize seeds (33.5%) and vegetable seeds (31%), followed by cereals (11.5%) and potato seeds (9%). Like most of the countries in ASEAN, Indonesia sourced most of its imported seeds from Asia (71%), with ASEAN providing 67%, followed by the USA (14%), E.U. (9%) and Oceania (6%). The ASEAN group represented 48% of imports, which were dominated by Thailand's 69% market share, which covered 83% of maize seed needs. Japan dominated the market for vegetable seeds with a 49.4% market share, substantially ahead of Thailand (14%).

Viet Nam's imports have been growing steadily. Imports increased from $44.5 million to $85 million between 2009 and 2014, making this country the top seed importer in ASEAN. Vietnam sources most of its seeds in Asia (83%), with 60% coming from ASEAN countries. The USA supplied 6% of Vietnamese seed demand, the EU 5% and Oceania 4%.
Some 54% of Vietnam's maize seed imports came mainly from Thailand (82%); vegetable seeds were around a fth (19%) of the country's imports and were provided by Thailand (39%), New Zealand (12.5%), Italy (12%) and China (11%). The USA supplied 96% of Vietnam's soybean seeds.

Seed imports to the **Philippines,** a country that is sensitive to adverse climatic conditions, fluctuated signicantly between 2009 and 2014 - - declined by 41% in 2011 ($37.6 million) and 2013 ($33.2 million), but rebounded by 58% in 2012 ($55.3 million) and 16% in 2014 to $39 million. Of all the ASEAN countries, the Philippines is the only one to import from largely outside Asia: 44% of its seed needs came from South America, 22% from South Africa, 21% from Asia, and 9% from the USA.

China, Japan and India are the seed distribution hubs for Asia. These three countries import mainly from third countries to re-export to the Asian market. They take 65% of all seeds imported into Asia. China is the leading seed importer in the region, importing $286 million of seeds in 2014. China is also the leading seed exporter, ahead of Thailand, India and Japan, with seed revenues of $292 million.

Source: Adapted from Asian Seed Vol 22, No 2, Mar/APR 2016 by Marie-Pierre Debrabant The figures are from UN Comtrade, Eurostat and USDA database.

Seed Imports from ASEAN

COUNTRY	SUPPLIERS								
	WORLD	ASIA	NAFTA*	OTHER AMERICA	EU	OCEANIA	OTHER AFRICA	MIDDLE EAST AND NORTH AFRICA	OTHER EUROPE
VIETNAM	71,924	**59,852.20**	4,766	710	3,448	2,982	164	2	
THAILAND	34,164	**18,918.90**	4,409	1,539	5,353	3,490	441	13	0
PHILIPPINES	33,077	**6,868.20**	2,923	14,418	557	539	7,371	400	2
INDONESIA	18,615	**13,186.00**	2,652		1,632	1,145			
MYANMAR	15,291	**14,878.80**			294	118			
MALAYSIA	14,204	**8,341.00**	2,656	8	2,385	723	42	49	
SINGAPORE	8,128	**7,090.70**	257	51	561	157	2	8	2
CAMBODIA	2,402	**2,162.40**		221		5	14		
LAOS	2,084	**2,071.90**			9	3			
BRUNEI	267	**166.6**	62		6	33			
TOTAL	**200,156**	**133,537**	**17,724**	**16,946**	**14,245**	**9,194**	**8,035**	**472**	**3**

Thousands of US dollars
Source: Debrabant, 2016

ASEAN Partners

COUNTRY	PARTNERS								
	THAILAND	INDONESIA	PHILIPPINES	VIETNAM	MALAYSIA	MYANMAR	SINGAPORE	LAOS	TOTAL
VIETNAM	42,504	902	67		3	152			**43,626**
MYANMAR	14,613				9				**14,622**
INDONESIA	6,114		1,168	2	1,593		13		**8,889**
MALAYSIA	4,015	937	970	436			14		**6,371**
THAILAND		1,556	1,841	2,011	1	872		31	**6,312**
PHILIPPINES	2,689	783		52					**3,524**
CAMBODIA	1,571	1		411	161		6		**2,150**
LAOS	1,445								**1,445**
SINGAPORE	349	475	13	70	243				**1,151**
BRUNEI	43	12		1	51		20		**126**
TOTAL	**73,342**	**4,665**	**4,059**	**2,983**	**2,060**	**1,023**	**52**	**31**	**88,216**

Thousands of US dollars
Source: Debrabant, 2016

2.2. Roles of FDI in the Development of Horticulture Sector

The wide variation in how seed industries evolve, the variation in local institutions and farming systems makes it difficult to draw clear lessons. The examples presented here do demonstrate a wide range of approaches from India, allowing 100% FDI in horticulture to the Philippines which maintains a constitutional limit of 40%.

Studies specifically addressing on the role of FDI in the horticulture sector are few. The two main over-arching studies on the issue in recent years have concluded that FDI benefits for the sector. Kolady et al. 2012 find that seed market liberalisation and strengthening legal protection on intellectual property rights is able to encourage private investment in the agricultural sector. A simulation exercise conducted by Derwishch et al (2010) finds that sustained FDI would boost private sector development both for national and international companies. Increasing investment in plant breeding and production seed generates a higher production that pushes demand that in turn generates higher income that is re-invested again in input for other variety development. Without FDI inflows, the domestic private sector is disadvantaged relative to the domestic sectors of other countries that encourage FDI (Derwishch et al 2010).

India

India has the most dynamic private seed sector in peer country examples presented here. India allows 100% FDI in its seed sector, including the participation of MNCs. India has grown and diversified without benefit of any IPRs but in the context of quite liberal seed laws and in many cases through the use of hybrids as a means of appropriation. After China, India is the second largest vegetable producer with production more than doubling over the past two decades. An estimated 75% of vegetable production is from saved seeds with notable variations. For example, cabbage, okra and tomato have seed replacement rates of more than 90%, chillies and cauliflower more than 80% (Koundinya and Kumar 2014)

Vegetable seed production is dominated by the private sector, which largely produces proprietary hybrids (including some imported seed) but also some public hybrids and OPVs. More than 40% of the total seed market is private. Export and import restrictions are limited to specific cases, including onions and wild varieties (DAC 2017)

The number of private companies engaged in seed production or seed trade ranges from 400 to 500 (DAC 2017). The main focus of private seed companies is high value low volume seeds. The public sector seed corporations dominate the market for low value high volume oilseeds, pulses and cereal seeds. In the case of vegetable seeds and planting materials of horticultural crops, the private sector is the dominant player. In 2012, India become the third ranked seed exporter in Asia, ahead of Japan as seed exports tripled to $152 million between 2010 and 2014 (Debrabant, 2016).

Viet Nam[3]

Viet Nam is the world's third largest vegetable producer after China and India. Viet Nam allows FDI, with approvals and equity restriction caps for some industries. At present, more than 600 companies produce and trade in seeds. The foreign companies have around an 80% market share of purchased seeds. Around half the vegetable production is from saved seed.

More than 50 countries have FDI activities in agriculture. Chinese Taipei, Japan, China, and Thailand are top investors with capital registered accounting for about 60% of FDI in agriculture. By 2014, Chinese Taipei accounted for 36% of the number of FDI projects in agriculture and 20% of the value of investment. Top investors in agriculture also include Thailand (11% of investment value), British Virgin Islands (10%), Singapore (10%) and Hong Kong (8.%). These statistics tend to underestimate the level of investment from European and North American investors, many of which
(e.g. Coca-Cola, Procter and Gamble, Unocal and Conoco Phillips) licence their investments through third countries.

