

2015 UPDATE
MAIZE SUB-SECTOR GROWTH STRATEGY
IN
EAST JAVA

August 3, 2015

BEING UPDATED

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Abbreviations

AIP-PRISMA	Australia-Indonesia Partnership for Promoting Rural Income through Support for Markets in Agriculture
CAGR	Compound annual growth rate
GM	Genetically modified
ha	hectares
ILAF	Intervention Logic Analysis Framework
KKPE	Kredit Ketahanan Pangan Energi
NTB	Nusa Tenggara Barat (West Nusa Tenggara)
NTT	Nusa Tenggara Timur (East Nusa Tenggara)
OPV	open pollinated varieties
PISAgro	Partnership For Indonesia's Sustainable Agriculture
ppb	parts per billion
RDKK	Rencana Definitif Kebutuhan Kelompok
TNI	Indonesian National Armed Forces

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Summary of key changes from previous GSDs and focus for next year

Year	August 2014 - June 2015
	<p>Over the past year, the team has focused on proving a business model for the adoption of hybrid seeds in Madura and has also explored the potential to work with market actors on other issues. This has improved their understanding of the dynamics, constraints, and opportunities in the sector, particularly in Madura. This has resulted in more updated and accurate details around the core value chain and supporting functions/services. In addition, the main changes to the GSD include:</p> <ul style="list-style-type: none"> • Changing the initial target districts: The initial target districts are now Sumenep, Sampang, and Pamekasan, which are three districts in Madura where AIP-PRISMA has commenced activities on promoting hybrid seeds. As the team has been focusing on Madura, the field investigations over the past year have also mainly targeted Madura. While Situbondo, Jember, and Bondowoso were also being suggested as initial target districts in the previous GSD, the team intends to revisit this selection after conducting further field work on the East Java mainland. • Revisiting the logic underlying the intervention to introduce affordable commercial fertilisers and removing the related constraint and intervention: According to the previous GSD, farmers were experiencing low productivity as a result of a lack of access to fertilisers. The GSD also claimed that the distribution of subsidised fertilisers has crowded out commercial fertilisers. Upon further investigation, there appears to be numerous commercially available fertilisers in East Java. At the same time, there are no significant delays in the distribution of subsidised fertilisers. As a result, the availability of fertilisers is not an issue. While there is still low knowledge on appropriate fertiliser usage, this is associated with limited access to information on good agricultural practices (GAP). This can be addressed through the provision of embedded information (which would include information on better fertiliser usage) when promoting improved seeds for dry season farming and hybrid seeds. • Clarifying how the irrigation related intervention will be taken forward: Within AIP-PRISMA, there is a cross-cutting team which is working on irrigation. This team has developed an irrigation intervention concept, which was originally based on a constraint identified through the maize GSD. This team will be responsible for developing partnerships and piloting business models which can potentially provide irrigation for off-season maize farming in drylands (as well as for the production of other crops). <p>The market growth potential in the sector has not changed, and there is still significant opportunity to expand maize production in East Java in order to meet growing demand from feed millers.</p> <p>The planned focus for July 2015-2016 is on:</p> <ul style="list-style-type: none"> • Expanding the outreach of the hybrid maize intervention with PT AHSTI, which will involve testing slight modifications to the model and crowding in more maize buyers and seed retailers • Exploring scale-up partners for the hybrid maize model and potentially develop a roadshow in Madura which may showcase a range of input suppliers • Conducting assessments on maize production in the East Java mainland (which will validate or identify constraints and potential interventions) and on post-harvest practices and technologies (which will identify the amount of income loss from current post-harvest practices and options for improved practices or technologies)

Year	July 2015 - June 2016

Year	July 2016 - June 2017

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1 Executive summary

The demand for maize in Indonesia has been increasing at an annual rate of 5.6% with much of the growth being fuelled by the rapidly expanding poultry industry. Animal feed has surpassed human consumption as the main use for maize in Indonesia. Both the animal feed and poultry industries are projected to continue experiencing robust growth as population and incomes increase.

East Java is the province with the highest level of maize production, accounting for more than 30% of national production in 2013. As a result of the importance of maize production in the province, there is a ubiquitous presence of commercial actors (traders, feed millers, and seed companies) along the maize value chain in East Java. Despite being the leading producer of maize and having the largest total harvested area in Indonesia, average yields were only 4.8 tonnes/ha in 2013 and are significantly below potential. Average maize yields for districts on Madura Island can reach as low as 1.7 tonnes/ha, and this can be attributed to the limited adoption of hybrid seeds and subsistence nature of maize farming in Madura. In comparison, the East Java mainland is characterised by high levels of adoption of hybrid varieties and a focus on supplying the animal feed industry.

There is market opportunity to further expand East Java's maize production in order to meet the growing demand for maize by the animal feed industry. While national production has been increasing, it has been insufficient to meet the growing demand of animal feed mills, which require continuity of supply all year round. Indonesia imports on average 8% of its annual maize consumption needs, with imports mainly going towards the feed industry. In 2012, this was equivalent to 1.7 million tonnes of maize, making Indonesia the second largest importer of maize in Southeast Asia. As a result, there is potential for East Java to expand production and productivity, especially in Madura and in the dry season, and to ensure that its maize meets the feed industry's standards

Analysis of the market reveals a number of problems that currently constrain the ability of maize farmers to take advantage of this market opportunity. Farmers in Madura experience low productivity because they mainly use local seed varieties. Farmers do not see or understand the potential benefits of using hybrid seeds and have limited access to information on good agricultural practices, which are particularly important for the production of hybrid maize. At the same time, only a few seed companies have started selling hybrid maize seeds in Madura, but market penetration has been slow and difficult. Farmers also tend to receive low prices because of poor post-harvest practices that affect the quality of maize and their ability to reap the benefits of storing and selling maize when prices are more favourable. Finally, farmers (mainly on the East Java mainland) experience difficulties in increasing maize production during the dry season in dryland areas. This is because they have limited knowledge and information on the most appropriate seed varieties and practices for dryland farming and lack access to irrigation services. Currently there are few commercial providers of irrigation and post-harvest equipment or services, particularly given the strong government presence in these areas.

The vision of change at the sector level is to: (1) increase smallholder productivity and production throughout the year, including during the dry season and (2) improve the quality of maize. At the **service level**, it is envisaged that farmers will have improved access to: (1)

improved seed, (2) information and extension, (3) post-harvest, and (4) irrigation services. To realise this vision, this report recommends the following four intervention areas:

- Promote the use of hybrid seeds and GAP (with a focus on Madura)
- Promote appropriate post-harvest services
- Promote the use of improved seeds suitable for dry season farming in non-irrigated drylands (with a focus on the East Java mainland)
- Develop access to proper irrigation systems and technologies (with a focus on the East Java mainland)

We envision that traders, collectors, trading companies, or feed millers would be involved in providing a range of these services, including post-harvest and irrigation services. Seed and information services would also involve input suppliers (seed or fertiliser companies) and agro-input retailers. Finally, irrigation services may also involve water user groups or farmer groups.

It is recommended that the intervention areas in the East Java maize sector be implemented in two phases. In the first phase, the focus will be on increasing productivity in Madura by *promoting the use of hybrid seeds*. The second phase will focus on improving the quality of maize and on expanding production in the dry season (mainly in the East Java mainland). Improved maize quality will be achieved through *promoting appropriate post-harvest equipment/technologies* whereas increased productivity and production during the off-season will be achieved either through *developing access to proper irrigation systems and technologies* or *promoting the use of improved seeds suitable for dry season farming in non-irrigated drylands*.

2 Background

The Australia-Indonesia Partnership for Promoting Rural Income through Support for Markets in Agriculture (AIP-PRISMA) is a multi-year program that is a part of the Government of Indonesia's midterm development strategy to accelerate poverty reduction through inclusive economic growth. With the support of the Government of Australia, the program aims to achieve a 30% increase in the net incomes of 300,000 male and female smallholder farmers in eastern Indonesia by June 2017. PRISMA works in East Java, West Nusa Tenggara (NTB), East Nusa Tenggara (NTT), Papua, and West Papua.

This Sector Report aims to provide a logic and rationale for market-based interventions which can support the maize sector to the benefit of smallholder farmers in East Java.

