

**2015 UPDATE**  
**MAIZE SUB-SECTOR GROWTH STRATEGY**  
**IN**  
**WEST NUSA TENGGARA**

**July 30, 2015**

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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
GAP	Good Agricultural Practices
FRC	Farmer Resource Centre
GM	Genetically modified
ha	hectare
ILAF	Intervention Logic Analysis Framework
KKPE	Kredit Ketahanan Pangan dan Energi
KUR	Kredit Usaha Rakyat
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 conducted numerous field investigations which has improved their understanding of the dynamics, constraints, and opportunities in the sector. This has resulted in more updated and accurate details around the core value chain, supporting functions/services, and supporting rules and regulation. In addition, the main changes to the GSD include:</p> <ul style="list-style-type: none"> <li> <p><b>Revisiting the assumption that farmers are experiencing low productivity from a lack of access to fertilisers and removing the related intervention area until further research is conducted:</b> According to the previous GSD, one of the underlying causes for why farmers were experiencing low productivity was the lack of access to fertilisers. The GSD also claimed that there were few commercial providers of fertiliser. As a result, there was a corresponding intervention that recommended introducing affordable commercial fertilisers. Upon further investigation, there appears to be a number of commercially available (and potentially affordable) fertilisers in NTB and availability of fertilisers may not be the problem. Rather it may be more of an issue of simply sensitising farmers to the benefits of using these commercially available fertilisers (especially during times when subsidised fertilisers are delayed) or providing better information on how to use fertilisers. As there is a lack of clarity around fertiliser usage and availability, the team will be doing further research in this area. This will inform whether there is a need for a fertiliser related intervention area in the future.</p> </li> <li> <p><b>Revisiting the logic underlying the intervention to develop irrigation systems/technologies for maize farmers and removing the related constraint and intervention:</b> In the previous GSD, one of the constraints listed was that farmers' production in dryland areas is sub-optimal since they only plant one maize crop annually during the rainy season. The lack of access to irrigation was presented as the reason why farmers are not planting a second season, which led to an intervention around developing irrigation systems/technologies for maize farmers. Upon further investigation, it is not clear whether a second season of maize is even possible given the climate and terrain of these areas and also given other crops that are being produced by farmers (or may be more profitable to produce) during the off-season. As a result, it was decided that more information is needed on the potential for off-season production before considering this as a constraint.</p> </li> <li> <p><b>Removing the constraint and intervention related to facilitating the release of idle government lands for maize production:</b> Availability for land to expand maize production is not in fact a constraint for maize farmers. Their primary focus is on being able to effectively farm the lands that they already have. Furthermore, contrary to what was claimed in the previous version of the GSD, the government has actually been very active in giving farmers access to reserved farming lands owned and managed by the Ministry of Forestry.</p> </li> </ul> <p>The market growth potential in the sector has not changed, and there is still significant opportunity to expand maize production in NTB in order to meet growing demand from feed millers in other provinces (particularly East Java).</p>
	<p><b>The planned focus for July 2015-2016 is on:</b></p> <ul style="list-style-type: none"> <li>Continuing implementation of the GAP intervention with PT Sarottama</li> <li>Identifying additional potential partners (e.g. PT Petrokimia Gresik) for scale-up of the GAP intervention</li> <li>Conducting assessments 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) and on fertiliser usage and availability</li> </ul>

Year	July 2015 - June 2016

Year	July 2016 - June 2017

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## 1 Executive summary

National Information	
Production	18,512,000 MT
Productivity	4.84 MT/Ha
Harvested Area	3,822,000 Ha
Import	3,194,419 MT/Year
West Nusa Tenggara Information	
Production	633,773 MT
Productivity	5.75 MT/Ha
Harvested Area	110,273 Ha
Farmer	383,781 HH
Poor farmer	87,725 HH

**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.

**Although NTB's contribution to national maize production is relatively small, maize cultivation has increased by more than 400% since 2007 (albeit from a low base).** This was driven by significant increases in the harvested area for maize alongside a doubling of productivity between 2007 and 2013. With an average yield of 5.75 tonnes/ha in 2013, NTB is now the province with the third highest productivity in Indonesia. Sector growth is strongly supported by the national and provincial governments, and maize production in NTB is almost entirely focused on supplying the animal feed industry in other provinces. The use of hybrid seeds is common and accounts for the high average productivity in NTB. However, productivity still remains below potential.

**There is market opportunity to further expand NTB'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 NTB to expand productivity and 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 NTB farmers to take advantage of this market opportunity.** Limited access to good agricultural practices means that farmers continue to employ poor agricultural practices and are unable to maximise yields. 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. In addition to lower than optimal yields, farmers' production costs are high because they are producing hybrid maize, which requires more investment. Since farmers have limited access to affordable credit, many farmers will borrow from moneylenders and collectors at high interest rates. This increases farmers' production costs and reduces their margins. Finally, farmers also receive low prices because of poor post-harvest practices that affect the quality of maize. There are few commercial or government providers of quality post-harvest services, and the team plans to conduct a more in-depth study on post-harvest services.

**The vision of change at the sector level is to:** (1) increase smallholder productivity and (2) improve the quality of maize. At the **service level**, it is envisaged that farmers will have improved access to: (1) extension, (2) finance, and (3) post-harvest services. To realise this vision, this report recommends the following three intervention areas:

- Promote the use of Good Agricultural Practices and Good Handling Practices
- Promote appropriate financial products for maize farmers
- Promote affordable drying and threshing services

We envision that traders and collectors would be interested in providing all of these services. Information/extension and fertiliser services could also be provided through input suppliers (seed or fertiliser companies) while financial services would also involve financial institutions.

**It is recommended that the intervention areas in the NTB maize sector be implemented in two phases.** In the first phase, the focus will primarily be on increasing productivity through *promoting the use of GAP and GHP*. The second phase, where the team is still looking for potential business models and partners, will involve *promoting appropriate financial services* and *promoting affordable drying and threshing services*. The promotion of GAP and GHP in the first phase would lead to higher, more consistent yields which could build the confidence of banks around the ability of farmers to more easily repay loans.