As of 2011, there were 240 companies in seed marketing and distribution, 76 crop variety centres (government), and 99 other business units for a total of 415. The large foreign companies include Syngenta (crop seeds, and the largest foreign maize seed supplier), Bioseed Research (hybrid maize), CP Seed Company (hybrid maize), Ease West Seed (VN) Company, and representative offices for Monsanto Thailand (maize), Siminis Vegetable Seeds, Nong Huu Seed Company and Bayer.

Eight multinational companies are involved in the seed businesses in Viet Nam. Among major domestic firms, Vinaseed (NSC) and Southern Seed (SSC) are the two dominant firms, both SOEs/joint stock companies and the only ones listed on the domestic stock exchange.

Seeds are typically sourced from domestic seed companies, government seed stations, farmer groups, co-operatives, and imports. The seed companies and seed centres distribute seeds to farmers through private agents (80% of total seed sales), co-operatives and the agricultural extension system, shops in seed stations, and other companies' branches (Nguyen Trung Kien, 2012).

Seed prices are market determined. The 2015 OECD review of agriculture study concludes that private domestic investment in seed production occurs and imports are

[3] The information presented here is from two sources: OECD's Agricultural Policies in Viet Nam 2015 and Agronews.

common. Quantitative import restrictions are limited with lists of approved varieties. Judging by the degree of import penetration in hybrid seed varieties, the border restrictions are minor, or are easily bypassed.

Seed imports are significant, especially of hybrid seeds, including 70-80% of hybrid seeds for rice, vegetables, and maize (Nguyen Mau Dung, 2013). Vegetable seeds originate in Thailand, China, Japan, Korea and France. Vietnamese imports have been growing steadily for many years. Imports increased from $44.5 million to $85 million between 2009 and 2014.

Viet Nam is today's largest ASEAN seed importer. Vietnam sources most of its seeds in Asia (83%), with 60% coming from ASEAN countries. The USA supplied 6% of Vietnamese seed demand, the EU 5% and Oceania 4%. Vegetable seeds accounted for roughly 20% of seed imports in 2014, with Thailand providing (39%), New Zealand (12.5%), Italy (12%) and China (11%).

The Philippines

The Philippines' constitution limits FDI to 40%. In contrast to other Southeast Asian countries with sectoral legislation or investment laws controlling FDI, having FDI limits enshrined in the constitution mean investment barriers are much less flexible and reform more difficult (OECD, 2016). OECD's recent Investment Policy review of the Philippines considers that the country is lagging in both foreign and domestic investment compared with its neighbors, Cambodia, Lao, Myanmar, and Vietnam, trending towards liberalizing.

The report suggests that FDI reform should 'not aim to give foreign investors special treatment, but a strong argument can be made that removing barriers to foreign investment in the Philippines could help to address issues of underinvestment by domestic firms through the impact that foreign investors might have in improving overall investment climate.'

On the other hand, The World Bank's 2016 report, 'Enabling the Business of Agriculture,' names the Philippines as one of the top performing countries for seed registration procedures and for seed development and certification systems[4]. The Philippines does have good seed laws in place, including best practice for variety release and

[4] The study's seed registration indicator measures the efficiency of registration, including the variety release committee procedures, the content, availability and frequency of the variety catalogue updates and the time and cost to register a new variety. The seed development and certification indicator measures the protection of plant breeders' rights, the access to initial classes of seed and germplasms, the licensing systems for public varieties and additional testing requirements for materials imported for research and development.

transparency and efficiency of seed registration and seed certification activities (World Bank 2016). The Philippines supports private sector initiatives in the seed systems.

Chapter 3 Structure and Performance of Indonesia's Vegetable Seed Industry

3.1. Market concentration in the seed industry

Foreign multinational companies have important roles in Indonesian seed industry. They accounted about 70% of seed sale in Indonesia. Two foreign companies, i.e., PT. East West Indonesia and PT.Bisi International had the largest market share on horticulture seed sales with the share 44.90% and 24.90%, respectively. Another foreign company that also dominated seed sales in Indonesia was PT. Syngenta with the share about 4.02%.

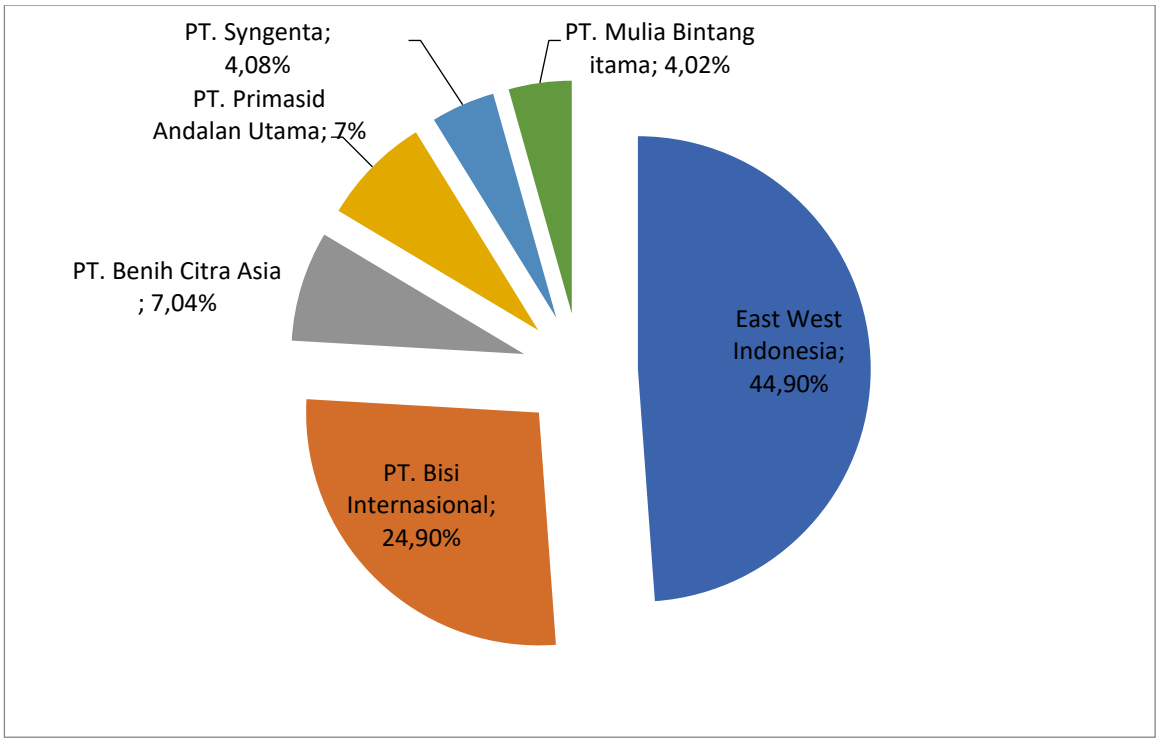

Figure 3-1 Share of Seed Companies on Seed Sales in Indonesia 2011 (Pambudi 2012)

However, the domination of the sales by foreign companies did not apply for every single commodity (see Figure 3.2). Two foreign companies, i.e., PT. East West Indonesia and PT. Bisi International dominated the seed markets for cucumber (45.25%) and water spinach (56.53%). Meanwhile, for tomato and chilli commodities, the seed markets were dominated

by domestic companies PT Benih Citra Asia with the share 58.73% and 38.8%. As such, it is difficult to generalize the roles of foreign companies across all commodities. The analysis for general horticulture products will be much more complicated considering the size of foreign versus local companies. In 2014 the number of foreign seed companies and domestic companies were 16 versus 49 companies (See Appendix 1). However, the majority

of domestic companies consisted of small and medium companies[5] while the foreign seed companies were dominated by large size companies with significant levels of investment in research, production and marketing.