3 Sector description

3.1 Sector profile

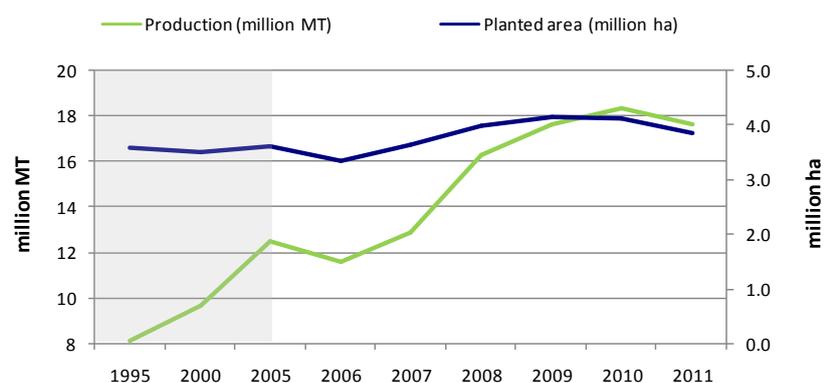
The sector profile provides information on the current status and potential of the target sector. This has been derived mainly from secondary data and literature relevant to the maize sector.

3.1.1 Overall context

Global demand for maize is growing, mainly as a result of increased usage as animal feed and in ethanol production, and is predicted to surpass the production of both rice and wheat by 2025. In 2012, maize was grown on more than 174 million hectares (ha) across 163 countries globally, and 839.7 tonnes of maize was produced. World production of maize is dominated by the United States, followed by China. Maize consumption is on the rise, with ethanol production alone accounting for 36% of the US corn crop in 2013. Between now and 2050, it is projected that the demand for maize in the developing world will double.

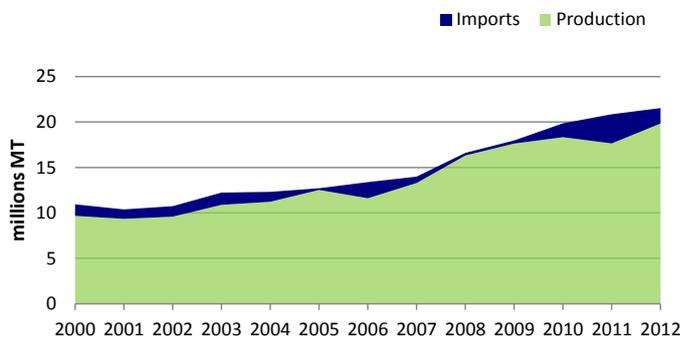
Maize is a dynamically expanding crop both internationally and in Indonesia. Indonesia is the largest maize producer in Southeast Asia and the eighth largest globally. Indonesia contributed to nearly 2% of global production with 18.51 million tonnes in 2013. From 1995 to 2011, production and productivity in Indonesia has roughly doubled while the harvested area has fluctuated between 3.3 to 4.2 million ha for the same period. After rice, maize is the second most important cereal crop in Indonesia and plays an important role in Indonesia's food security policy.

Figure 1: Production and harvested areas in Indonesia (1995-2011)



Despite upward trends in production and goals by the Government of Indonesia to be self-sufficient in maize, Indonesia imports on average 8% of its annual maize consumption needs. In 2012, this was equivalent to 1.7 million tonnes of maize, making it the second largest importer of maize in Southeast Asia next to Malaysia.¹ Indonesia imports maize

Figure 2: Indonesian maize production vs imports



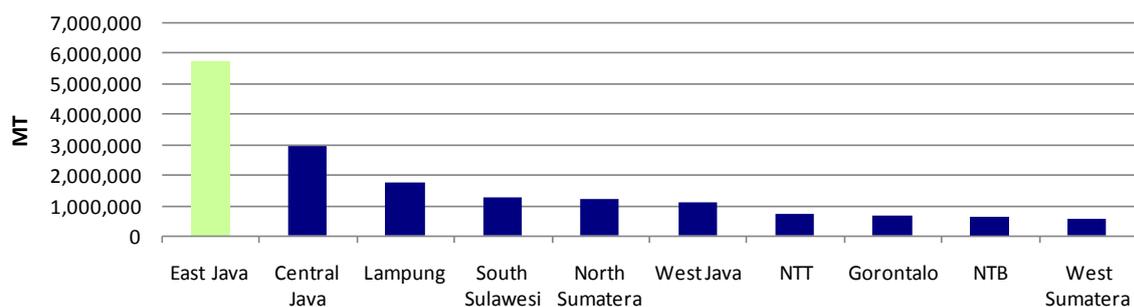
primarily from India (37%) and Argentina (34%). The volume of maize imports into Indonesia is typically 100,000 to 200,000 tonnes/month but can reach over 500,000 tonnes/month. According to the Indonesian Feed Millers' Association, "there will always be a requirement for imports due to the seasonal concentration of production in Indonesia."

The demand for maize in Indonesia has been increasing at an annual rate of 5.6% with much of the growth being fuelled by the rapidly expanding poultry industry. Animal feed has surpassed human consumption as the main use for maize in Indonesia. As incomes increase in Indonesia, consumers are diversifying their diets and sources of protein. Poultry products are the most affordable animal protein source in Indonesia. As a result of increasing per capita consumption of chicken, corresponding demand for poultry feed has also experienced robust growth and is expected to continue rising. According to PT ICRA Indonesia, the average annual growth of the feed industry was 11% between 2008 and 2012. Maize alone contributes 50-55% of the raw material cost for animal feed.

3.1.2 Local context

East Java is the province with the highest level of maize production, accounting for more than 30% of national production in 2013. East Java produced 5.7 million tonnes of maize in 2013, nearly twice that of the second leading producer in Indonesia. In second place is Central Java with 2.9 million tonnes of maize. East Java has been the leading producer for numerous years. Between 2007 and 2013, it consistently accounted for more than 29% of national production and in some years reached as high as 35%. Overall production has demonstrated an upward trend and has grown at a compound annual growth rate (CAGR) of 5.2% between

Figure 3: Top 10 maize producing provinces (2013)



¹ FAOStat

2007 and 2013. While lower than the national CAGR of 7.4% for the same period, production in East Java has been growing from a high base.

Despite being the leading producer of maize and having the largest total harvested area in Indonesia, average yields were only 4.8 tonnes/ha in 2013 and are significantly below potential. East Java is not among the top ten provinces with the highest maize yields. West Java and West Sumatra have the highest average yields, with 7.2 tonnes/ha and 6.7 tonnes/ha respectively. Maize is harvested on approximately 1.2 million ha in East Java. As a result of long term population pressure on land availability, future expansion will mainly have to be through intensification of maize farming. Higher maize yields may also encourage farmers to replace other crops with maize. By contrast, production in provinces like NTT is not land constrained.

As a result of the importance of maize production in the province, there is a ubiquitous presence of commercial actors along the maize value chain in East Java. In addition to a large number of traders, most feed millers in Indonesia are located in East Java. There are also large poultry farms and cattle feedlots, some of which produce their own feed using maize as a raw material. The largest dairy farm in Indonesia, which is owned by Nestle, is located in East Java. There is even a Korean company located in Jember which is producing corn silage for export to Korea. These companies contribute to the high demand for maize in the province.

Maize farming is estimated to involve over 2 million farmers in East Java and is an important source of income for poor farmers. According to a study by Swastika et al, the percentage contribution that maize makes to household income for farmers in East Java is 20% for poor farmers with less than 0.5 ha, 22% for farmers with 0.5-1 ha, and 24% for farmers with more than 1 ha. Maize is one of the primary cash crops for farmer and can be grown on lands where there may not be sufficient water to grow rice. Based on poverty statistics from the Ministry of Agriculture, approximately 70% of poor farmers in East Java are growing primary crops, including maize.