## 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 NTB.

## 3 Sector description

### 3.1 Sector profile

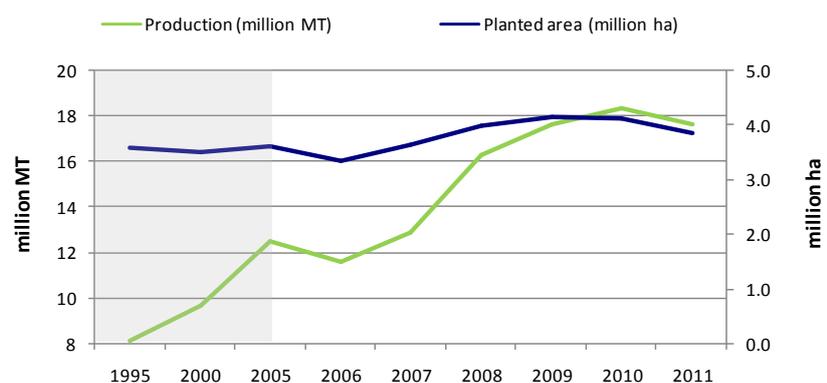
The sector profile provides information on the current status and potential of the target sector. This has been derived mainly from secondary data and literature relevant to the maize sector.

#### 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 million 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.

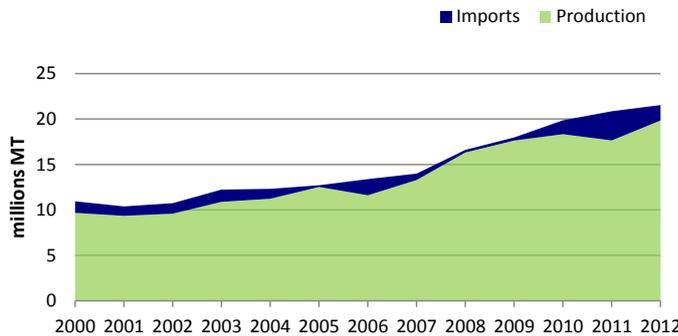
**Maize is a dynamically expanding crop both internationally and in Indonesia. Indonesia is the largest maize producer in Southeast Asia and the eighth largest globally.** Indonesia contributed to nearly 2% of global production with 18.51 million tonnes in 2013. From 1995 to 2011, production and productivity 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 8.06% of its annual maize consumption needs of 21.06 million MT. 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.<sup>1</sup>

**Figure 2: Indonesian maize production vs imports**



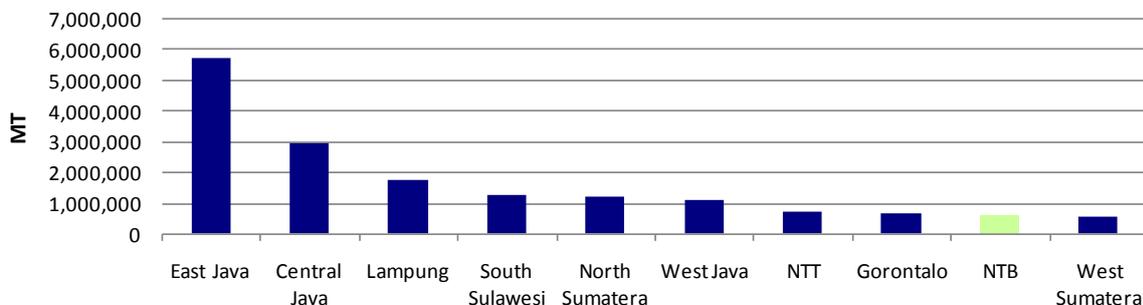
Indonesia imports maize primarily from India (37%) and Argentina (34%). The volume of maize imports into Indonesia is typically 100,000 to 200,000 tonnes/month but can reach over 500,000 tonnes/month. According to the Indonesian Feed Millers' Association there will always be a requirement for imports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

NTB's contribution to maize production in Indonesia is relatively small. Although NTB is among the top 10 maize producing provinces, it accounts for only 3.4% of maize production in Indonesia, with 633,773 tonnes in 2013. In comparison, East Java, the leading maize producer, contributes more than 30% of national production.

**Figure 3: Top 10 maize producing provinces (2013)**



Nevertheless, maize cultivation in NTB has rapidly increased over the past years, with a focus on supplying the animal feed industry in East Java. Average productivity in NTB is also high relative to other provinces but still below potential. Albeit from a low base, maize

<sup>1</sup> FAOStat

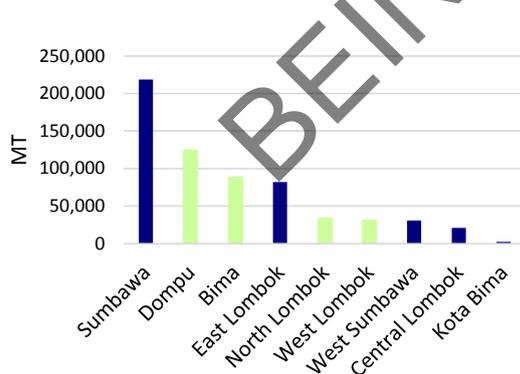
production in NTB increased by more than 400% since 2007. This corresponds to a compound annual growth rate (CAGR) of 32% between 2007 and 2013. In comparison, the national CAGR was 7.4% during the same period. Rapid growth in the maize sector in NTB was driven by significant increases in the harvested area for maize (from 43 thousand ha in 2007 to 110 thousand ha in 2013), alongside a doubling of productivity between 2007 and 2013.

With an average yield of 5.75 tonnes/ha in 2013, NTB is the province with the third highest productivity in Indonesia. Only West Sumatra and West Java have higher average yields of 7.2 tonnes/ha and 6.7 tonnes/ha respectively. Over 95% of maize production in NTB uses hybrid seeds and is delivered to the feed industry. As maize is not traditionally a part of the diet in NTB, only small quantities are consumed locally.

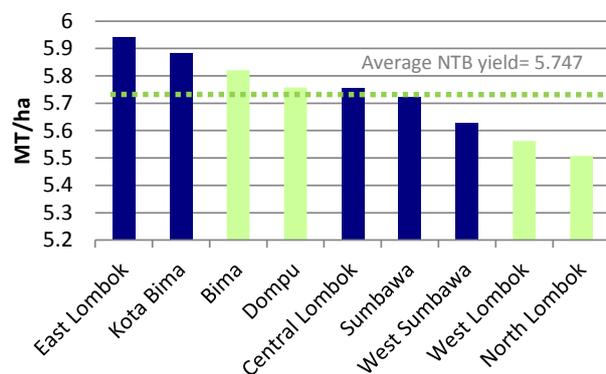
**The provincial government places high priority on increasing maize production, and it estimates that there are 73,000 poor households involved in maize farming.** According to a study by Swastika et al, the percentage contribution that maize makes to household income for farmers in NTB is 49% for poor farmers with less than 0.5 ha, 44% for farmers with 0.5-1 ha, and 41% for farmers with more than 1 ha.