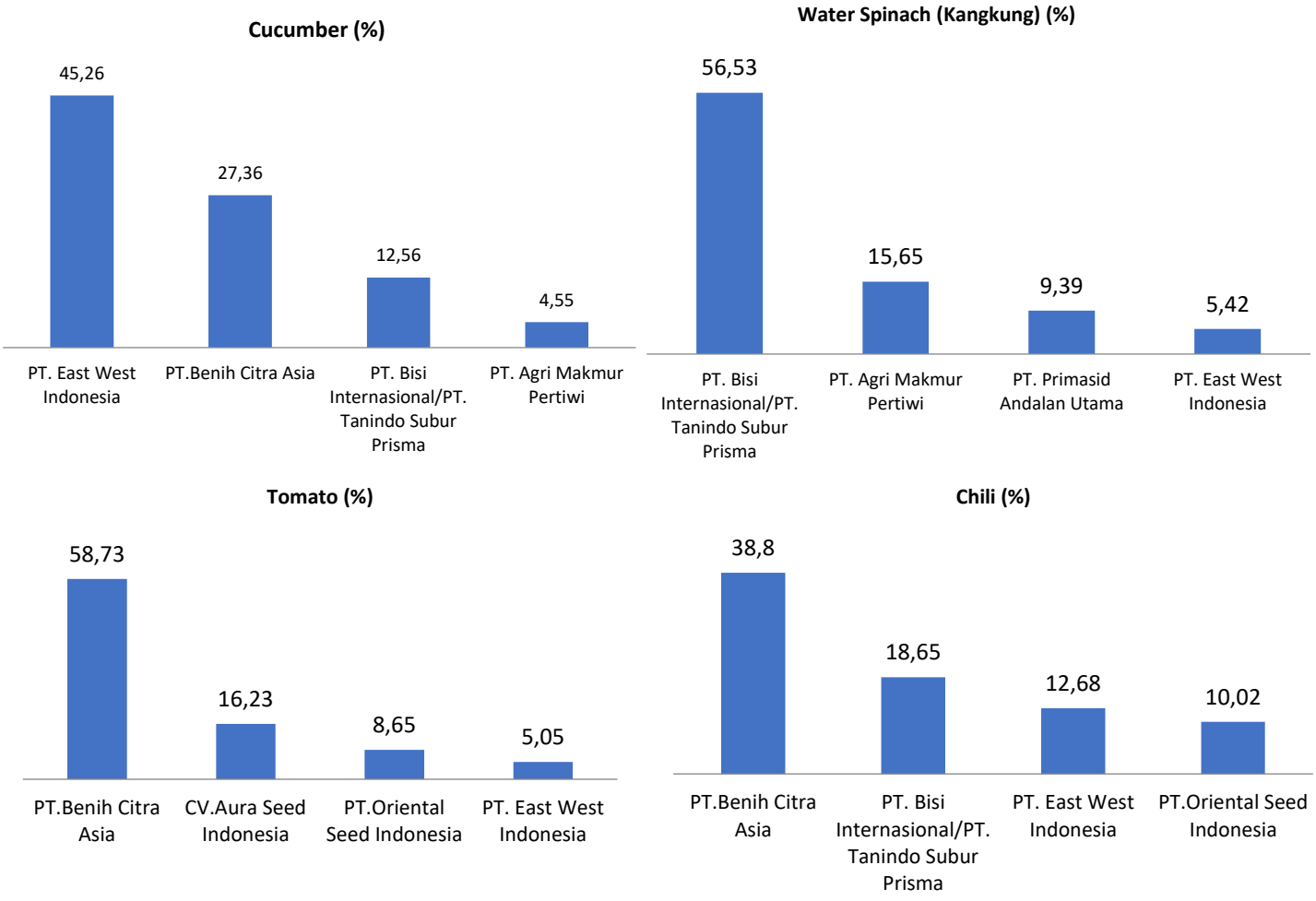

Figure 3-2 CR4 for Cucumber, Water Spinach, Tomato and Chili Seed in Indonesia (Sayaka 2014)

[5] Only a few of domestic companies include as larger size companies such as PT. Benih Citra Asia and PT. Agri Makmur Pertiwi

3.2. The role of FDI in the seed industry

In order to produce and bring high quality seed to farmers, there are four main aspects conducted by seed companies: (1) forecasting market demand, (2) breeding traits, (3) producing seed, and (4) seed marketing and extension. Domestic and foreign companies might differ in these aspects.

Forecasting market demand

Market demand for horticulture products provides signals to the seed companies about what kind of seed should be produced; therefore, farmers can fulfil the needs of their customers. As we know, the demand for horticulture seed is a derived demand, based on the consumer demand for horticulture products. As such, it is important for seed companies to produce seeds that can fulfil consumer expectation (i.e., high quality, size and good taste). For example, currently consumers prefer to seedless watermelon and this information should be accommodated by seed companies in order to win the competition in watermelon market. Identifying consumer expectation requires a careful study of the market (consumer behavior). Based on FGD results, foreign companies have utilized the value chain approaches to recognize the expected values of consumers and use them as the guidance in seed productions. Similarly, big domestic companies have utilized value chain approaches to forecast market demand. Because of capital constraint, small scale companies do not consider consumer expectation on horticulture products (the demand side of horticulture products). Some small scale companies only consider the need of farmers living around the company areas; so they tend to utilize information from local farmers with respect to the preferred seed.

Breeding traits

Breeding activities determines the seed quality to be produced; increasing harvest yields, higher resistance to pests, diseases and weather condition. Seed companies create new varieties based on crossing selecting desired, valuable traits that can increase yields, improve resistance against pests and diseases that are adapted to new or adverse growing

conditions. This process requires huge investment in materials, biotechnology, operational expertise and times. On average it takes about five years to produce a new hybrid variety. Currently, by using haploid technology, the process can be shorter to 1-2 years. But, such technology is very expensive and can be accessed only by big companies. By using their research and development facilities, breeding traits for the foreign companies can be conducted continuously in order to produce new varieties of seed horticulture.

It is also important to note, based on FGD result foreign companies have more access on germplasm in genebanks from other countries (using both business to business and government to government exchange schemes) compared to domestic companies. Germplasm is utilized as parent material in breeding activity to produce high quality foundation seed. The combination of complete facilities and more access to genebanks lead to foreign companies to produce larger number of high quality varieties compared to local companies. For example, East West had released 170 vegetables seed varieties versus 42 varieties released by one domestic company (this company in fact includes as big size company).

Foreign companies and big local companies have also considered the effect of global climate change when they produce new varieties. Global climate change has affected weather pattern and planting season in Indonesia. For example, La Nina and El Nino cycle had affected the rainy season in the coming year leading to crops to greater threats of disease and pests. As such, farmers need to use seeds that can withstand these vulnerabilities. In 2012, East West had also released nine vegetable varieties that were resistant to 'Gemini' virus consisting of tomato (six varieties), beans (two varieties), cucumber (one variety). Over the last seven years from 2012, the virus destroyed about 70% of land planted with tomatoes in Indonesia. Meanwhile, for small scale companies with limited funding to purchase needed equipment and materials, breeding traits can only be conducted by using few parent materials with more simple process and longer time period compared to foreign and big companies. As a result, small scale companies can only produce limited varieties of horticulture seeds.

Producing seed

Producing seed determines the quantity of food quality seed to be produced. Before seed companies produce or commercialize the seeds, they need to register their new varieties to Ministry of Agriculture in order to obtain protection from Indonesian Government (Plant Variety Protection, PVP). The validity period of PVP is 20 years for seasonal plant and 25 years for annual plant after producers receiving PVP certificate. In order to get PVP

certificate, the new variety must be registered and inspected. After the Horticulture Law was passed, the number of varieties for vegetable seeds registered for PVP certificate increased significantly particularly for domestic companies. However, whether the certificates registered had been commercialized is still questionable. In some cases, the number of varieties registered might not be commercialized due to capital limitation owned by small scale seed companies. Based on results from FGD and interviewed with some seed producers that have registered their varieties, they face constraints particularly capital constraints to commercialize the varieties. For foreign and local big companies, considering their size and capital, they do not face difficulty to commercialize their registered varieties with large amount of number.