Figure 4: Maize harvested area by key districts (2013)

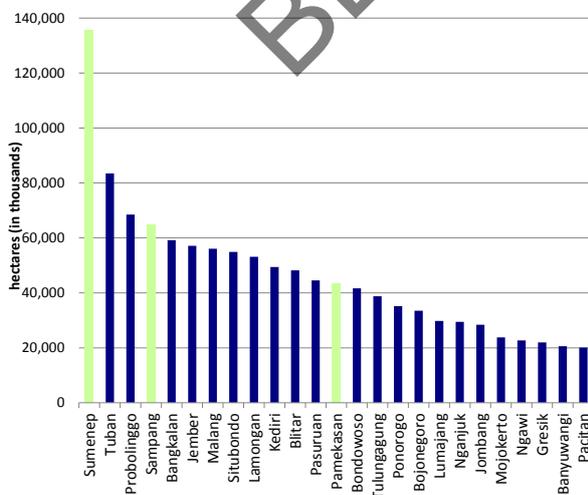
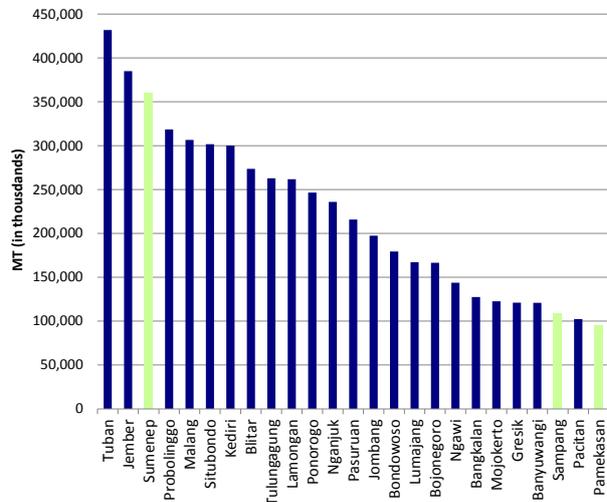


Figure 5: Maize production by key districts (2013)



At the district level, the 3 districts in which AIP-PRISMA is starting its maize sector interventions account for 20% of the harvested area in East Java but less than 10% of the province's production. These districts are Sampang, Sumenep, and Pamekasan on Madura Island. Sumenep has the largest maize harvested area in the province with over 135,000 ha. Although this is 50 thousand ha more than the harvested area in Tuban, Sumenep's production is only 80% that of Tuban. It is also the district with the second lowest average yield in the province (2.05 tonnes/ha). Overall, maize yields in Madura are the lowest in East Java since the use of hybrid seeds is still not widespread on the island. Average district yields in Madura range from a low of 1.7 tonnes/ha in Sampang to a high of 2.2 tonnes/ha in Pamekasan, which is less than half the average provincial yield. This contrasts with the East Java mainland where most farmers have been exposed to hybrid maize.

The team has targeted Sumenep, Pamekasan, and Sampang as initial intervention districts because of the huge potential for productivity increases and the existence of interested partners and service providers that have made it feasible to commence an intervention in these areas. The team will be exploring the potential for interventions in Bangkalan in Madura, as well as other areas on the East Java mainland in the future. This will involve conducting an assessment of the East Java mainland to identify which production zones to target. For example, while Malang is among the top five maize producers, production in the district is mainly focused on seed multiplication and most of the maize farmers in Malang are already engaged in contract farming arrangements to produce seed for multi-national seed companies. This suggests there may be limited opportunities for impact in this district and that AIP-PRISMA should focus on other districts on the East Java mainland.

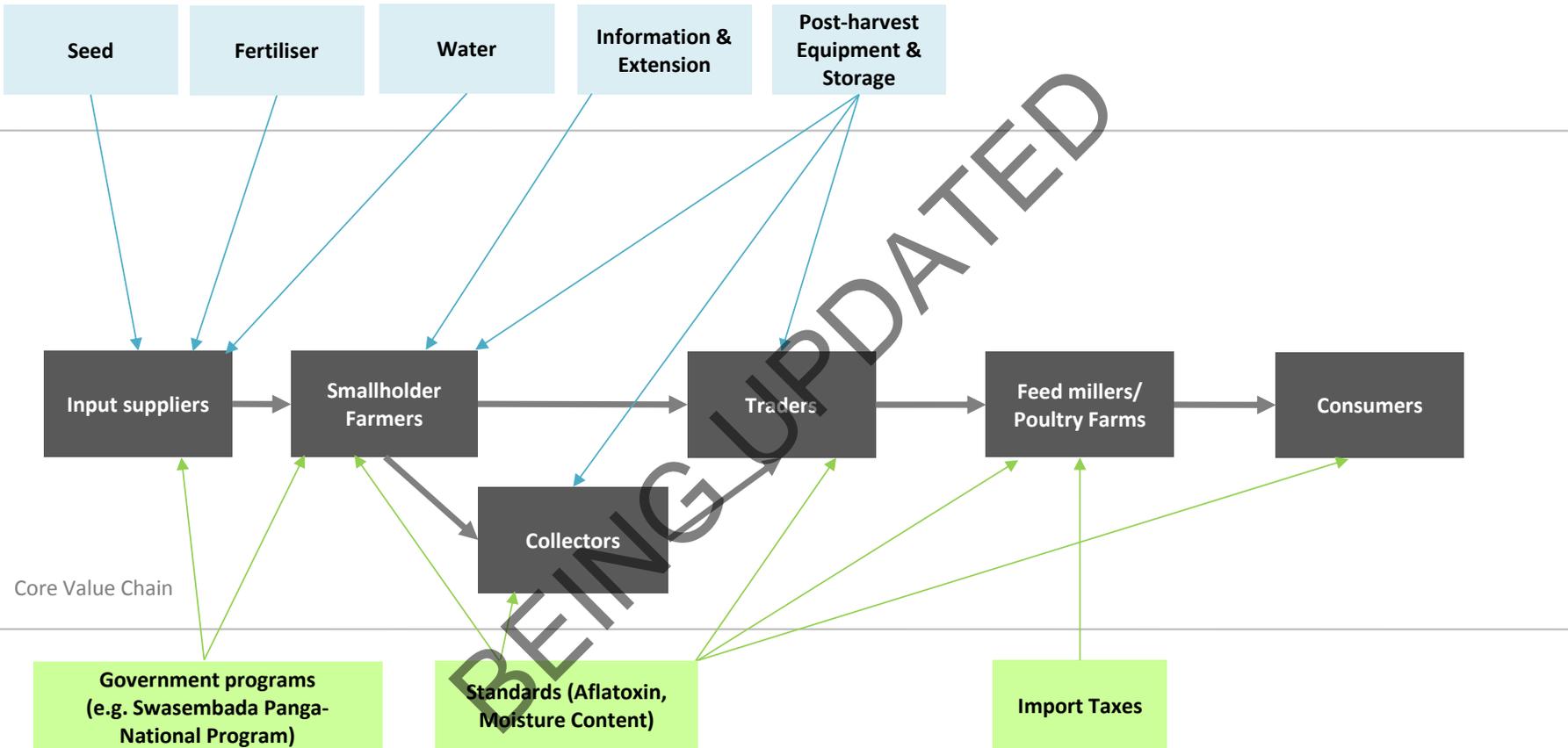
3.2 Sector dynamics

3.2.1 Market overview

Maize farming varies significantly between East Java mainland and Madura Island. Production on the mainland is characterised by widespread use of hybrid maize, which is geared to supplying the animal feed industry—an industry which is dominated by large-scale Javanese millers. Farmers on the mainland will cultivate one or two crops depending on the topography and access to water. In contrast, maize is still consumed as a staple food crop in Madura, and farmers predominantly grow local maize varieties for household consumption, with only one maize crop during the rainy season. A small number of farmers are beginning to shift towards hybrid maize, but commercial trading of maize in Madura is nascent. There is, however, interest from seed companies and some trading companies to expand into Madura since production on the mainland is more land constrained than on Madura.

3.2.2 Sector map

Supporting Services



Business Enabling Environment

3.2.3 Core value chain

Inputs

Production on East Java's mainland is characterised by high levels of adoption of hybrid varieties. There are three types of seeds that are used in maize farming in Indonesia—local varieties, composite/open pollinated varieties (OPV), and hybrids. Genetically modified (GM) seeds are not yet available in Indonesia although Monsanto is positioning itself to enter the market and is awaiting government approval for the use of GM seeds for animal feed. East Java is the centre of hybrid seed production in Indonesia. Adoption of hybrid seed varieties in East Java, particularly in rainfed and irrigated lowland areas where transportation networks and the agro-industry is more developed, has been widespread. Based on seed usage statistics from 2009, approximately 73% of farmers on the East Java mainland use hybrid seeds; 6% use OPV; and 21% use local varieties.

There is a lot of competition among seed companies on the mainland, making it difficult for new seed companies to enter the market. Hybrid maize seeds on the East Java mainland are available through multi-national seed companies such as Monsanto, Syngenta, BISI, and Dupont. These companies account for 70% of the hybrid maize market in Indonesia. There are also private Indonesian companies (PT Agri Makmur, PT Pertiwi, PT Esa Sarwaguna Adinata, PT Saprotan, and PT Petrokimia Gresik) which produce hybrid seeds. Some of these national companies produce varieties that are cheaper than those sold by multi-national companies. Farmers purchase hybrid seeds from distributors or through lead farmers that have been selected by seed companies. Cash payment on purchase is typically required for seeds and other inputs.