**At the district level, the 4 districts in which AIP-PRISMA is starting its maize sector interventions account for nearly 44% of maize production and harvested area in NTB.** These districts are Bima and Dompu on Sumbawa Island and North Lombok and West Lombok on Lombok Island. Sumbawa Island is known for its commercial maize activity, and it is characterised by mostly drylands, which allow for one maize crop per year. Bima and Dompu, which are both on Sumbawa Island, are the second and third largest maize producing districts in NTB. With yields of 5.82 tonnes/ha and 5.76 tonnes/ha respectively, they are slightly higher or on par with the average NTB productivity in 2013.

**Figure 4: Maize production by district (2013)**



**Figure 5: Maize yields by district (2013)**



Maize production in Dompu has grown faster than any other district in NTB (with an annual growth rate of 57% between 2008 and 2013). Maize farming in Dompu receives strong support from the local government, which introduced hybrid seeds to the district. Due to Dompu's proximity to Sumbawa (the leading maize producing district in NTB), large traders from Sumbawa are also looking to procure maize from Dompu and neighbouring Bima. Both Bima and Dompu also have ports which are currently being used to export small quantities of maize.

In comparison, North Lombok and West Lombok produce much smaller amounts of maize (approximately 10% combined of total production in NTB). Productivity is also slightly lower than other districts in NTB. Since it receives more rainfall and has areas with good access to irrigation, farmers often prefer to cultivate rice and other crops in Lombok.

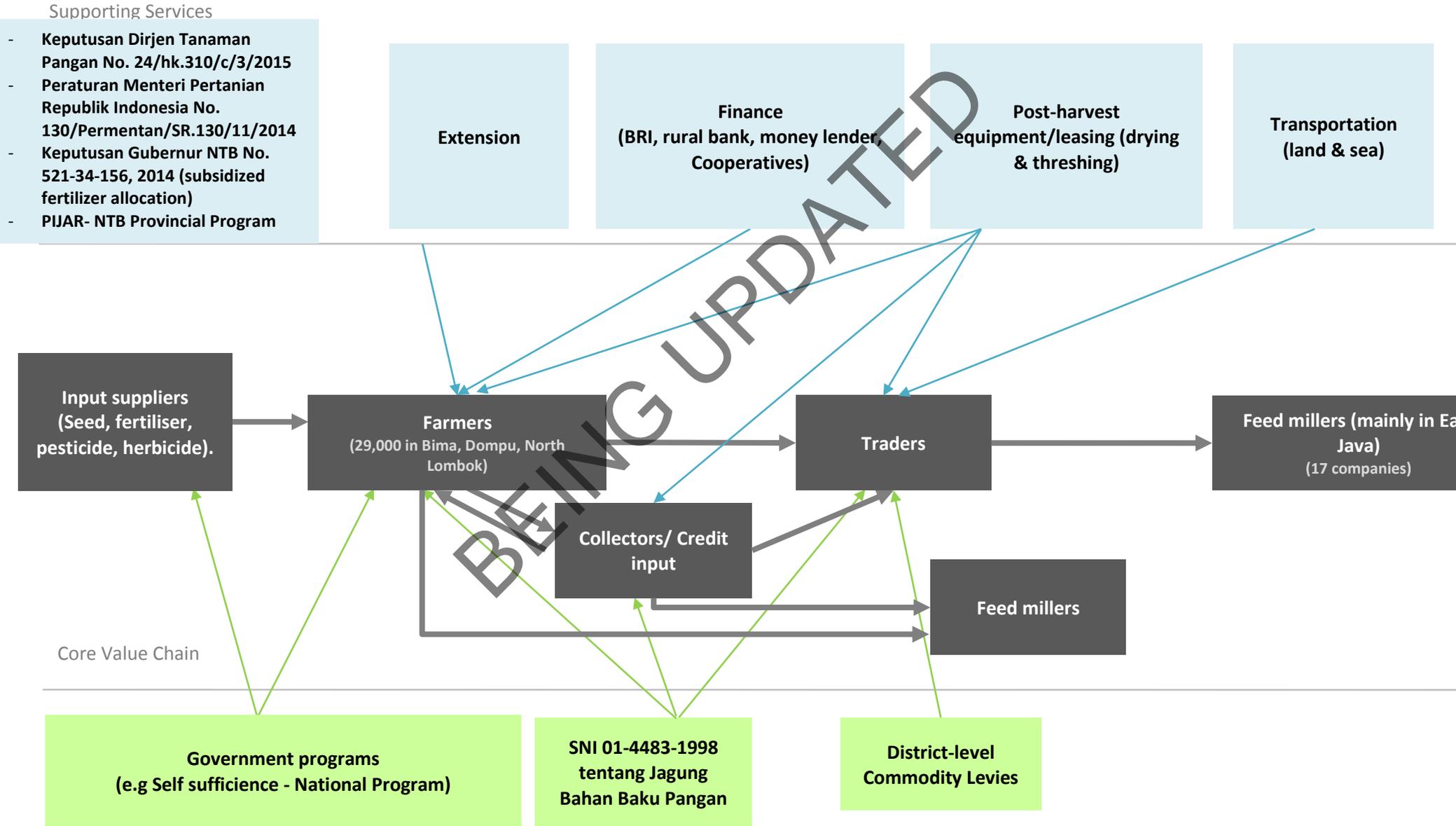
## 3.2 Sector dynamics

### 3.2.1 Market overview

Maize farming in NTB is a relatively recent trend and involves production mainly for the animal feed industry in Surabaya, Sulawesi, and Bali. Production patterns vary between Sumbawa and Lombok Islands, where differences in topography and access to water affects when farmers plant maize each year. The use of hybrid seeds is common and accounts for the high average productivity in NTB. Nonetheless, there is potential for increased productivity, especially since farmers still rely mainly on farmer-to-farmer exchanges for information on maize cultivation. In terms of trading, there are also differences between the islands, with traders in Dompu and Bima having stronger, more formal links with the feed milling industry in other provinces (particularly East Java).

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### 3.2.2 Sector map



### 3.2.3 Core value chain

#### Inputs

**The use of hybrid seeds is widespread in NTB, and the majority of maize farmers purchase hybrid seeds from agro-input retailers.** 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.

Local varieties tend to be low in productivity and are not common among farmers in NTB, except for a minority of farmers in Lombok. Farmers prefer hybrid seeds and have noted that hybrid varieties have better yields, shorter growing times (90-115 days versus >115 days for composite maize), and lower moisture content than the composite varieties that are distributed by state-owned companies such as PT Sang Hyang Sri and PT Pertani. While the government has provided some support for composite and hybrid seeds, the public sector seed distribution program often provides seeds at the wrong time (i.e. after the planting process) and of variable quality. In some cases, farmers will sell their subsidised seeds to other farmers and then purchase hybrid seeds. Hybrid seeds are produced by BISI, Syngenta, Du-Pont, and Monsanto and can be purchased from agro-input dealers. Cash payment on purchase is required for seeds and other inputs.