To produce commercial seed, foreign companies and local big companies uses a contract farming programs in which the companies give the foundation seed to the contracted farmers and provide them with training, support and technical supervision. The contracted farmers have the obligation to sell back to the companies. Contract farming includes as community development providing more job and assisting contract farmers in shifting from traditional agriculture to the production of diversified, higher values-added products leading to increase farmers' income. PT. East West established contract farming with 3000 seed production farmers (for horticulture seed). PT. Bisi International had contract farming with 74,709 farmers (horticulture and staple food seed).

The majority of horticulture seed are sold in market as packed seed with relevant information to maintain the identity of the seed. As such, packaging is important aspect particularly for maintaining the quality and attracting seed consumers. Foreign companies and big local companies always improve their advanced packaging techniques that are hygienically packed to maintain quality with attracted label and information on how to use seed. Meanwhile, small scale companies use more simple packaged seed.

Seed marketing and extension

Marketing and extension involve activities to distribute seed from companies to farmers. While, small scale seed companies can only market their products to fulfil local markets around their production areas, foreign seed companies and big local seed companies have implemented various marketing strategies in order to strengthen their positions in the Indonesian seed market. The marketing strategies include demo plot, promotion (television, radio or newspaper, billboards, banners, leaflets and brochures), partnership with farmers, and extension. These activities include several actors (Table 3.1).

Table 3-1 Actors involve in the seed marketing activities of big companies

No	Actors	Activities
1	Seed company	Produce varieties of hybrid seed
2	Distributor	Distribute seed from seed company to retailers, usually they have exclusive marketing channel until input shops. Sometimes this actor is part of seed company, but sometimes this actor is independent and import seed or buy from local seed companies
3	Retailer	Retailers sell seed to input shops. In most cases, the retailers are part of distributors
4	Input shop	Sell inputs to farmers including hybrid seed
5	Nursery	Produce seedling seed, then sell to farmers

Big companies (foreign and local) also provide extension to farmers particularly in providing information about production methods for farmers. For example, Sahara (2012) examined the role of extensions provided by big companies and concluded that about 21% of chili farmers obtained information with respect to chili production methods from big input companies. Current survey conducted by study team in 2016 also confirmed the results. From the information of 231 farmers planting chilies, they received extension services from government and big input companies both in individual and village levels (Table 3.2). It can be seen that private services received by chili farmers at individual level was higher compared to government extension service. On average, big companies conducted meeting 1.2 times per year versus 0.49 time per year as conducted by government. Besides, private big companies also provided input subsidies for chili farmers in the form of seed, fertilizer, or pesticides. As outlined in Table 3.2 the number of farmers received subsidies provided from private companies was higher compared those receiving government subsidies (1.84 versus 1.60). At the village level, input companies also provide extension services particularly in the form of plot demonstration. Meanwhile extension services provided by small scale companies are very limited.

Table 3-2 Extension services received small farmers

Extension	All samples (n=231)	
	Mean	Std.Dev
Extension - individual level		
Government extension meeting (number/year)	0.49	1.54
Government subsidies (0/1)	1.60	0.50
Private extension meeting (number/year)	1.12	4.35
Private subsidies (0/1)	1.84	0.37
Extension - village level		
Government extension meeting (number/year)	1.20	2.31
Demo plots from government (0/1)	1.67	0.47
Private extension meeting (number/year)	1.06	2.77
Demo plots from private (0/1)	1.76	0.43

Source: Primary data collected by the study team 2016

3.3. The potential implications of FDI restrictions

The Horticulture law sends a clear signal to the international companies to reduce the number of foreign capital. If the Law is consistently implemented, foreign companies can take several strategies to response it by transferring equity, offshoring activities, and or market exit. This situation provides opportunity for local seed companies to develop. However, based on the explanation above, the opportunity seems can only be taken by big local companies and unfortunately, the Indonesian seed companies were dominated by small scale companies. They have limited access on capital and knowledge particularly on technological innovation in breeding and marketing aspects which in turn providing constraints for small scale companies to replace the roles of foreign companies on the four aspects as outlined previously. As such, Indonesia might lose opportunities for knowledge and technological innovation, jobs, and extension service if foreign companies respond to the Law. On the farmer level, slowing down technological innovation could potentially reduce

yields and profit impacting economic growth in rural communities as well as Indonesia's ability to achieve higher levels of food security.

Similar to other developing countries, demand for horticulture products in Indonesia tend to increase due to increasing in income per capita. As such, there are some prices to be paid when the Horticulture Law was implemented particularly when slowing down technological innovation occurs during the transition stage, i.e. (1) increasing land and (2) import. In order to compensate decline in productivity growth when the slowing down of innovation occurs, more land needed for horticulture areas. The question is how can government get more productive land to increase the production of horticulture product? Considering tremendous land competition in Indonesia, bringing more land to increase horticulture production is almost impossible. Besides, it might conflict with government program to expand strategic staple food in Indonesia (paddy, maize and soybeans). Further, reducing yield of horticulture products particularly for the strategic commodities (chili and shallot) means that Indonesian Government will rely on import to fulfill demand for horticulture products. Increasing import leads to trade deficit for horticulture products and against with government program on food sovereignty. To provide clear picture about these two costs, we will provide some calculations for three strategic horticulture commodities in Indonesia, chili, tomato and shallot.

3.3.1. Technological slow down and land

With rapidly growing demand for horticulture products, Indonesia has no real choice but to expand horticultural production. Chili production, for example, grown at a rapid pace of over 6% annually (close to the GDP growth rate), and even this high growth rate is perceived by the public to be insufficient as demonstrated by popular press coverage of high chili prices and chili related “inflation”. Failure to keep on the current rapid pace of growth in production will undeniably lead to either a significant increase in prices (and public disapproval) or a high reliance on imports (contradicting the “self-sufficiency” agenda). The government’s optimal (perhaps only) strategy is to sustain the growth rate of domestic horticulture production.

Since expanding domestic production is mandatory, an expansion path must be chosen that involves both: (1) extensive expansion – bringing more land into production, or; (2) intensive expansion – improving the productivity (output/ha). Prioritizing an ‘extensive expansion’ path will require a massive investment in bringing additional land into production

and potentially displacing other land-uses. This appears to be the current administration's approach as evidenced by the tremendous amount of resources (and military labor) used to push extensive expansion of rice. Such pushes require large tracts of land and the production increases are, at best, linearly related to the total investment ($\Delta Production = \alpha * \Delta Land$).

Taking an 'intensive expansion' path will depend heavily on the supply of suitable seeds, planting materials, farming techniques, and extension. This requires the prioritization of extension and R&D, particularly in the development and dissemination of improved planting materials. Any slowdown in the development and dissemination process during the transition stage would severely constrain production growth in this path.

The Horticulture Law implicitly prioritizes extensive expansion because it inhibits the development of improved planting materials. If production growth must be sustained, this slowdown in the development of planting materials must be compensated for by bringing more land into production. So, while the immediate production impacts of R&D will be small, the point of concern should be the long-term decline in productivity growth (output/ha). Two scenarios use in this section:

Scenario 1 (baseline):

will assume that technological progress (as measured by output/ha) continues on the same growth rate as before the law was introduced

Scenario 2:

will assume a proportional decline in the rate of technological progress in increments of 10%, from 100% (baseline) to 0% (complete technological stagnation).

This analysis will assume that production increase MUST stay on pace with the rate of growth experienced from 2000 to 2010 (pre-horticulture law phase). For three strategic commodities- shallot, chili, and tomato- the annual production growth rate is about 3.1%, 6.2% and 4.2% respectively, and we will assume that these growth rates must be sustained. Given that the government and the population regarded these rates to be insufficient (as evidenced by popular press articles on horticulture driven "inflation"), we interpret this growth rate to be the minimum acceptable scenario.