In contrast, farmers in Madura tend to use local maize varieties, and most of their seeds are retained from the previous harvest. Whereas 73% of farmers on the East Java mainland were using hybrid seeds in 2009, only 6% of farmers in Madura were using hybrid seeds and 93% were using local varieties. There have since been some efforts by the local government to introduce hybrid seeds to Madura, but adoption remains low, with less than 20% of farmers now using hybrid varieties. For 2015, the government is distributing free seeds for 20,000 ha in Madura (5,000 ha per district). This covers less than 10% of the maize production area in Madura.

Madurese farmers do not perceive the quality of local seeds to be a problem since maize production is mainly for household consumption. The local seed variety is characterised by low yields, small kernels, and small-sized cobs and is not appropriate for the feed milling industry. It only takes 80 days to grow whereas hybrid varieties require approximately 90-110 days depending on the variety. Farmers in Madura are reluctant to use hybrid varieties not only because of its long growing period but also because the corn tastes different from the local variety and cannot be stored for extended periods without being infested by weevils. The high cost of hybrid seeds and fertilisers, along with weak linkages to buyers of hybrid seeds, are also disincentives for adoption. Finally, numerous farmers, particularly in Sampang, have had poor experiences with hybrid seeds that were distributed under the government seed subsidy program. This has left some farmers under the impression that hybrid seeds are of lower quality than local varieties.

Despite the challenges of penetrating the market in Madura, small coverage of hybrid seeds means that there is still room for seed producers and agro input providers to expand their

market to Madura. This will require significant efforts to develop the right strategy and to create a shift from subsistence to commercial maize farming. Currently, the three main seed companies that are selling small amounts of hybrid maize seeds to farmers in Madura are AHSTI, Dupont, and BISI. AHSTI, which provided hybrid seeds for the government program, continued selling to interested farmers after the government program ended. Dupont and BISI have also set up commercial seed operations in Madura, with Dupont being the first to enter the Madura market six years ago. In 2013, Dupont built a learning centre for hybrid maize farming in Pamekasan.

Farmers in both the mainland and Madura rely heavily on government subsidised fertiliser, and few purchase commercial fertilisers. But commercial fertilisers are widely available in the market. The government estimates that as many as 79% of maize farmers in East Java receive government assistance in the form of subsidised fertilisers. Farmer groups, with the assistance of public extension agents, need to first prepare an RDKK (Rencana Definitif Kebutuhan Kelompok). The RDKK is an annual work plan which contains, among other things, details about production and planting area targets. This plan is submitted to the government and is used to estimate the budget allocation for fertilisers and other agricultural support. Despite these strategic planning exercises, allocations made by the government are often lower than the amounts requested by farmer groups. Some farmers have noted that there is not enough fertiliser for maize farming because of competition from other crops.

Commercially fertilisers are widely available in East Java, and this includes all types of chemical fertilisers (urea, NPK, ZA, SP36, etc.). Although these products can be used for maize farming, commercial fertilisers are mainly bought by vegetable farmers. Commercial fertilisers are often produced by the same companies that supply the government fertiliser subsidy programs. In order to differentiate the product from the subsidised fertilisers, companies will use a different packaging or even different colour for the fertiliser. Companies that sell commercial fertilisers in East Java include state-owned fertiliser companies such as PT Petrokimia Gresik, Pupuk Kaltim, and Sriwijaya, as well as private companies like PT Saprotan Utama. Imported fertilisers can also be found in some agro-input stores.

Production

Madurese farmers mainly cultivate maize during the rainy season, with the peak harvest period during February and January. Most of the arable land in Madura is dryland with minimal rainfall. In districts without irrigation, there is only sufficient water to cultivate maize during the rainy season. These farmers are dependent on the onset of the rains, and the main cropping pattern is *maize – tobacco*. There are also a few sub-districts with access to irrigation. In these areas, farmers typically plant rice during the rainy season and then tobacco during the dry season. In general, maize is more prevalent than rice farming in Madura.

Whereas maize farming in Madura has predominantly been for subsistence, farmers in Madura have recently started to produce small amounts of hybrid maize for the feed industry. With tobacco prices falling, there is increasing interest from farmers in Madura to shift from subsistence maize farming to the production of hybrid corn. This will allow them to generate an additional income source, thus reducing their dependence on tobacco as the main source of income. Given the reduced margins from tobacco farming, there are cases where farmers are opting

to not plant anything at all during the dry season. Furthermore, with rice becoming more easily available, consumption patterns are changing and rice is now becoming a more common part of the diet in Madura. In other parts of Indonesia, this has contributed to the shift from producing maize for human consumption towards producing maize predominantly for the feed industry.

Maize production on the mainland involves either one or two maize crops depending on whether maize is farmed on wetland or drylands. Wetlands are defined as areas where rice is planted during the rainy season and are usually irrigated lands. As a result of good access to irrigation facilities, farmers in wetland areas are able to plant a maize crop or multiply maize seeds for seed companies during the dry season. Only in dryland areas is maize the first priority crop during the rainy season. Farmers will plant maize at the beginning of the rainy season with the main harvest in February. In both irrigated and non-irrigated drylands, farmers may attempt to plant a second maize crop between March and June. Insufficient water during the second planting season often leads to lower volumes and quality of maize. There is also more vulnerability to disease during this period and higher risk of crop failure.

Both women and men farmers are active in maize cultivation, with a number of tasks being done jointly by women and men. Men tend to make more of the decisions related to maize since they have more knowledge about maize farming. As with other main commodities, men are in charge of buying inputs for maize production but decisions of whether or not to invest in various inputs may be made jointly. Men also tend to decide if and when maize is planted. Many of the maize related tasks are done jointly by men and women, except for land preparation and the spraying of fertiliser which are predominantly done by men due to the labour intensive nature of these tasks. Women may do less labour intensive tasks (such as weeding and planting) by themselves.

Post-harvest practices also vary significantly between Madura and the mainland, with farmers on Madura more likely to store maize on-farm for long periods. For the local maize variety, Madurese farmers will sundry the corn for two days while it is still completely enclosed in the husk. The corn is then stored in the loft above the kitchen without peeling back or removing the husk. Farmers will store it for up to one year and will use it for household consumption or as seed for the next cultivation. When farmers need to sell or use maize, they can shell the maize using machines that have been provided to farmer groups by government projects. Drying and storage practices used for local maize are not well suited for hybrid maize. In fact, they can make hybrid maize more susceptible to insect infestations, mould, and aflatoxin contamination. There have been cases where farmers have attempted to use similar practices with hybrid maize only to find that all the grains have been damaged or hollowed out by weevils after a few months.

Currently, farmers who are successfully producing hybrid varieties in Madura for the feed milling industry often conduct minimal post-harvest activities before selling. After harvesting the corn, farmers will only remove the husk and will not dry or shell the maize before selling it. There are also some farmers who will remove the husk after harvesting the corn and dry it for one week on plastic sheets and bamboo mats. The corn is then shelled and further dried for two days before being stored in plastic sacks.

While minimal drying is done in Madura, farmers on the mainland will peel back the husk and first field dry the corn before harvesting and sun drying it. Sun drying is done on concrete floors or on plastic sheets for two to three days. Drying, which is important for reducing crop moisture down to safe levels for storage, can be problematic when the harvest occurs during the rainy season. High rainfall or humidity, coupled with primitive methods and facilities to dry corn, can result in lower overall quality of maize in the supply chain.

Both men and women are involved in the drying of maize, although women will also be responsible for other post-harvest activities like threshing. Threshing is primarily done with machines, and there are small commercial service providers that operate mobile corn threshers. These service providers will travel around villages or the sub-districts. Poor quality threshing equipment can reduce grain quality if it causes physical damage to the grain.

Poor post-harvest practices can result in rotten, mouldy, or discoloured maize grains, as well as aflatoxin contamination. Inadequate drying, physical damage from poor shelling methods, exposure to moisture during storage, or insect infestations can render the grain more susceptible to aflatoxin. According to a number of independent studies conducted in Indonesia, extremely high levels of aflatoxin (of up to 1,000 parts per billion (ppb)) has been found in maize products. This is well beyond acceptable levels of 20 ppb for maize. Aflatoxin has been linked with liver cancer, paralysis, and death for humans, as well as stunted growth for poultry. Unfortunately, it is rare for farmers or even other actors along the maize value chain to have any knowledge of aflatoxin. Those with some knowledge of aflatoxin were unaware of its genesis or dangers. Other post-harvest issues include contamination with foreign materials (dust, soil, stones, animal droppings, etc.) or losses if eaten by birds, chickens, and other animals.