**Since fertilisers are necessary for the production of hybrid maize, almost all maize farmers are using fertiliser. Much of the fertiliser is obtained through the government subsidy program but there are also commercial fertilisers available in the market.** For the government subsidy program, 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. However, there is also a common practice among farmers where the default solution to any problems (e.g. problems related to the height of the plant or colour and quantity of the leaves) is to apply more urea. This can lead to problems with overdosing. In addition to issues around the quantities supplied by the government, farmers also complain about delays with subsidised fertiliser distribution, with delays ranging from 1 week to 1 month after planting. If there is a delay in applying fertilisers, this can affect the productivity of the maize plants.

Various commercial fertilisers (urea, NPK, and bio-fertilisers) are available at agro-input stores. This includes Gandasil D and Sampurna B for NPK and ExtraGen, which is a liquid organic fertiliser. Many of the available commercial fertilisers are liquid fertilisers, in either solution or suspension form. While some farmers have indicated that commercial fertilisers are being used to supplement subsidised fertilisers, it is unclear what proportion of maize farmers are buying commercial fertilisers and in what quantities. Using a mixture of commercial fertilisers (during the initial planting) and subsidised fertilisers (once they are available) can be a potential solution to delays in government

distribution. There are also other farmers who have indicated that they are not using liquid fertilisers because they are not familiar with how to use the product and are not confident about their effectiveness. PRISMA plans to conduct a fertiliser study to improve understanding around farmers' fertiliser usage and purchasing practices; availability of commercial and subsidised fertilisers; and the cost-benefit of using a mixture of commercial and subsidised fertilisers.

**In addition to fertilisers, maize farmers also rely heavily on other agro-chemicals, which has contributed to the rapid expansion of maize production on Sumbawa Island.** Instead of using tillage for land preparation, there has been a rapid increase in the use of pre-emergent herbicides to kill local grasses and weeds before planting. This 'no tillage' system has facilitated expansion of the maize area, largely into former cattle pasture, and has been mostly taught by private company technicians and also promoted by the government. Farmers mainly purchase pesticides and herbicides from private field agents that represent input supply companies, as well as from local retailers and distributors.

### Production

**Farmers cultivate one season of maize annually, primarily during the rainy season from November to March. There are also farmers in West Lombok, where there is higher rainfall, who will only begin cultivating maize in March after the rice harvest.** The topography of NTB, in particular Sumbawa Island, is dominated by drylands with minimal rainfall. Maize planting on Sumbawa Island is dependent on the onset of rains. The main cropping patterns in Bima and Dompu are either *maize – fallow* or *maize – mungbean/soybean*. In areas where farmers leave the land idle during the dry season, this is often because the land is too dry for other crops or there is a threat that cattle from neighbouring farmers will consume anything that is being grown. The topography and cropping pattern in North Lombok is similar to Bima and Dompu. West Lombok, on the other hand, is characterised by rain-fed irrigated areas and a longer rainy season with higher rainfall throughout the season. Farmers in West Lombok tend to grow rice from November to February followed by maize from March to May. The average harvested area per household is smaller in Lombok (0.75 ha) than Sumbawa Island (1.5 ha).

**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 are made jointly. Men also tend to decide if and when maize is planted. Ploughing and preparation of land is usually carried out by men. On the other hand, planting (dominated by women), spraying of herbicides and pesticides, fertiliser application, guarding the field from pests, and harvesting are usually done in mixed groups of men and women. It is common for farmers to move into huts close to the maize field in order to guard the crop from pests, such as monkeys and wild boars.

**For maize planted during the rainy season, the harvest usually occurs by April. This year was an exceptional case where farmers decided to postpone the harvest as a result of low market prices during the regular harvest period.** Since the market price was lower than previous years and farmers' expectations, most farmers in NTB decided to postpone the harvest in 2015.

While farmers typically receive IDR 2,500-2,600/kg for dried kernels in the month of May, the price this year was IDR 2,400 for dried corn kernels or IDR 2,000 for wet shelled corn. It is unclear whether the decrease in prices is related to an increase in local production and/or trends in the import of maize. Nevertheless, the government has responded to farmers' complaints by setting a price floor of IDR 2,700/kg for dried corn kernels and IDR 1,800 for wet shelled corn.<sup>2</sup> Unfortunately, traders are unable to purchase maize at these prices, and the longer that farmers postpone their harvest, the higher the risk that there will be a deterioration in the quality of the grains as result of high humidity.

**The use of paid labour to supplement family labour is widespread during the harvest time.**

Given the smaller plot sizes in Lombok, these farms often require less paid labour than farms on Sumbawa Island. On Sumbawa Island, the harvest is staggered by 3 to 4 weeks with the first harvest in Bima, followed by Dompu, and then Sumbawa district. As a result, labour moves from district to district, and there are also migrant labourers coming from other provinces. Despite these movements, labour shortages are common and can result in extended harvesting periods of up to 30 days (instead of 5 days). This can place financial constraints on farming households as they need to wait longer before they can sell their grain. There are also increased risks of deteriorating grain quality due to rodents, pests, and rainfall. In some villages, to reduce labour costs during the harvest period, farmers will work together in groups to harvest each other's fields. Harvesting is usually done in mixed groups of men and women.

**Post-harvest practices vary by district. Whereas some farmers will sell wet maize, others will first remove the husk, dry, and then shell the maize before selling it.** In West Lombok, it is common practice to sell the whole maize plant. The plant can be harvested earlier (within 70 to 80 days) and is used to make corn silage for cattle, which requires higher moisture content. In other areas, farmers will peel back the husk and first field dry the corn before harvesting and sun drying it on a concrete floor or on plastic sheets in the yard or fields. Both men and women are involved in the drying of maize and other post-harvest activities.

Drying, which is important for reducing crop moisture down to safe levels for storage, can be problematic in Sumbawa since the harvest often occurs while there is still some rainfall. Rainfall and humidity during this period, coupled with primitive methods and facilities to dry corn, can result in lower overall quality of maize in the supply chain. Threshing is primarily done by machines which are operated by men. Threshers can be rented from private service providers or are available through farmer groups that have received subsidised equipment from the government. However, the quality of available threshing equipment is often poor and results in chaff and stalk being mixed in with 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

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<sup>2</sup><http://www.suarakarya.id/2015/04/13/pemerintah-tetapkan-hpp-jagung-kering-pipilan-rp-2-700kg.html>

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

**Farmers tend to sell all their maize as quickly as possible after the harvest.** Some farmers sell to the same collectors year after year while others sell to different collectors on the basis of best price. Men tend to be in charge of selling maize to collectors both at the farm gate and at other selling points. While in some villages men will make the decisions of when and whom to sell the maize, in other areas this decision is made jointly by the men and women. Men typically receive money from maize sales, but this is later given to women to manage.