In the baseline case, we will assume that technological progress (growth in output/ha) will continue on the same pace as the pre Horticulture Law phase (2000-2010). This means

that output per hectare for shallot, chili, and tomato will improve at a rate of 0.4%, 3%, and 2.3% respectively. We refer to this as the rate of technological progress.

The Horticulture Law will inhibit the rate of technological progress which will affect the entire production system. However, we aim to simplify this by presenting a metric that can be understood by many different stakeholders. The metric we use is the amount of displaced land (ha). Assuming that production must keep increasing, this metric represents the land area needed to compensate for the reduced rate of technological progress. The amount of displaced land is a concrete, valuable, and salient unit in the minds of policy-makers. In addition, it can be used in policy dialogues at all levels to illustrate the tradeoffs that need to be made on the ground.

To express this mathematically, the total amount of land needed to sustain production growth is given simply as follows:

$$Q * R^t = Prod(\alpha * I)^t * Land_t$$

Where:

(1) t indexes time in years; (2) Q is production quantity; (3) Productivity is output/ha; (4) Land is ha planted; (5) R is rate of production growth; (6) I is rate of technological progress, and; (7) α represents the proportion of baseline technological progress: 1=baseline; 0=complete technological stagnation; 0.9 = 90% capacity

Treating Land as the only choice variable, solving for land yields this equation:

$$Land_t = \alpha^{-t} \frac{Q}{Prod} \left[\frac{R}{I}\right]^t$$

Analytically, the impact of the horticulture law would enter via the α parameter, representing the slowdown in technological progress. The partial derivative we are interested in presenting is the amount of land needed to substitute for a slowdown in technological progress. This expression is given below:

$$\frac{\delta}{\delta\alpha} Land_t = -t\alpha^{-t-1} \frac{Q}{Prod} \left[\frac{R}{I}\right]^t$$

Using secondary data on total production over time, productivity over time, and area planted over time, we approximate this partial derivative. Since we do not know what alpha will be, we approximate the substitution assuming multiple levels for alpha.

In addition, the extent to which each commodity will be affected by the Horticulture Law will depend on the commodity-specific optimum expansion path. We present the impacts assuming that the past expansion paths are the optimums. In other words, we assume that expansion will be sustained even if technological progress makes the production of non-

horticulture products (or non-horticulture land-use) more profitable. This assumption allows us to present a conservative lower-bound for the amount of land needed to compensate for the slowdown in technological innovation. Treating the expansion path as an endogenous process will only increase the need for extensive expansion which will only increase the estimates of additional land needed to support growth.

Lastly, the impact on product quality will depend highly on the extent to which MNC seed products are currently used in production. We use estimates from sample surveys to speculate on any quality and product changes that may occur in each of the previously discussed scenarios.

All analysis in this section assumes that imports stay at current levels (see import sub-section for endogenous treatment of trade balance) and that technological progress in horticulture is driven primarily by the development of improved planting materials[6].

Scenario 1: Business as usual

Before the Horticulture Law was introduced in November 2010, the industry was operating in the "business as usual" scenario. This scenario is characterized by rapid growth driven by both intensive expansion and extensive expansion.

For the three major horticulture products in this analysis (chili, shallot, tomato), each grew at a steady and high pace (Figure 3-3). The growth of land and productivity are presented in Figure 3-4 and Figure 3-5. The growth of three commodities was achieved in different ways. While the supply growth of shallot (Table 3-3) was driven almost exclusively by extensive expansion onto more land, chili (Table 3-4) and tomato (Table 3-5) growth were driven by a combination of extensive expansion and intensive technological progress (Table 3-6).

[6] We assume that innovations in fertilizers, chemicals, and farming techniques are secondary drivers of productivity growth in Indonesian horticulture. This is evidenced by stagnant productivity of shallots (low adoption of improved varieties), and high productivity growth of chili & tomato (high adoption of improved varieties).