Trading & Processing

In comparison to the East Java mainland, there is minimal commercial trading of maize in Madura. The local Madura variety is usually consumed by the household, although small amounts may be sold if the household requires cash. Local maize is always sold as kernels, and farmers will sell it to collectors who own general goods stores in the village. Farmers often use the proceeds from the sale to purchase common food items (e.g. oil, salt, noodles, and sugar) from the same shopkeeper or to finance other household needs. These collectors tend to sell the maize to small or medium poultry farms or to the local market as feed for birds.

For hybrid maize, farmers in Madura will mainly sell to PT Esa Sarwaguna Adinata, poultry farmers, or local maize collectors and traders. While maize collectors and traders tend to only buy dried maize grains, PT Esa Sarwaguna Adinata only accepts wet corn and poultry farmers accept either types of maize. In terms of local traders, Pak Ainur in Sumenep is one of the largest traders in Madura. He has direct relationships with several feed millers including Charoen Pokphand and buys approximately 1000 tonnes/month of dried maize during the peak season.

PT Esa Sarwaguna Adinata is an agricultural trading company which purchases tobacco and maize from Madura. During the tobacco season, PT Esa Sarwaguna Adinata purchases tobacco to supply its sister company, PT Sampoerna. Since the taste of tobacco from Madura is particularly unique, it is important to maintain a good relationship with tobacco farmers and support alternative income

generation opportunities during the off-season. As a result, PT Esa Sarwaguna Adinata is encouraging maize farming after the tobacco season and is purchasing hybrid maize from these farmers during the off-season for tobacco. Previously, the company had an agreement with Dupont that it will buy maize from farmers who are planting seeds from Dupont. Now PT Esa Sarwaguna Adinata is producing its own hybrid seeds which it sells to farmers on credit. In addition to having a warehouse in Pamekasan, which is equipped with drying and shelling machines, PT Esa Sarwaguna Adinata also has plans to build a feed processing facility in West Java. Since the company only buys wet maize, its buying capacity is limited by how much it can dry (30 tonnes/day in the dry season and 30 tonnes every 2 days in the rainy season).

There is also another agricultural trading company, iPasar, which is interested in sourcing maize, including from Madura. It has contracts with feed millers and also organises an auction market that trades in agricultural commodities. iPasar is able to absorb over 10,000 tonnes of maize per season and can provide trade financing to local maize buyers to purchase on behalf of the company. They can also facilitate access to national government owned drying facilities in Sumenep.

Farmers on the mainland tend to sell all their maize as quickly as possible after the harvest, and nearly all of the maize produced will go to feed millers. Men tend to be in charge of selling maize to collectors both at the farm gate and at other selling points, but women are usually in charge of managing the money from the maize sales. Farmers are price takers and will sell directly to collectors. Farmers on the mainland will rarely store maize, and the storage of maize is mainly at the collector and trader level. This is despite how storage could provide farmers with more flexibility in when they sell their maize, thereby allowing them to reap higher profits when price conditions are more favourable. It is common practice for collectors to pay farmers only 90% of the weight of the maize in order to compensate for potential high moisture content. In some areas, collectors provide interest free loans to farmers at the beginning of the season and expect farmers to pay back these loans as soon as they harvest the crop. Collectors will either purchase maize at the farm gate or when farmers deliver the maize to them. Similar to farmers, collectors will use plastic sheets to further sundry the maize.

Those who have limited storage facilities will tend to deliver the maize immediately to larger collectors and traders. These larger collectors and traders also tend to automatically deduct a percentage of the weight of the maize when purchasing from collectors, and again this is done on the grounds of high moisture content. According to traders, there is excess storage capacity (for example in Malang, Sumenep, and Tuban) even during the peak harvest. This is in part because maize is never stored for long periods of time. The number of intermediaries between farmers and feed mills varies depending on distances and infrastructure. In addition to supplying feed mills, some traders will also sell directly to poultry farms that will process maize into feed themselves.

Maize milling for animal feed is dominated by large-scale Javanese millers, which account for 28% of total installed capacity of feed mills in Indonesia. There are more than 60 feed mills nationwide, of which 17 are in East Java. The largest feed mills in East Java are Charoen Pokphand, Wonokoyo, and Japfa Comfeed. According to the Indonesia Feed Millers' Association, the total installed capacity was 18.5 million tonnes in 2012. Existing feed mills are estimated to run at less than 80% of total installed capacity. While feed millers have indicated a preference for locally

produced hybrid maize, the supply of maize is highly seasonal and concentrated within several months of the year. As feed mills require continuity of supply year round, they continue to rely on imports of maize to supplement locally sourced maize.

3.2.4 Supporting functions / services

Seed services in the maize sector are driven by multi-national seed companies. These companies work with farmers to multiply hybrid seeds. On the mainland, there are at least 12 districts engaged in contract seed multiplication arrangements with large seed companies. For example, Syngenta works with farmers in a number of districts clustered around Kediri, Tuban, and Jember to produce hybrid maize seeds. These companies will provide seed, training, and credit to contract growers. The production of seeds needs to follow specific procedures and requires higher levels of technical skills. Farmers who successfully produce seeds are compensated with higher prices (almost triple that of maize grains for consumption). Given limited land availability on the mainland, this will eventually place constraints on the growth of seed production on the East Java mainland. However, there is potential to expand seed production into Madura, particularly to Sumenep district where the soil is more fertile than other districts on the island. At present, there is no hybrid maize seed production on Madura.

In addition to producing hybrid seeds, these private companies are also engaged in developing new hybrid varieties. Whereas the hybrid varieties that are being grown in East Java require between 110 and 120 days, Dupont, Syngenta, Monsanto, and AHSTI have developed early maturing varieties that can be harvested within 95 to 100 days. AHSTI also has an early maturing variety that requires less water and is better adapted to dry season farming. Dupont will be launching in 2016 a new hybrid named "Optimax," which is also more suitable for maize farming in the dry season.

Another important supporting function is how farmers obtain information and training on agronomic and post-harvest practices. Farmers mainly obtain this information through other farmers, as well as through trial and error on their own farms. They tend to use traditional farming practices and have limited technical knowledge about the appropriate amounts of agro-chemicals to use and proper application methods for agro-chemicals. Excessive use of chemical inputs not only increases farmers' overhead costs but can also have negative health and environmental implications. Farmers also have limited exposure to technologies that may facilitate and improve production and post-harvest handling.

Government extension is not able to effectively satisfy the need for technical information and training, nor is it equipped to do so. The Department of Agriculture (Dinas Pertanian) at the provincial and district levels provide agricultural extension agents. However, there are few agents relative to the number of farmers, and many of these agents are not sufficiently trained or do not have specific expertise on maize. Given the large geographic areas that each agent has to cover, they are also unable to provide regular technical assistance to farmers. The government has started to take some measures to address the shortage of extension workers by supplementing the 20,000 government extension agents across Indonesia with an additional 50,000 non-commissioned

officers of the Indonesian National Armed Forces (TNI). It remains to be seen whether these additional agents will have the required technical expertise to support farmers.

Private input suppliers do provide some information services, but this is geared towards promoting their own products. Seed and inputs companies will provide demoplots as a promotion tool to convince farmers about the benefits of using hybrid seeds and agro-chemicals. However, these companies have relatively few promotion agents and resources. This limits their overall outreach.

In terms of finance, Madurese farmers have less access to capital than farmers from the mainland, but maize farming in Madura is also less capital intensive for local varieties. Maize farmers on the mainland tend to use working capital from the previous harvest or are able to access low-interest or no-interest loans from collectors. Given the high constant demand for maize from feed millers, collectors have incentives to encourage maize production, particularly during the low season. By providing input credit, collectors are able to secure greater volumes of maize. There is also a public private partnership which involves the provincial government of East Java, Bank Rakyat Indonesia, PisAgro (Partnership for Indonesia's Sustainable Agriculture), Monsanto, and Cargill to improve access to formal finance for maize farmers. The pilot, which was conducted in Mojokerto in 2014, enabled access to working capital loans through the Credit Food and Energy Security (KKPE) scheme along with access to seeds, training on good agricultural practices and post-harvest handling, and access to market (through an off-take guarantee).

In Madura, small-scale subsistence maize farming requires minimal investments and is a low input-low output production system. This, however, also means that households are not accumulating sufficient capital from traditional maize farming to engage in more capital intensive activities such as hybrid maize farming. Some of the farmers who are now growing hybrid maize were initially introduced to these varieties through the government's project to promote hybrid seeds in Madura. These farmers have used the higher incomes that they generated during the project to continue growing hybrid maize without government support.