**Nearly all of the maize produced in Dompu and Bima goes to feed millers outside the province. Unlike Sumbawa Island, most of the production from Lombok is used locally by livestock businesses.** Traders in Lombok do not appear to have regular relationships with large buyers from other provinces. Farmers who sell wet corn are typically paid by the hectare rather than by the kilogram (as is the norm for dried maize grains), and the wet corn is used to make maize silage to feed livestock. Farmers selling dried maize in Lombok will either sell to collectors or directly to local poultry businesses such as UD Shinta and PT Jati Makmur.

In Bima and Dompu, collectors purchase maize at the farm gate. Similar to farmers, they use plastic sheets to further dry the maize or to keep the maize covered. Those who have limited storage deliver the maize immediately to local traders. Larger local traders include CV Fajar Bening Trio Utama and CV Glori Persada Manunggal in Bima and PT Seger Agro Nusantara and PT Sarottama in Dompu. These traders generally have close relationships with feed millers in Surabaya, Sulawesi, or Bali and are likely to have contracts with feed mills. They also tend to have storage facilities ranging from 1,000-20,000 tonnes, with the largest facility owned by PT Seger Agro Nusantara. There is at least one trader who is taking advantage of the production boom in the province by building an additional storage, processing, and drying facility in Dompu. Finally, there are also inter-provincial traders based in Surabaya who buy maize directly from collectors in Sumbawa Island and transport maize on trucks that are returning to Surabaya after having delivered other goods to NTB. Although there are small port facilities in both districts (with the capacity of 2,000-3,000 tonnes/shipment), maize is mainly transported to East Java using trucks and the ferry system.

**Farmers do not sell directly to feed mills, and the use of contract farming arrangements is still relatively new in NTB.** Large feed mills in East Java (such as PT Charoen Pokphand and PT Panca Patriot Prima) have attempted in the past to procure maize directly from farmers but with minimal success. While it is unclear in which province they have attempted this, failure to engage farmers directly was primarily due to logistical challenges such as payment and transportation, along with concerns about jeopardising longstanding commercial relationships with traders.

With respect to contract farming schemes, PT Petrokimia Gresik, a relatively new market player in NTB's maize sector, has plans to develop a contract farming model with 20 farmer groups recommended by the government. PT Petrokimia Gresik, a fertiliser company based in East Java, recently launched a new variety of hybrid maize and set up a demoplot in North Lombok in January 2015. PT Sarottama is already using a contract farming model in Dompus to secure sufficient quantities of maize from surrounding farmers. The company has relationships with a large buyer in Sumbawa district (PT Mutiara Vanguard) who is able to absorb 500-1000 tonnes/day. Since farmers in Dompus already have multiple channels to sell their maize, PT Sarottama was facing difficulties procuring large amounts of maize. In order to provide farmers more incentives to sell to PT Sarottama, the company decided to launch a contract farming scheme that provided seeds, herbicides, and fertilisers on credit to 1,700 farmers in 2014.

### 3.2.4 Supporting functions / services

**Farmer-to-farmer exchanges remain the main vehicle for transmission of information about maize cultivation.** Farmers obtain information on agronomic and post-harvest practices through other farmers, as well as through trial and error on their own farms. They tend to use traditional farming practices and have limited 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 (such as seed and fertiliser planting tools, storage drums, etc.).

Since maize production in NTB is relatively recent, farmers have not yet had to deal with problems of weeds, pests, and disease on a large scale. These problems tend to get worse with continuous maize cropping, and farmers will face future problems in these areas, as is the norm for farmers in East Java and NTT.

**Government extension is not able to effectively satisfy the need for technical information and training, nor is it equipped to do so.** There is approximately 1 extension agent per sub-district who provides extension services across all crops. Many of these agents are not sufficiently trained or do not have specific expertise on maize. According to the head of the extension worker agency in Bima and Dompus, some of the extension workers are hired as temporary employees or government contractors. These agents receive lower pay compared to permanent employees, which can negatively influence their motivation for delivering information and extension services. 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.

**At the same time, while private seed companies have a strong presence in NTB, their after sales support is minimal.** Input companies have made their presence very visible by putting small

banners across farm lands in NTB. They often provide demoplots to convince farmers about the benefits of using hybrid seeds and agro-chemicals, but these are geared towards promoting their own products and there is almost no support to farmers after they have purchased these products. In general, these companies tend to have relatively few promotion agents and resources, which limits their overall outreach.

**Farmers mainly obtain loans from moneylenders and collectors, both of whom charge high interest rates.** The capital required for hybrid maize cultivation ranges between IDR 5 to 8 million/ha. Cash is needed to finance hybrid seeds and chemical inputs, as well as labour during the harvest period. Loans from moneylenders and collectors are available with interest rates of up to 50-100% for a six month loan. Farmers are compelled to borrow from moneylenders because the process for obtaining loans is relatively straightforward and quick. Even though some moneylenders may ask for a land certificate or some form of collateral, the requirements and approval process is less complex than that of banks. Farmers also prefer to take loans at a higher interest rate rather than forego the use of certain inputs or purchase inputs of inferior quality.

**Although banks offer lower interest rates, farmers face difficulties meeting the loan requirements. At the same time, banks also have limited human resources to deliver these products.** A couple of formal banking institutions, including Bank Rakyat Indonesia, Lumbung Perkreditan Rakyat, Koperasi and Bank NTB, offer loans under the government KUR (Kredit Usaha Rakyat) and KKPE (Kredit Ketahanan Pangan dan Energi) schemes. The KUR scheme offers a credit limit of up to IDR 6 million/ha of cultivated area at an interest rate of 13% per annum. The credit disbursement is done in two stages—once at the beginning of cultivation (for the purchase of agro-inputs) and then prior to the harvesting period (for labour and transportation costs). To access KUR loans, farmer groups need to prepare a proposal which is reviewed by the local extension agent before being recommended to the head of the village and local head of the agricultural department. The main benefit to the KUR loans is that it does not require farmers to provide collateral. The process for obtaining loans through the KKPE is similarly long and cumbersome but also requires farmers to provide collateral to access the government subsidised interest rate of 5.5% per annum.