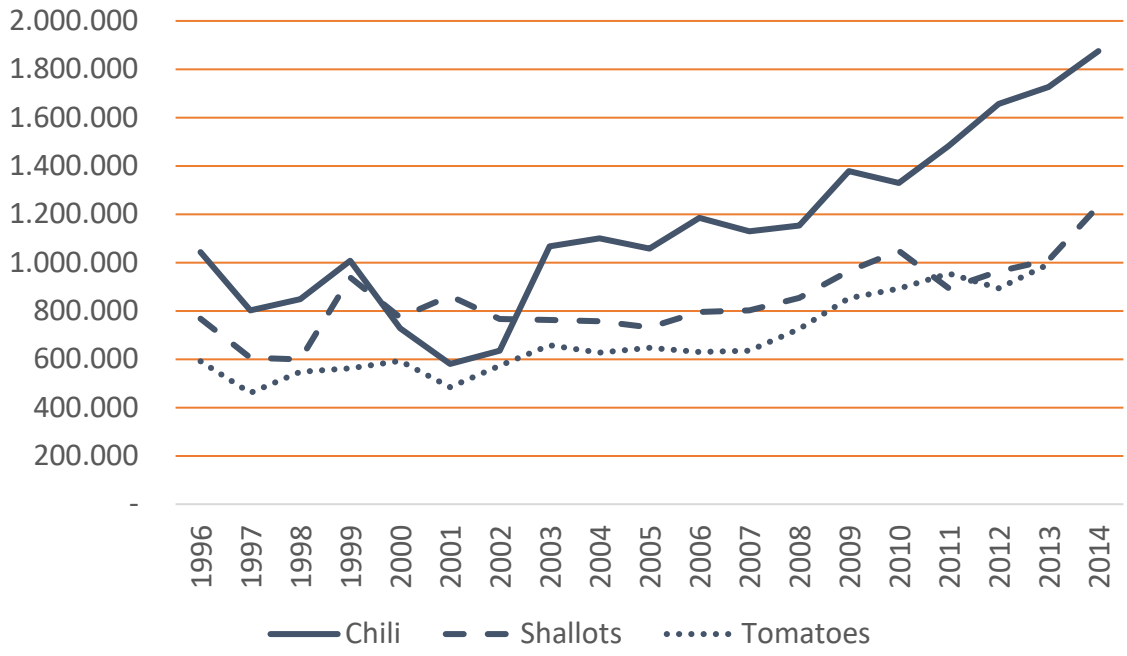

Figure 3-3 National Production (Ton) of Chili, Tomato and Shallot in Indonesia

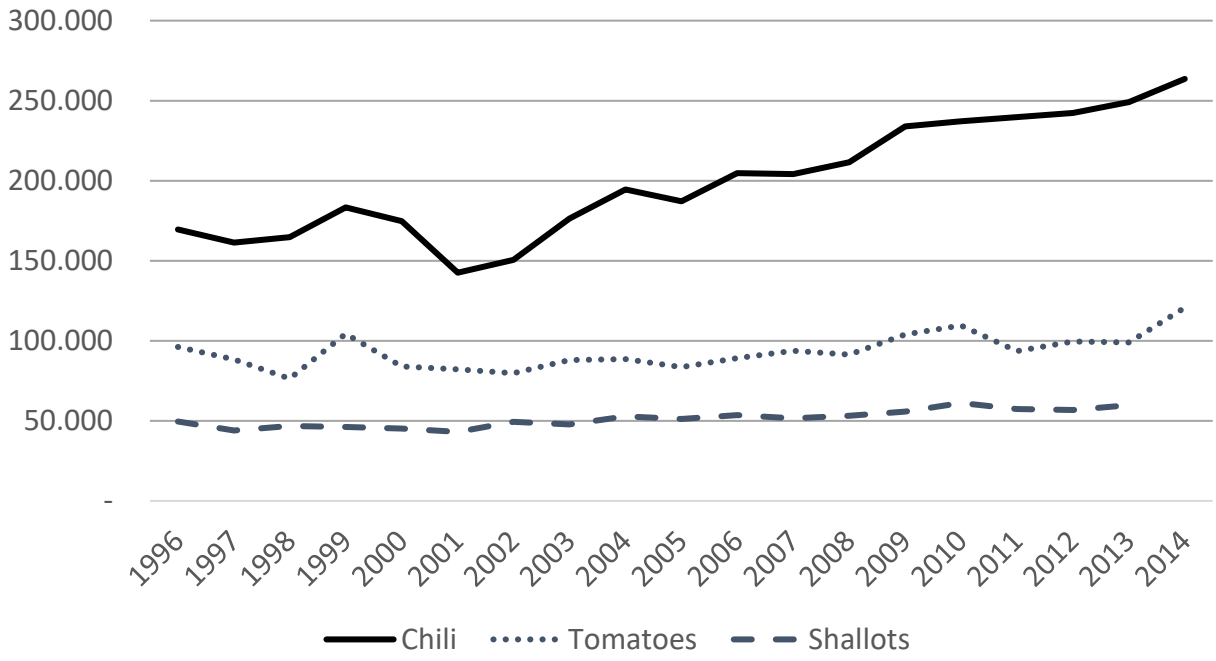

Figure 3-4 Area Planted by Chili, Tomato and Chili in Indonesia

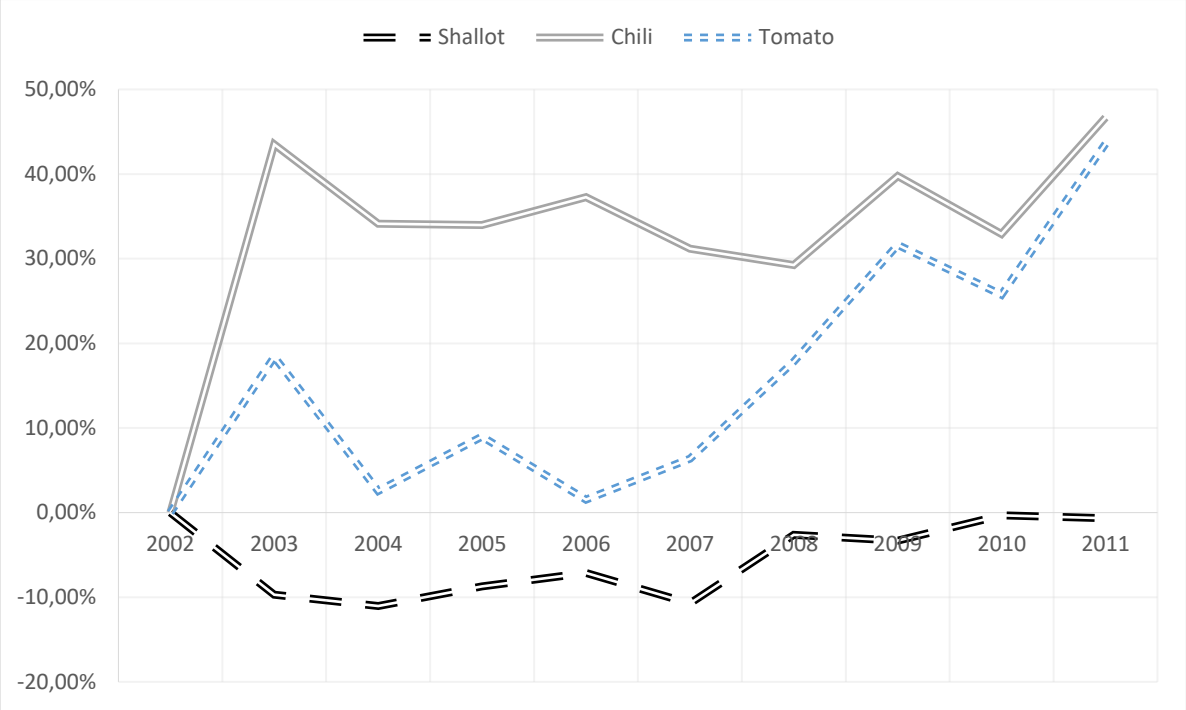

Figure 3-5 Productivity (Tons/Ha)

Table 3-3 Shallot production (Tons)

Year	Production	Land (Ha)	Ton/Ha
2000	772,818	84,038	9.20
2001	861,332	82,147	10.49
2002	766,572	79,867	9.60
2003	762,795	88,029	8.67
2004	757,152	88,672	8.54
2005	732,609	83,614	8.76
2006	794,931	89,188	8.91
2007	802,810	93,694	8.57
2008	853,615	91,339	9.35
2009	965,164	104,009	9.28
2010	104,8934	109,634	9.57

Table 3-4 Chili production (Tons)

Year	Production	Land (Ha)	Ton/Ha
2000	727,747	174,708	4.17
2001	580,464	142,556	4.07
2002	635,089	150,598	4.22
2003	1,066,722	176,264	6.05
2004	1,100,514	194,588	5.66
2005	1,058,023	187,236	5.65
2006	1,185,057	204,747	5.79
2007	1,128,792	204,048	5.53
2008	1,153,060	211,566	5.45
2009	1,378,727	233,904	5.89
2010	1,328,864	237,105	5.60

Table 3-5 Tomato production (Tons)

Year	Production	Land (Ha)	Ton/Ha
2000	593,392	45,215	13.12
2001	483,991	43,118	11.22
2002	573,517	49,457	11.60
2003	657,459	47,884	13.73
2004	626,872	52,719	11.89
2005	647,020	51,205	12.64
2006	629,744	53,492	11.77
2007	635,474	51,523	12.33
2008	725,973	53,128	13.66
2009	853,061	55,881	15.27
2010	891,616	61,154	14.58

Table 3-6 Average rates of change (2000 to 2010)

	Shallot	Chili	Tomato
Production	3.10%	6.21%	4.25%
Productivity	0.04%	3.01%	2.30%
Land	2.69%	3.10%	1.90%

In the baseline scenario, we assume the following:

(1) The rate of technological progress continues unhindered for 5 more years.

(2) The rate of production growth must continue 5 years into the future.

(3) Only land can be adjusted to meet production targets.

Given the above assumptions, Indonesia would need an additional 17,000 hectares for shallot production; 53,000 hectares for chili production, and; 6,000 hectares for tomato production by 2019 (see row 2 of Table 3-7). These projections are very close to the amount of land added over the previous 5 years (see row 1 of Table 3-7). In total, this is 76,000 hectares of additional land. In the baseline scenario, Indonesia must add a Jakarta-sized piece of land (66,000 ha) into production just to keep up with production for three horticulture products. Any decline in the rate of technological innovation will mean very large amounts of land will need to compensate.

Table 3-7 Land area needed to sustain the rate of growth (Ha)

	Shallot	Chili	Tomato
Historical (2009-2014)	16,695	52,050	6,630
Baseline rate (2014-2019)	17,624	53,011	6,034
Productivity Growth	ADDITIONAL LAND NEEDED		
90% of baseline	336	5,612	928
80% of baseline	673	11,340	1,872
70% of baseline	1,012	17,187	2.830
60% of baseline	1,351	23,156	3,803
50% of baseline	1,691	29,251	4,792
40% of baseline	2,032	35,473	5,797
30% of baseline	2,373	41,826	6,819
20% of baseline	2,716	48,313	7,856
10% of baseline	3,060	54,938	8,911
No Tech Change	3,405	61,704	10,945

Scenario 2

Inhibiting research and development of tomato and shallot planting material can only have a detrimental effect on the rate of technological innovation. We estimate the tradeoff in land with different levels of alpha (slowdown in technological progress). We analyze slowdowns in progress in 10% increments and show the area of land needed to compensate for the incremental slowdown in progress.