3.2.5 Supporting rules and regulations (enabling environment)

Under the new Swasembada Pangan 2015, President Joko Widodo has ambitious goals for Indonesia to be self-sufficient in corn, rice, and soybean within the next four years. In order to meet these goals, the government plans to make significant improvements to supporting infrastructure (particularly irrigation, warehouses, and post-harvest facilities). Alongside these investments, the government also plans to expand seed production and free seed distribution; increase fertiliser subsidies (including the provision of free fertilisers) while improving the distribution system; encourage the development of cooperatives; improve access to agricultural financing; and initiate land reforms. The new government has allocated more funds than the previous administration to support the maize sector and has set a production target of 20 million tonnes of maize for 2016. The program is targeting 100 districts across Indonesia. The previous Swasembada Pangan program, which began in 2010, had targets to reach an average productivity of 5.8 tonnes/ha, 29 million tonnes of maize, and 5 million ha of planting area by 2014.

Other national level initiatives to support the maize sector include the signing of a Memorandum of Understanding between the Ministry of Agriculture and the Feed Miller Association in May 2015 around the purchase of maize for feed milling. There is also a National Maize Council (Dewan Jagung Nasional) which provides policy recommendations to the government around maize production, trading, and processing. The council is a multi-stakeholder forum which was established in 2005 and is supported by a secretariat in the Ministry of Agriculture.

In order to support national production of maize, import restrictions have been introduced in the past. In 2005, the government imposed a 5% import tax on maize. In 2011, the Association of Feed Millers lobbied to have the government relax the tax, citing that the tax was pushing up the price of feed. Currently, according to the tariff schedule published on the Ministry of Finance website, there does not appear to be any import taxes or tariffs on maize. Imports are, however, controlled by the issuance of import permits by the Ministry of Trade. Importers need to submit a proposal to the Ministry of Agriculture, which will review and make a recommendation to the Ministry of Trade. While the Ministry of Agriculture has stated that imports should not occur during the harvest, imports are arriving throughout the year including during the peak harvest months.

Other relevant enabling environment factors include standards in the sector. Although the social cost of aflatoxin in Indonesia (from maize) is estimated to be in the order of AUD 200 million annually, maximum allowable aflatoxin levels are not being enforced. According to the Indonesian National Standards (SNI01-4483-1998), permissible aflatoxin levels are 50 ppb for animal feed. This is already high compared to the standard maximum of 20ppb for poultry feed in the US and other countries. In order to better control aflatoxin in maize and peanuts, the Aflatoxin Forum Indonesia was established in February 2006. This is an information network that brings together government, research institutions (Gadjah Mada University), and businesses (processors, traders, farmer groups) in order to increase awareness related to aflatoxin. Nevertheless, government has been reluctant to enforce maximum levels and efforts to create awareness among the public have yet to be put in place.

The only product standard that is being observed by the industry is around the moisture content for maize. The Indonesian National Standard for Maize Feed allows a maximum moisture content of 14%, which is in line with international limits of 12-14%. There are also standards around allowable percentages of protein, fibre, fat content, foreign materials, and breakage. In reality, the standard moisture content accepted by the animal feed industry in Indonesia typically ranges from 15-20%. The feed milling industry does not pay quality premiums, but rather it discounts for excessive moisture on a sliding scale. According to Charoen Pokphand, they begin applying penalties when the moisture content is above 16% and will only reject the maize if it is above 28%. Despite the importance of moisture for feed manufacturers and the penalties applied, most farmers and traders do not see the cost-benefit advantage of improved drying.

4 Analysis

4.1 Problems and underlying causes

The problems and underlying causes are specific to the poor target groups that AIP-PRISMA seeks to support through interventions in the maize market system in East Java. These problems have been identified through the Sector Dynamics section above and are also presented in the Intervention Logic Analysis Framework (ILAF) table. The three key problems can be summarised as:

- Farmers in Madura experience low productivity because they mainly use local seed varieties and poor agricultural practices
- Farmers receive low prices because farmers sell on harvest and employ poor post-harvest practices
- Farmers experience difficulties in increasing maize production during the dry season in non-irrigated dryland areas (mainly on the East Java mainland)

Farmers in Madura experience low productivity because they mainly use local seed varieties.

Maize yields in Madura are the lowest in East Java, ranging from a low of 1.7 tonnes/ha in Sampang to a high of 2.2 tonnes/ha in Pamekasan. In contrast, the average provincial yield in 2013 was 4.8 tonnes/ha, with the highest yield at 8 tonnes/ha in Nganjuk. Low yields in Madura can be attributed to the pervasive use of low-yielding local maize varieties. Relatively few Madurese farmers have adopted hybrid seeds since they do not see or understand the potential benefits of using hybrid seeds. This is largely because maize has been traditionally farmed as a subsistence crop in Madura. Farmers also have limited access to information on good agricultural practices (such as spacing, seed utilisation, proper application of chemical inputs, planting, and harvesting schedules). Good practices are particularly important when shifting to hybrid maize since the production of hybrids require more advanced practices.

Farmers receive low prices because farmers sell on harvest and employ poor post-harvest practices. Farmers and traders are penalised by feed millers for excessive moisture in maize grains. Farmers can also receive lower prices when there are foreign materials in the maize. Poor quality maize can be attributed to insufficient knowledge of good post-harvest practices and maize quality standards, along with limited access to good post-harvest equipment. Most farmers and collectors are still using primitive methods and facilities to dry and store corn kernels. At the same time, the lack of adequate storage technologies at the farm level means that farmers sell their entire crop after the harvest, and they are not able to reap the benefits of storing and selling maize when price conditions are better.

Farmers experience difficulties in increasing maize production during the dry season in non-irrigated dryland areas (mainly on the East Java mainland). On the East Java mainland, it is common for dryland farmers to attempt a second maize crop after the rainy season. Dryland farmers who plant a second maize crop in areas which lack access to irrigation or alternative water sources

are more susceptible to crop failure. In the best case scenario, they will experience poor yields and lower quality maize as a result of insufficient water during the planting process. In addition to lacking access to water and irrigation services, these farmers also have limited knowledge and information on the most appropriate seed varieties and practices for dryland farming.

4.2 **Services, enabling environment, and weaknesses analysis**

There are a number of services and enabling environment factors which affect the underlying causes of the problems highlighted above. In order to strengthen the market system, it is crucial that identified weaknesses in these services and enabling environment factors are the target of interventions. The key services weaknesses are detailed in the ILAF table and include:

- Few seed companies are servicing Madura, alongside limited brokering services to link Madurese maize producers to potential buyers of hybrid maize
- Limited provision of information and extension services because of weak public provision and lack of private alternatives
- Few commercial providers of irrigation and post-harvest technologies and facilities, particularly given the strong government presence in these areas

Few seed companies servicing Madura, alongside limited brokering services to link Madurese maize producers to potential buyers of hybrid maize

Since relatively few farmers have transitioned from subsistence to commercial maize farming in Madura, this poses challenges for seed companies who want to expand commercial seed sales to Madura. Not only are farmers not accustomed to purchasing seed for maize, but there is also a tendency for them to evaluate maize varieties based on household consumption needs rather than on commercial potential. As a result, common problems that Madurese farmers have with hybrid maize include how it tastes different than local varieties, cannot be stored for extended periods without damage, and requires longer to mature (which affects how quickly households can access the maize as a food source). Only a few seed companies have started selling hybrid maize seeds in Madura, but market penetration has been slow and difficult. Concurrently, weak linkages between producers and buyers of hybrid maize also disincentivise farmers from investing in hybrid maize farming.

Limited provision of information and extension services because of weak public provision and lack of private alternatives

This affects farmers' knowledge of good agricultural practice (particularly around the use of appropriate seed varieties and farming practices for dryland cultivation, as well as appropriate fertiliser application) and of good handling practices. There are few reliable sources of information for maize farmers. Government extension is not able to effectively satisfy the need for technical information, and it is rare for input suppliers and traders to provide embedded information on maize cultivation. When input suppliers do provide information services, these are geared towards promoting their own products. As a result, farmers mainly obtain information through their peers

and have limited exposure to better practices and innovation in maize farming and post-harvest handling. At the same time, weak linkages with downstream actors mean that quality standards and specifications are rarely conveyed to the producer level.