**The only other options for affordable credit is through PT Sarottama's contract farming arrangement and the Partnership for Indonesia's Sustainable Agriculture (PISAgro) microfinance program.** PT Sarottama provides credit to farmers to cover 90% of input costs for seed, fertiliser, and herbicides. The interest rate is 16% for a six-month loan. PISAgro's corn working group has piloted a micro-finance scheme with 200 farmers in Dompus. The pilot project is a partnership supported by Syngenta, Mercy Corps, Bank Andara, BPR Pesisir Akbar, the Ministry of Agriculture, and the local governments of Dompus and Bima. Bank Andara provides working capital (IDR 8 million/ha at an interest rate of less than 2% per month for a six-month loan) to farmers through BPR Pesisir Akbar, a local microfinance institution. Mercy Corps conducts the credit demand assessments and provides financial literacy training to farmers. Finally, Syngenta provides training on good agricultural practices (GAP). One of the key ideas behind this partnership is that farmers will be better equipped with the knowledge and inputs to increase their yields, thus allowing them to more easily repay their loans. This is expected to give banks more confidence to lend to

maize farmers. PISAgro plans to scale this model and will be disbursing IDR30 billion in micro-finance loans to 2,000 farmers in Bima and Dompu in the next planting season.<sup>3</sup>

### 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, including Bima and Dompu in NTB. 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. More recently, the President has also intervened by setting a price floor in April 2015 for maize purchases in NTB.** 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.

**In line with national objectives, the provincial government also has ambitious plans for the maize sector, which is prioritised as one of the top three commodities for poverty reduction in NTB.** PIJAR, NTB's poverty alleviation program, was initially launched in 2008 and is now in its second phase, which is from 2013-2018. It promotes the development of maize, cattle, and

<sup>3</sup> PISAgro (May 2015). *Quarterly Newsletter, Issue #10*.

seaweed in the province. In both 2009 and 2010, NTB's maize production surpassed the targets set by the program. The target of exceeding 600 thousand tonnes of maize in 2014 was also reached by 2012, with 642 thousand tonnes of maize produced that year. Under the first phase of the program, the government provided hybrid seeds, chemical inputs, and extension services. During the second phase, the government invited traders from Surabaya and Jakarta to encourage them to purchase maize from NTB. The provincial government also invited Kadin Indonesia (Indonesian Chamber of Commerce and Industry) to encourage them to invest in developing a feed milling industry in NTB. The government has identified land that they will be able to allocate to interested investors. At the district level, local governments in Dompu and Bima have also enthusiastically adopted maize as a priority sector. For example, Dompu district allocated IDR 3 billion towards promoting maize self-sufficiency.

**Despite provincial and district level support for the maize sector, district commodity levies can be counter-productive for economic development.** These levies exist in both Bima and Dompu. Vehicles that are transporting commodities (such as maize, mungbean, soybeans, cashews, etc.) outside the district are asked to pay a fee upon exiting the district. Since the regulation does not specify the amount that needs to be paid, corruption is widespread. Nevertheless, the overall impact is small and unlikely to influence farm gate prices.

**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 20 ppb 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 national 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 ranges from 15-20%. The feed milling industry does not pay quality premiums, but rather it discounts for excessive moisture on a sliding scale. 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. At the same time, very few farmers, traders, or collectors use standardised tools to test for moisture content. Instead a traditional 'bite test' or visual test is used to gauge the moisture content.

## 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 NTB. 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 experience lower than optimal productivity because they employ poor agricultural practices
- Farmers' production costs are high because they are producing hybrid maize, which requires more investment
- Farmers receive low prices because of poor post-harvest practices that result in impurities and high moisture content of maize

**Farmers experience lower than optimal productivity because they employ poor agricultural practices.** The average yield in NTB is 5.75 tonnes/ha. This places NTB among the top three provinces in terms of maize productivity and well above the national average of 4.84 tonnes/ha. Nonetheless, productivity is still below potential when measured against yields achieved by West Java (7.2 tonnes/ha) and against the potential yield of hybrid varieties used in NTB (10 tonnes/ha). Current yields are constrained by farmers' limited access to information on GAP. In order to boost productivity, farmers need better knowledge on all aspects of maize production (including spacing, seed utilisation, application of chemical inputs, planting, and harvesting schedules). Since most farmers are already planting hybrid maize, only an incremental change is expected through better agricultural practices.

**Farmers' production costs are high because they are producing hybrid maize, which requires more investment.** For maize cultivation, especially since farmers in NTB are mainly using hybrid seeds, sufficient inputs such as fertiliser, pesticides, and herbicides are necessary to ensure good yields. Most farmers have limited funds to finance these inputs and need to borrow from external sources. As farmers have limited access to affordable credit, many farmers will borrow from moneylenders and collectors at high interest rates. Borrowing at interest rates of up to 50-100% for a six-month loan can significantly increase farmers' production costs and reduce their margins.

**Farmers receive low prices because of poor post-harvest practices that result in impurities and high moisture content of maize.** 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 maize. Available threshing equipment is usually of poor quality, often resulting in chaff and stalk being

mixed with the grain. At the same time, farmers lack knowledge on how to properly maintain such equipment.

## 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:

- Limited provision of information and extension services because of weak public provision and lack of private alternatives
- Limited affordable options for finance, particularly given difficulties in accessing loans from banks
- Few commercial providers of post-harvest services, potentially given the strong government presence in these areas

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

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 (including after-sales support in the case of seed and chemical companies). When input suppliers do provide information services, these are mainly geared towards promoting their own products or have limited outreach. 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.

### **Limited affordable options for finance, particularly given difficulties in accessing loans from banks**

Banks are generally reluctant to lend to the agriculture sector since agriculture is risky with unpredictable weather, pests, and market prices. This means there is no guarantee that farmers will be able to repay loans on time or at all. While several banks offer agricultural loans with lower interest rates than moneylenders, these are accompanied with stringent conditions. The difficult requirements (which often includes collateral), combined with the long application process, deter farmers from accessing these products. Concurrently, banks have few loan officers who have experience lending to farmers, which can also increase the risk of lending. Value chain financing is rare in the maize sector in NTB. Where collectors have provided loans to farmers, they have done so at similar interest rates as moneylenders.

## Few commercial providers of post-harvest services, potentially because of strong government presence in these areas

Government involvement in the distribution of subsidised post-harvest equipment has likely contributed to the limited number of private actors providing post-harvest equipment. Outreach through the government program has been limited. Where there are private actors renting out threshers, this equipment is of a similar poor quality as the subsidised equipment from the government. The team is planning to conduct an assessment to understand more about post-harvest maize services in NTB, which will include identifying and assessing what services/equipment are currently available.

## 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 NTB'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 NTB to expand productivity and ensure that its maize meets the feed industry's standards.