The slowdown in progress affects each of the commodities differently. Commodities, like shallot, that still utilize traditional saved-seed systems will not be affected. On the other hand, commodities, like chili and tomato, that have a high adoption rate of improved varieties will likely be adversely affected by the declining role of foreign companies in the seed sector. This is consideration is incorporated into each of the scenarios below.

First, we present the worst-case scenario. If the Horticulture Law results in a complete stagnation in technological innovation (in other words, productivity stays at 2014 levels), Indonesia will need to add an additional 3,000 ha of shallot; 61,000 ha of chili, and; 11,000 ha of tomato compared to the baseline scenario (Table 3-7). This is roughly double the baseline scenario, and total additional hectares needed (baseline + relative change) is over 150,000 (more than two DKI Jakarta sized pieces of land: 66,000 ha x 2).

The real impact will likely be a moderate slowdown in technological progress. However, even a small 20% decline in technological progress (recall that MNC share of R&D expenditure and seed market is significantly more than 20%, so we are significantly under-estimating) would mean that an additional 600 ha of shallot; 11,300 ha of chili, and; 1,800 ha of tomato would be needed compared to the baseline scenario. This is about 13,000-14,000 ha of land. Adding this with the baseline (Jakarta size land), an additional Bogor sized piece (12,000 ha) of land will be needed to compensate for the decline in technological innovation. These are non-trivial amounts of land [Detailed results for different specifications on the decline in technological innovation are presented in detail in Table 3-7]

3.3.2. Technological slow down and import

If foreign owned companies exit Indonesia completely, the productivity stagnation will reduce the production of horticulture products in the future. The production gap needs to be fulfilled from import. Increasing the importation volume of horticulture products will increase deficit of trade balance. This section will provide example of the number of import for chili and shallot commodities if technological slow down occurs.

Chili and tomato farmers use certified seed produced by big companies including foreign companies. If the Horticultural Law does not exist, the baseline scenario shows that the growth of production, land and productivity tend to increase over the period 2000-2010. As outlined previously, production, land, and productivity of chili over the period 2000-2010 grew about 6.21%, 3.10%, and 3.01%, respectively.

By using baseline scenario (average production growth 6.21%), chili production will continually increase and reach by about 2,691 thousand tonnes in 2020 (Table 3.8). If foreign companies exit Indonesia, technological stagnation, productivity in 2015-2020 will fix as the productivity rate in 2014 (7.11 ton/ha). If there is no change in productivity level, increasing in production should be supported by land expansion above its growth in the baseline scenario. However, bringing more land into production above its growth in the baseline scenario is almost impossible considering land competition in Indonesia. With the growth of land similar to its baseline scenario, increase by 3.10% per year, the availability land for chili production will reach 316 thousand ha in 2020. The multiplication between the availability of land for chili and productivity results in chili production with constant productivity as indicated in the column 5 (Table 3.6). As we can see, the amount of production of chili with constant productivity is lower compared to production using the

baseline scenario. The gap between production in baseline scenario and production with constant productivity is presented in column (6). The gap of production should be fulfilled from import. As such, the volume of imported chili will increase to about 438 thousand tonnes in 2020 leading deficit of trade balance of chili to increase.

Table 3-8 The impact of the Horticulture Law on import: chili commodity

Year	**Production using baseline scenario (ton)**	**Land (ha)**	**Productivity (ton/ha)**	**Production using constant productivity (ton)**	**Gap of Production (import, ton)**
(1)	(2)	(3)	(4)	(5)	(6)
2017	2,246,304.76	288,908.38	7.11	2,054,977.26	191,327.50
2018	2,385,715.70	297,867.37	7.11	2,118,701.68	267,014.02
2019	2,533,778.81	307,104.18	7.11	2,184,402.19	349,376.62
2020	2,691,031.06	316,627.42	7.11	2,252,140.06	438,891.00

By using scenario as outlined above, similar situation occurs in tomato commodity. If the growth of tomato production follows the growth in the baseline scenario (16.79% per year), tomato production in 2020 should reach 1,328 thousand tonnes. It is assumed when foreign companies exit Indonesia, the supply of suitable seeds and planting materials for tomato reduce significantly leading to technological stagnation in tomato productivity. This means that the productivity of tomato remained unchanged over the next period (16.79 ton/ha). To maintain tomato production in the next period similar to its baseline scenario, we need to bring more land in tomato production. Considering land competition with other activities, it is very difficult to increase land dedicated for tomato above its baseline growth. With the growth of land similar to its baseline scenario, the production of tomato under technological stagnation is presented in column 5 Table 3.9. The gap between production of baseline scenario and production of constant productivity mean that Indonesia needs to bring more tomatoes from other countries. As such, the Horticulture Law forces a trade deficit for tomato to increase.

Table 3-9 The impact of the Horticulture Law on import: tomato commodity

Year	Production using baseline scenario (ton)	Land (ha)	Productivity (ton/ha)	Production using constant productivity (ton)	Gap of Production (import, ton)
(1)	(2)	(3)	(4)	(5)	(6)
2017	1,172,803.02	64,450.05	16.79	1,082,055.59	90,747.43
2018	1,222,694.87	65,679.53	16.79	1,102,697.44	119,997.43
2019	1,274,709.15	66,932.46	16.79	1,123,733.07	150,976.09
2020	1,328,936.16	68,209.30	16.79	1,145,169.98	183,766.19

Chapter 4 The Path Forward – Considerations for Policy and Program Support

Domestic firms cannot yet match the proficiency of MNCs in the seed industry. They do not have the access to the massive genetic resources (germplasm) available to MNCs, lack the national distribution channels to market new varieties to farms across Indonesia, and lack ability to build proper technical capacity in their workforce. While domestic industry can someday be able to access the same kind of genetic resources and national distribution strategy, it cannot do so efficiently today.

As Indonesia expels foreign investment, there is currently no cohesive or unified plan to transition the domestic seed industry into its new role as market leader. While it is true that the FDI restrictions will create opportunities for local producers to expand, it is not clear how the fledgling industry can rise to the occasion and take advantage of the opportunity. Without proper policy and programming to wean the industry from heavy reliance on foreign investment and knowledge, the transition period may take far longer and be far costlier than policy makers had ever anticipated.

In particular, the domestic industry needs policy and program support to overcome three significant hurdles in development:

(1) Access to genetic resources

(2) Development of national distribution platform

(3) Human resource development

Genetic Resources

Success in the seed industry is primarily driven by the ability to generate and protect intellectual property in the form of germplasm. In the 1970s, the global seed industry was a network of thousands of small household enterprises, but now the it is dominated by a handful of agrochemical firms that invested in the development of vast collections of proprietary genetic resources used to breed new valuable traits faster and cheaper than their competitors. There is a large cost advantage for larger firms in using existing genetic resources that small firms simply cannot access, and it will take decades of sustained investment to develop equivalent resources for a newly created firm. Such investment is not feasible for small to medium sized firms.

The use of genetic resources, however, is quite different between MNC and small firms. While large firms tend to focus their R&D investments into developing innovations that can

be applied globally, smaller firms tend to focus on adaptation and localization of existing varieties to the surrounding farming systems (local agro-climactic, reduced chemical use). In light of this, the FDI restriction may impact the seed industry in the following way:

(1) In the short-run, small and medium seed companies can make large strides in improving publically available varieties by creating localized variants that fit with Indonesia's farming systems.

(2) However, FDI restrictions have led to the exit of some firms and restriction to access key varieties

(3) FDI restrictions also reduces Indonesia's role in setting the R&D agenda of MNCs. Considering the fact that Indonesia is the largest market in SE Asia, this may significantly change the direction of R&D in ways that are not as beneficial.