Few commercial providers of irrigation and post-harvest equipment or services, particularly given the strong government presence in these areas

Traditionally, irrigation has been seen as being the responsibility of the government. Government involvement in the provision of irrigation, as well as the distribution of subsidised post-harvest equipment, has created disincentives for private sector companies to invest in these areas. Furthermore, private actors are often deterred by the high investment required for irrigation infrastructure, along with challenges in maintaining the infrastructure. For both irrigation and post-harvest services, outreach through government programs has been limited, and in the case of irrigation, these services are usually only available for rice cultivation. There are currently no providers of small-scale storage or drying solutions/services for smallholder farmers in East Java. In order to understand more about the weaknesses in post-harvest maize services in East Java, the team is planning to conduct an assessment on post-harvest services (including current post-harvest practices and options for improved practices or technologies).

5 Strategy for change

The strategy is designed to strengthen the weaknesses in the current service provision and enabling environment in the market system. This takes the form of (1) identifying the market potential, through calculations to show the potential of the sector; (2) a vision of change, to envisage how the value chain or market system would operate if identified problems are resolved; and (3) a set of interventions which can be targeted at specific market actors or groups of market actors which can be engaged to drive change in the system.

5.1 Market potential

There is market opportunity to expand East Java's maize production in order to meet the growing demand for maize by the animal feed industry. Both the animal feed industry and poultry industry are projected to continue experiencing robust growth as population and incomes increase in Indonesia. While national production has been increasing, it has been insufficient to meet the growing demand of animal feed mills, which require continuity of supply all year round. As a result, there is potential for East Java to expand production and productivity, especially in Madura and in the dry season, and to ensure that its maize meets the feed industry's standards.

Based on our calculations, there is potential to unlock at least AUD 64.9 M in intervention districts.

Table 1: Business potential in target area

Description/Years	Total Business in the target area (s)
Existing Production (MT)	156,650
Potential New Production in Existing Areas (MT)	234,974
Total Potential Production (MT)	391,624
Average Selling Price maize per kg (IDR)	2,900
Current Value of Production (million IDR)	454,283.8
Total value of potential production (million IDR)	1,135,710
Total value of potential production (AUD)	108,162,819
Total potential value of increased production (million IDR)	681,426
Total potential value of increased production (AUD)	64,897,691

5.2 Vision of change

Focusing on achieving the potential outlined above for the maize sector in East Java, a vision of change can be outlined for both the sector and service levels. The vision of change at the **sector level** is to: (1) increase smallholder productivity and production throughout the year, including during the dry season and (2) improve the quality of maize. At the **service level**, it is envisaged that farmers will have improved access to: (1) improved seed, (2) information and extension, (3) post-harvest, and (4) irrigation services.

We envision that traders, collectors, trading companies, or feed millers would be involved in providing a range of these services, including post-harvest and irrigation services. Seed and information services would also involve input suppliers (seed or fertiliser companies) and agro-input retailers. Finally, irrigation services may also involve water user groups or farmer groups.

5.3 Intervention areas

It is crucial that interventions are designed which are 'systemic' so that outcomes are not dependent upon the project or development partner for sustainability. This means that AIP-PRISMA should not seek to provide services (or at least only temporarily) but rather enter the market system in a catalytic manner to tackle the service weaknesses in existing market actors. Based on our analysis, four key intervention areas will be necessary to transform the maize sector in East Java. The following table shows the key intervention areas along with approved, on-going, or completed interventions and intervention concepts:

Intervention Areas	Approved, on-going, or completed interventions and intervention concepts
Intervention Area 1: Promote the use of hybrid seeds and GAP (with a focus on Madura)	<ul style="list-style-type: none"> Promote the use of hybrid seeds (PT AHSTI in Sumenep, Pamekasan, and Sampang)
Intervention Area 2: Promote appropriate post-harvest services	-
Intervention Area 3: Promote the use of improved seeds suitable for dry season farming	-

in non-irrigated drylands (with a focus on the East Java mainland)	
Intervention Area 4: Develop access to proper irrigation systems and technologies (with a focus on the East Java mainland)	-

Intervention Area 1: Promote the use of hybrid seeds and GAP (with a focus on Madura)

The introduction of hybrid seeds in Madura would have a significant impact on farmer yields, especially given the low average yields in Madura. By improving the returns from maize farming, this can change farmers' mindsets and motivate them to begin treating maize as a commercial crop. Since women are active in the cultivation of maize and managing of household finances, it will be important to ensure that exposure to the benefits of hybrid seeds and information on better practices are also accessible to women and tailored to their needs.

In order to promote the use of hybrid seeds and GAP, AIP-PRISMA has been working with PT AHSTI to develop and pilot a business model for the sales of hybrid seeds to farmers in Sumenep, Sampang, and Pamekasan. Prior to partnering with AIP-PRISMA, PT AHSTI had some distributors in Madura but it was not providing any training to its distributors or farmers groups and it did not link producers to potential buyers of hybrid maize. In order to promote the business case for switching from local varieties to hybrid seeds, the pilot includes embedded finance and training, as well as linkages to maize buyers. The next phase of the pilot will involve more actors in the selling of seeds and buying of maize, as well as trade financing from iPasar to maize buyers.

Since the seed market in East Java mainland is approaching saturation, a number of seed companies have been looking to expand into new areas, including Madura. As a result, there is significant potential to scale-up the PT AHSTI model or test other interventions with seed companies that are already operating on a small-scale in Madura (PT Dupont and PT BISI) or are interested in entering Madura. This will likely involve some combination of support around setting up distribution networks, developing promotional activities, and improving capacity to provide embedded services (information, finance, access to market).

Intervention Area 2: Promote appropriate post-harvest services

The introduction of appropriate post-harvest services can allow farmers to realise higher prices through two channels—first of all, the ability to store maize can give farmers greater flexibility to sell maize at more favourable prices, and secondly, better post-harvest practices, equipment, and technologies can reduce or prevent deterioration in the quality of maize. Appropriate post-harvest handling is important for reducing impurities and the moisture content, as well as for minimising the risk of aflatoxin contamination. This will require not only expanding the dissemination of technical information to farmers but also identifying cost-effective storage, drying, and threshing technologies or methods. For example, there is already some evidence from other provinces and countries that the use of jerry cans, plastic barrels, or storage drums have been highly effective at reducing post-harvest quality losses and increasing household incomes. There is potential to work with traders and feed millers who have incentives to secure better quality maize.

Intervention Area 3: Promote the use of improved seeds suitable for dry season farming in non-irrigated drylands (with a focus on the East Java mainland)

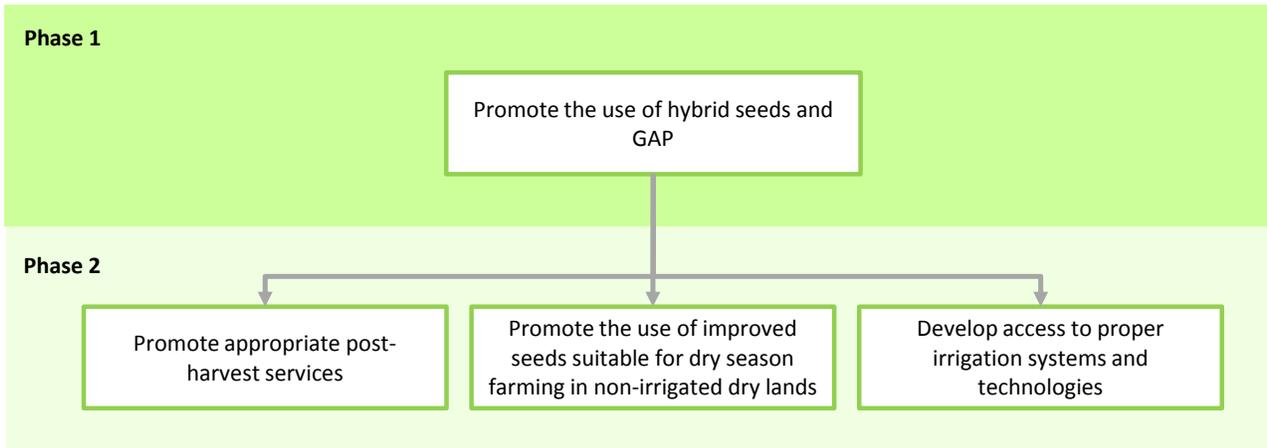
The introduction of seeds that are better adapted for dry season farming is another solution for increasing farmer yields during the dry season. These varieties are better adapted to dry season farming because they require less water than other hybrid varieties. There is potential to work with PT AHSTI since they have already developed such a variety but have not yet been successful in marketing the new variety. They had initially marketed the variety as an all-season variety, but it ended up performing poorly during the rainy season, which was the first season that they tried to introduce this new variety to the market. This has affected subsequent adoption by farmers. Other seed companies may also have dry season varieties that could be promoted. The introduction of such varieties should also be accompanied with embedded information on appropriate dryland farming practices.