Based on our calculations, there is potential to unlock an additional AUD 18M in proposed intervention districts for the maize sector in NTB.

**Table 1: Business potential in target areas**

Description/Years	Total Business in the target area (s)
Existing Production (MT)	150,935
<b>Potential New Production in Existing Areas (MT)</b>	<b>75,468</b>
Total Potential Production (MT)	226,403
<b>Average Selling Price Maize per kg (IDR)</b>	<b>2,500</b>
<b>Current Value of Production (million IDR)</b>	<b>377,338.00</b>
<b>Total value of potential production (million IDR)</b>	<b>566,007</b>
<b>Total value of potential production (AUD)</b>	<b>53,905,429</b>
<b>Total potential value of increased production (million IDR)</b>	<b>188,669</b>
<b>Total potential value of increased production (AUD)</b>	<b>17,968,476</b>

## 5.2 Vision of change

Focusing on achieving the potential outlined above for the maize sector in NTB, 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 (2) improve the quality of maize. At the **service level**, it is envisaged that farmers will have improved access to: (1) extension, (2) finance, and (3) post-harvest services.

We envision that traders and collectors would be interested in providing all of these services. Information/extension and fertiliser services could also be provided through input suppliers (seed or fertiliser companies) while financial services would also involve financial institutions.

## 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, three key intervention areas will be necessary to transform the maize sector in NTB. 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
<b>Intervention Area 1:</b> Promote the use of good agricultural practices	<ul style="list-style-type: none"> <li>Promote the use of GAP and GHP through Farmer Resource Center (PT Sarottama in Bima and Dompu)</li> </ul>
<b>Intervention Area 2:</b> Promote appropriate financial products for maize farmers	-
<b>Intervention Area 3:</b> Promote affordable drying and threshing services	-

### Intervention Area 1: Promote the use of Good Agricultural Practices and Good Handling Practice

The promotion of GAP and GHP are expected to help farmers increase yields and narrow the gap between current productivity and potential productivity of hybrid maize. Since women are active in the cultivation of maize, it will be important to ensure that exposure to information on better practices are accessible to women and tailored to their needs.

In order to promote GAP and GHP, AIP-PRISMA has been working with PT Sarottama, a trading company which is operating a maize contract farming scheme. Although PT Sarottama was providing a small amount of technical support to its contract farmers, it was interested in developing a Farmer Resource Centre (FRC) to improve the outreach and effectiveness of knowledge transfer

on GAP and GHP to maize farmers in Bima and Dompu. The FRC has since been established, along with a number of demoplots which exhibit a range of agricultural practices. PRISMA is providing support to strengthen the FRC and develop educational products for farmers. Potential exists to work with other market actors involved in contract farming schemes (including PT Petrokimia Gresik) to scale-up the model. There is also potential to develop new interventions with other input suppliers to improve embedded information in their distribution system.

### **Intervention Area 2: Promote appropriate financial products for maize farmers**

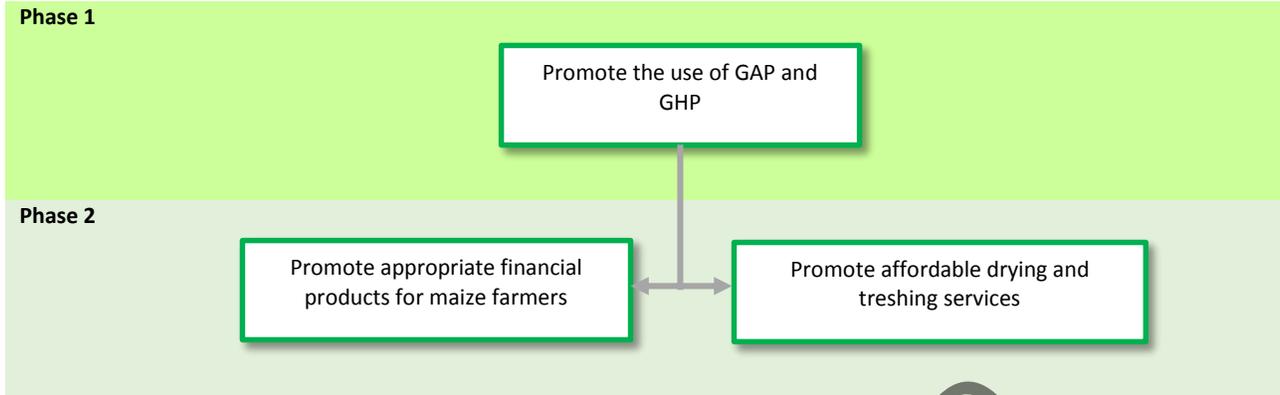
The introduction of appropriate, affordable financial products for maize farmers is expected to reduce the need to borrow from moneylenders and collectors. In turn, the lower cost of credit will reduce production costs for farmers. There is potential to work with formal financial institutions and/or through larger maize buyers who could provide embedded finance if they establish more formal procurement arrangements with farmers. For example, Sarana NTB Ventura is a financial institution that has experience providing agricultural financing in the cashew sector in Dompu. While it has not provided loans to maize farmers, it is interested in expanding into other agricultural sectors. It will be important to ensure that financial products are equally accessible to women and men farmers.

### **Intervention Area 3: Promote appropriate post-harvest equipment and technologies**

The introduction of appropriate post-harvest equipment and technologies will be important for improving the quality of maize, which in turn would allow farmers to realise higher prices for maize. Appropriate equipment and technologies will not only be important for reducing impurities and the moisture content but also for minimising the risk of aflatoxin contamination. There is potential to work with agricultural equipment providers, drying or threshing service providers, and traders/collectors. This may require identifying cost-effective drying and threshing equipment or methods, as well as a business case for the provision of such equipment or post-harvest services. Women have expressed a particular interest in post-harvest equipment and technologies that could reduce their labour burden, especially given their high involvement in post-harvest activities. As a result, it will be important that the proposed equipment, solutions, or services are accessible or adapted to women.