There is a lack of policy that addresses how domestic firms will be able to work around the lack of access to limited genetic resources and intellectual property. While short-run gains are definitely possible, it is not clear how the potential long-run negative outcomes of restricting access to valuable intellectual property can be redressed.

Distribution Platform

A less considered reason for the success of MNC seed companies in Indonesia is the efficiency of the supply chains and effectiveness of their marketing strategies. These large companies have spent decades building a nationwide brand and a network of distributors, nurseries, and farmers who demand their products. Even if a smaller company develops a variety that is superior in every way, it is unlikely that they can capture more than a localized market without a distribution platform to market product to end-users.

A typical marketing model for a large company often consists of demonstration plots, dissemination of trial seeds, extension services to lead farmers and nurseries, and long-standing trade relationships with input retail stores. For domestic industry to successfully transition, they will need to build their own marketing platforms that can disseminate seeds in an equally efficient way. Policy and programming support is needed to build this capacity as the capacity is not within the domain of expertise of smaller firms that tend to focus on the seed propagation side of the enterprise.

Human Resource Development

Another key constraint is the ability of domestic firms to build capacity in their workforce. Currently, even large MNCs rely on international hires to fill technical roles or

send Indonesian staff to train abroad to build the technical skills necessary for their jobs. FDI restrictions that cause certain firms to exit also means the ending of important technology spillover that help domestic industry.

As an example of key spillover, the large domestic seed companies in Indonesia were all started by former employees of MNCs who used their acquired expertise to develop a viable niche business. This means that MNCs are providing a significant amount of knowledge spillover and are a major driver in the development of the domestic industry itself. If the enforcement of FDI restrictions causes more firms to withdraw from Indonesia or reduce their operations in Indonesia, it may have large negative unforeseen consequences on the future development of the domestic industry. While the magnitude of the negative effect is speculative, the direction of change in technical capacity will surely be negative. Any decline in technical capacity in an industry heavily reliant on the acquisition and application of new technologies should be met with aggressive policy to mitigate and compensate. However, this is not apparent in the dialogue and rhetoric of the policy makers that pushed forth this law.

To support domestic industry, there must be improvements in the capability to train the seed industry work force. This may involve an expanded role for the ministry of agriculture and agricultural universities to work closely with domestic seed industry to identify training needs and designing programs to fill the void.

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Appendix

Appendix 1. Lists of companies producing horticulture seed in Indonesia in 2012 and 2014

2012			2014		
No	**Company**	**Origin of country**	**No**	**Company**	**Origin of country**
Foreign Company					
1	PT. East West Indonesia	Netherland	1	PT. East West Indonesia	Netherland
2	PT. Sygenta Indonesia	Switzerland	2	PT. Sygenta Indonesia	Switzerland
3	PT. Known You Seed	Taiwan	3	PT. Known You Seed	Taiwan
4	PT. Takii Indonesia	Japan	4	PT. Takii Indonesia	Japan
5	PT. Mosanto Indonesia	US	5	PT. Mosanto Indonesia	US
6	PT. Marcopolo Seed Nusantara	France	6	PT. Marcopolo Seed Nusantara	France
7	PT. Nunhems Indonesia	Netherland	7	PT. Nunhems Indonesia	Netherland
8	PT. Namdhari Seed Indonesia	India	8	PT. Namdhari Seed Indonesia	India
9	PT. Koreana Seed Indonesia	Korea	9	PT. Koreana Seed Indonesia	Korea
10	PT. Oriental Seed Indonesia	Korea	10	PT. Oriental Seed Indonesia	
11	PT. Bisi Internasional/PT. Tanindo Subur Prisma	Thailand	11	PT. Bisi Internasional/PT. Tanindo Subur Prisma	Thailand
			12	PT. Advanta Seed Indonesia	India
			13	PT. Bayer Indonesia	German
			14	PT. Clause Indonesia	France
			15	PT. Nusantara Surya Benih	Amerika
			16	PT. Hexar Seed Indonesia	Malaysia
Domestic Companies					
1	PT. Hikmah Farm	Indonesia	1	PT. Hikmah Farm	Indonesia
2	PT. Tunas Agro Persada	Indonesia	2	PT. Tunas Agro Persada	Indonesia
3	PT. Benih Citra Asia	Indonesia	3	PT. Benih Citra Asia	Indonesia
4	PT. Agri Makmur Pertiwi	Indonesia	4	PT. Agri Makmur Pertiwi	Indonesia
5	PT. Primasid Andalan Utama	Indonesia	5	PT. Primasid Andalan Utama	Indonesia
6	PT. Sang Hyang Sri	Indonesia	6	PT. Sang Hyang Sri	Indonesia
7	PT. Agri manunggal Sejati	Indonesia	7	PT. Agri manunggal Sejati	Indonesia
8	UD. Tani Murni	Indonesia	8	UD. Tani Murni	Indonesia
9	PT. Mulia Bintang Utama	Indonesia	9	PT. Mulia Bintang Utama	Indonesia
10	PT. Selektani Hortikultur	Indonesia	10	PT. Selektani Hortikultur	Indonesia
11	PT. Sari Benih Unggul	Indonesia	11	PT. Sari Benih Unggul	Indonesia

2012			2014		
No	**Company**	**Origin of country**	**No**	**Company**	**Origin of country**
12	PT. Radina Bio Adicita	Indonesia	12	PT. Radina Bio Adicita	Indonesia
13	PT. Riawan Tani	Indonesia	13	CV. Riawan Tani	Indonesia
			14	PT. Agrosid Manunggal Sentosa	Indonesia
			15	PT. Agro Farmaka Nusantara	Indonesia
			16	PT. Andall Hasa Prima	Indonesia
			17	PT. Bathara Seed	Indonesia
			18	PT. Inko Seed Makmur	Indonesia
			19	PT. Global Agrotech	Indonesia
			20	PT. Fajar Seed	Indonesia
			21	PT. Oriented Seed Indonesia	Indonesia
			22	PT. Prabu Argo Mandiri	Indonesia
			23	PT. Parisonna Alam Sejahtera	Indonesia
			24	PT. Petrokimia Gresik	Indonesia
			25	PT.Royal Agro Persada	Indonesia
			26	PT.Raja Pilar Agrotama	Indonesia
			27	PT. Sekar Agro Lestari Seed	Indonesia
			28	PT. Winon Intercontinental	Indonesia
			29	PT. Kresna Citra Utama	Indonesia
			30	PT. Polar Chem	Indonesia
			31	PT. Maju Makmur Utomo	Indonesia
			32	PT. Gunung Kombeng	Indonesia
			33	CV. Everfresh	Indonesia
			34	CV. Sari Tani Seed	Indonesia
			35	CV Agro Bumi Asri Sejahtera	Indonesia
			36	CV. Multi Global Agrindo	Indonesia
			37	CV. Aditya Sentana Agro	Indonesia
			38	CV. Aura Seed Indonesia	Indonesia
			39	CV. Buana Agro Lumlum	Indonesia
			40	CV. Bartan Seed	Indonesia
			41	CV. Global Agro Mandiri	Indonesia
			42	CV. One Tani	Indonesia
			43	CV. Panca Tani Raya	Indonesia
			44	CV. Jogja Horti Lestari	Indonesia

2012			2014		
No	**Company**	**Origin of country**	**No**	**Company**	**Origin of country**
			45	CV.Duta Agro Utama Nusantara	Indonesia
			46	CV. Tiga Putra Tani	Indonesia
			47	UD. Agro Citra Mandiri	Indonesia
			48	UD. Nikos Jaya	Indonesia
			49	UD. Plasma Benih Indonesia	Indonesia

Source: Pambudi (2012), Oktaviani (2015), and Secondary Data Collected by the Study Team