Intervention Area 4: Develop access to proper irrigation systems and technologies (with a focus on the East Java mainland)

Proper irrigation systems and technologies would allow dryland farmers to improve yields and the quality of maize when they attempt to grow a second maize crop during the dry season. There is potential to work with local government, water user groups, and/or traders to improve access to irrigation. One possible model is to look at Tuban in East Java where a trader has set up a commercial model to supply water to smallholder farmers. The irrigation team in AIP-PRISMA will be responsible for developing partnerships and piloting business models which can potentially provide irrigation for off-season maize farming in drylands (as well as for the production of other crops). They are currently in discussions with Vasham, a new venture capital firm based in Jakarta which provides financing for integrated market solutions to smallholder farmers in Indonesia. Vasham is interested in investing IDR 200 million in a pilot irrigation scheme in East Java. The pilot will involve farmer groups or water user groups in the maintenance of equipment and collection of payments from farmers.

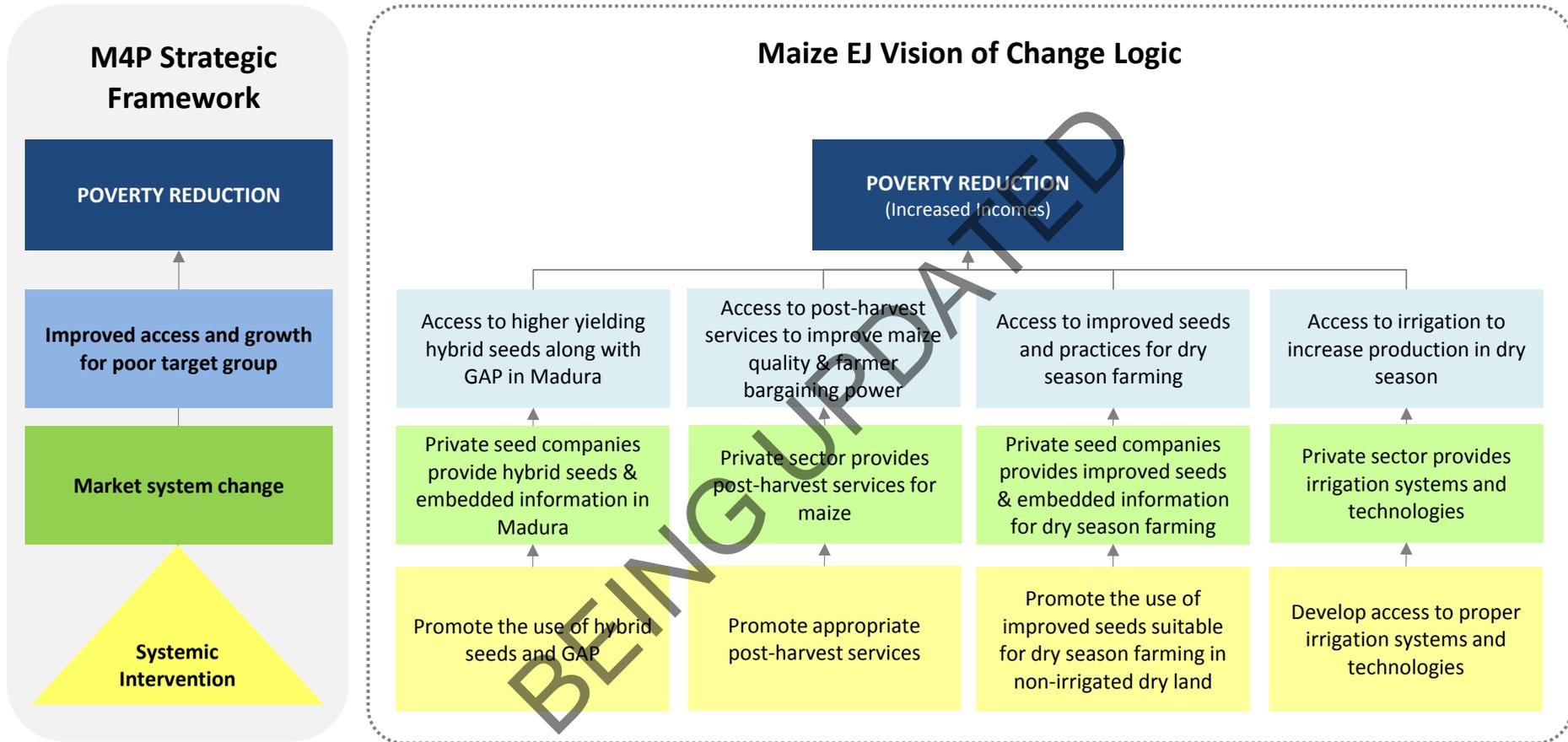
5.4 Sequencing and prioritisation of intervention areas

It is recommended that the intervention areas in the East Java maize sector be implemented in two phases. In the first phase, the focus will be on increasing productivity in Madura by *promoting the use of hybrid seeds*. The second phase will focus on improving the quality of maize and on expanding production in the dry season (mainly in the East Java mainland). Improved maize quality will be achieved through *promoting appropriate post-harvest equipment/technologies* whereas increased productivity and production during the off-season will be achieved either through *developing access to proper irrigation systems and technologies* or *promoting the use of improved seeds suitable for dry season farming in non-irrigated drylands*.



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5.5 Sector vision of change logic



Annex 1: Intervention Logic Analysis Framework (ILAF)

(1) Problem/ Symptom	(2) Underlying cause	(3) (4) Services and Enabling Environment	(5) Service weaknesses/ underlying causes	(6) Intervention Area	Service Provider/Partner
Farmers in Madura Island experience low productivity because they mainly use local seed varieties	Farmers do not see or understand the potential benefits of using hybrid seeds	Seed services Brokering services	Few seed companies are servicing Madura. Few linkages to feed millers who require hybrid seeds.	Intervention Area 1: Promote the use of hybrid seeds and GAP	<ul style="list-style-type: none"> • Input companies (BISI, Dupont, AHSTI) • Agro-input retailers • Collectors/ Traders/ Trading Companies (Esa Sarwaguna Adinata, iPasar) • Farmer groups
	Farmers have limited access to information on good agricultural practices (GAP)	Information & extension services	Weak public provision of extension services and lack of private alternatives. Existing input suppliers and traders provide limited embedded information.		
Farmers receive low prices because farmers sell on harvest and employ poor post-harvest practices	<p>Farmers and collectors have limited knowledge of good post-harvest practices and maize quality standards</p> <p>Farmers have limited access to good post-harvest equipment or facilities (storage, drying)</p>	<p>Information & extension services</p> <p>Post-harvest services</p>	<p>Weak linkages with downstream actors mean that specifications/ standards are rarely conveyed to producers.</p> <p>Weak public provision of extension services and lack of private alternatives. Existing input suppliers and traders provide limited embedded information.</p> <p>No providers of storage or alternative drying technologies or facilities for farmers.</p>	Intervention Area 2: Promote appropriate post-harvest services	<ul style="list-style-type: none"> • Traders/Trading Companies (Esa Sarwaguna Adinata) • Feed mills (Charoen Pokphand, Japfa Comfeed, etc.)

(1) Problem/ Symptom	(2) Underlying cause	(3) (4) Services and Enabling Environment	(5) Service weaknesses/ underlying causes	(6) Intervention Area	Service Provider/Partner
Farmers experience difficulties in increasing maize production during the dry season in non-irrigated dryland areas (mainly East Java mainland)	Farmers have limited knowledge and information on the most appropriate seed varieties and practices for dryland farming	Information/ Extension Services	Weak public provision of extension services and lack of private alternatives. Existing input suppliers are not providing sufficient embedded information.	Intervention Area 3: Promote the use of improved seeds suitable for dry season farming in non-irrigated drylands	<ul style="list-style-type: none"> • Seed companies (BISI, AHSTI, Monsanto, Dupont, Pertiwi, Syngenta)
	Farmers lack access to irrigation services	Irrigation Services	Irrigation services are mainly provided by government but have limited outreach or are only available for rice cultivation.	Intervention Area 4: Develop access to proper irrigation systems and technologies	<ul style="list-style-type: none"> • Traders • Water user groups • Farmer Groups

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Annex 2: Gender table

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