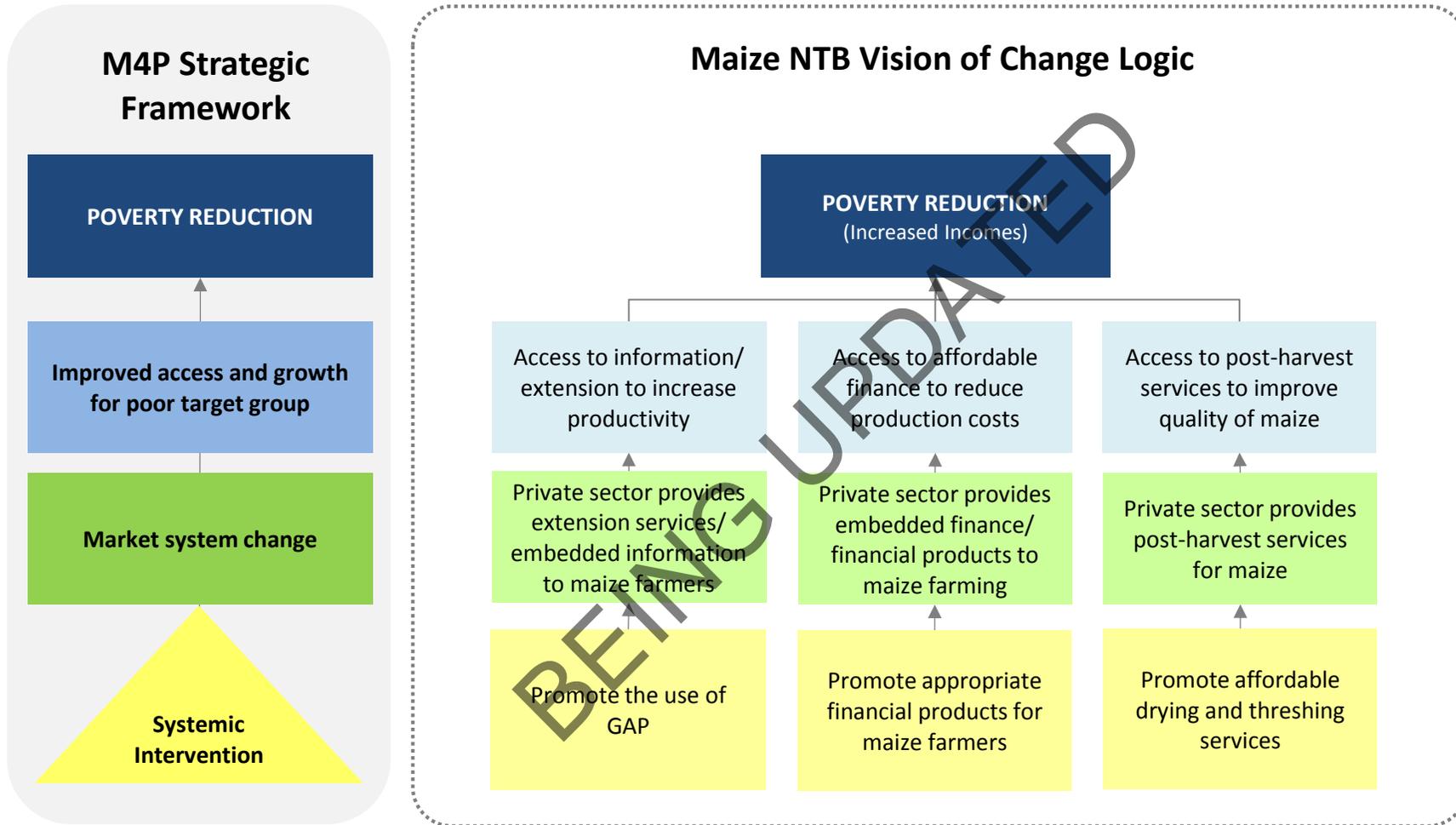
## **5.4 Sequencing and prioritisation of intervention areas**

**It is recommended that the intervention areas in the NTB maize sector be implemented in two phases.** In the first phase, the focus will primarily be on increasing productivity through *promoting the use of GAP and GHP*. The second phase, where the team is still looking for potential business models and partners, will involve *promoting appropriate financial services* and *promoting affordable drying and threshing services*. The promotion of GAP and GHP in the first phase would lead to higher, more consistent yields which could build the confidence of banks around the ability of farmers to more easily repay loans.



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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 experience lower than optimal productivity because they employ poor agricultural practices	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.	<b>Intervention Area 1:</b> Promote the use of GAP and GHP	<ul style="list-style-type: none"> <li>• Input companies (Bisi, Syngenta, Petrokimia Gresik)</li> <li>• Traders (Sarottama)</li> <li>• Farmer groups</li> </ul>
Farmers' production costs are high because they are producing hybrid maize, which requires more investment	Farmers have limited access to affordable credit and borrow mainly from moneylenders who provide credit at a high interest rate	Financial services	Financial institutions are not willing to provide credit without collateral. There are few affordable alternatives to formal financial institutions.	<b>Intervention Area 2:</b> Promote appropriate financial products for maize farmers	<ul style="list-style-type: none"> <li>• Formal financial institutions (BRI, Bank NTB, Sarana NTB Ventura)</li> <li>• Large traders (Sarottama)</li> <li>• Collectors</li> </ul>
Farmers receive low prices because of poor post-harvest practices that result in impurities and high moisture content of maize	Farmers and collectors have limited knowledge of good post-harvest practices and maize quality standards	Information & extension services  Post-harvest services	Weak public provision of extension services and lack of private alternatives. Existing traders provide limited embedded information and weak linkages with downstream actors mean that standards are rarely conveyed to producers.  Subsidised post-harvest equipment has limited outreach. Few commercial providers of post-harvest services.	<b>Intervention Area 3:</b> Promote affordable drying and threshing services	<ul style="list-style-type: none"> <li>• Drying/threshing service providers</li> <li>• Equipment or technology providers</li> <li>• Traders/ Collectors</li> </ul>

## Annex 2: Gender table

No	Activity in production	Task Division		Explanation
		M	F	
1	Decision seed will be planted	V	V	Discussion between men and women. Decision made based on their or their neighbor's experience on last harvest
2	Buying seed	VV	V	Dominated by men
3	Land preparation			Dominated by men. Men cut the grass, women collect the drying grass and burned.
3a	Cutting and burned grass	V	V	For spraying, women prepare water for mixing the herbicide.
3b	Spraying herbicide I	VV	V	
4	Planting	V	VV	Dominated by women. Men task, move the line (rope) which use for measure the distance planting.
5	Fertilizing I and II	V	V	Some farmers were helped by their children
6	Weeding (spraying herbicide II)	VV	V	Dominated by men, women prepare water for mixing the herbicide.
7	Pest and diseases control	VV	V	Dominated by men, women prepare water for mixing the pesticide
9	Harvesting and post-harvest	V	V	
8a	Picking corn	V	V	
8b	Open the cornhusk		V	
8c	Threshing	V	V	Use threshing machine, packing by women and men
8d	Drying	V	V	
8e	Selling maize	VV	V	
8f	Using the money after selling	V	V	Women and men discussed, decision made by both of them. For buy something expensive, example land, cattle they discussed. But for consumption, decision made by women

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