

**MANGO SUB-SECTOR GROWTH STRATEGY
IN NTB**

April 15, 2016

PHASE OUT

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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
ha	hectares
ILAF	Intervention Logic Analysis Framework
NTB	Nusa Tenggara Barat (West Nusa Tenggara)
ES	Extension Services
MT	Metric Tonnes

PHASE OUT

1 Executive summary

Indonesia is the fourth largest mango producer globally, with approximately 2.4 million tonnes of mangoes in 2014. Mango is the largest fruit crop in Indonesia, with production increasing at an annual rate of 4%. The main variety is Arumanis (also called Gadung in some areas), which is very popular among domestic consumers. Mango production in Indonesia is highly seasonal, with most mangoes harvested between October and December. Since off-season prices can be nearly four times as high, some mango producing areas, particularly in West Java and Central Java, are placing increasing emphasis on getting an early crop. Although Indonesia enjoys unique competitive advantages in Asian markets, it has a very marginal presence in international trade and nearly all of its production is consumed domestically.

NTB ranks the fifth as the largest mango producing province in Indonesia with approximate production 110,000 tonnes in 2014. Bima and Sumbawa are the largest mango producing districts in NTB. Mango farming in NTB is characterised by small farm sizes, with most smallholder farmers managing their own trees instead of renting them out. Additionally, there are some farmers renting-in productive land with mango trees in it where they also grow other crops, such as: maize, chilli, etc. Where smallholder farmers grow their own mangoes, they tend to be passive in the management of their trees, expending minimal effort and resources. There is no off-season production in NTB, the use of crop manipulation technology is not yet spread in NTB. The *tebasan* selling system is prevalent, and the majority of mangoes is channelled to Java, Bali, and other major islands as well, where they are consumed fresh.

There is market opportunity to stimulate production of mangoes during the off-season when prices are particularly high and to promote the development of alternative end markets to absorb the oversupply of mangoes in the peak season. Despite high market prices for mangoes harvested during May to September, most farmers in NTB are only producing mangoes during the peak season when prices are a fraction of that in the off-season. There is potential for PRISMA to tap into the prospect of shifting 50% of total production to an earlier harvest time to enable farmers to get a better price during off-season months. There is also scope for growth in exports and processed mangoes, which could improve returns from peak season mango production.

Analysis of the market reveals a number of problems that currently constrain the ability of mango farmers to take advantage of this market opportunity. Poor farmers receive low prices for their mangoes because they lack access to early flowering technologies and to alternative end markets. Since chemical companies regard mango farming as a low potential market, they are not actively promoting the use of chemicals for off-season mango production or providing embedded services to assist farmers with successful application of such technologies. The export sector is largely underdeveloped, and the processing industry is also in its early infancy. As a result of low prices received for mangoes, poor mango owners are often reluctant to invest in their trees. This keeps farmers trapped in a low-return, low investment model in the main harvest season. Poor mango farmers also experience low productivity when they manage their own trees since they lack access to good agricultural practices, particularly around pest and disease management. Losses from pest and disease attacks can be significant, which makes mango farming even less attractive for farmers.

The vision of change at the sector level is to: increase smallholder productivity and prices received in both the peak and off-season for mangoes, but with an initial focus on off-season production. At the **service level**, it is envisaged that farmers will have improved access to: (1) crop manipulation technology, (2) export and processing services, and (3) information and extension services. To realise this vision, this report recommends focusing on three intervention areas:

- Increase production in the off-season
- Promote alternative end markets in the peak season
- Introduce better practices and more effective and affordable pest and disease management

We envision that crop manipulation technology and information and extension services will be provided through chemical companies and collectors. Export and processing services may potentially be developed through traders and existing or new processing enterprises.

It is recommended that the interventions in the NTB mango sector be implemented in two phases. In the first phase, the focus will be on *increasing production in the off-season*. This will allow farmers to benefit from the higher prices in the off-season. The second phase will involve improved prices for peak season production through the *promotion of alternative end markets in the peak season* and higher productivity for both seasons through the *introduction of better practices and more effective and affordable pest and disease management*. As farm incomes rise, farmers will have more incentives to invest in more intensive tree management practices and pest control strategies.

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 mango 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 mango sector.

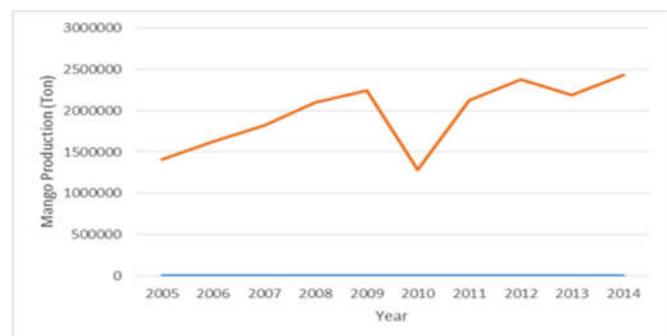
3.1.1 Overall context

Mango is the third most widely grown fruit in the tropics and sub-tropics after watermelon and banana. Global production of mango has been increasing, with growth largely driven by favourable demand conditions in producing countries. Between 2003 and 2013, global production of mango, mangosteen, and guava increased from 29.7 to 43.3 million tonnes and grew at a compound annual growth rate (CAGR) of 4%. While data from the FAO does not disaggregate among these commodities, the latter two crops have residual importance in terms of production. Representing over 40% of global production, India is the world’s leading mango producer, followed by China and Thailand.

Mexico has been the leading mango exporter for decades while the US is the leading importer of mangoes. The EU and Gulf States are also key export markets for mango. In East and Southeast Asia, five countries account for the bulk of imports – Malaysia, Hong Kong, Singapore, Laos, and Japan. Despite strong growth in the international mango trade, over 95% of the world’s harvest is still consumed within producing countries.

Indonesia is the fourth largest mango producer globally, with approximately 2.4 million tonnes of mangoes in 2014. It accounts for 3 to 5% of global production depending on the year. Mango is Indonesia’s largest fruit crop. Similar to global trends, mango production in Indonesia has also been increasing at a CAGR of 4% over the past decade. After several years of continuous growth, production peaked in 2009 at 2.24 million tonnes. It then dropped to 1.3 million tonnes in 2010, a year characterised by an

Figure 1: Trends in mango production in Indonesia



Source: Badan Pusat Statistik (2016)



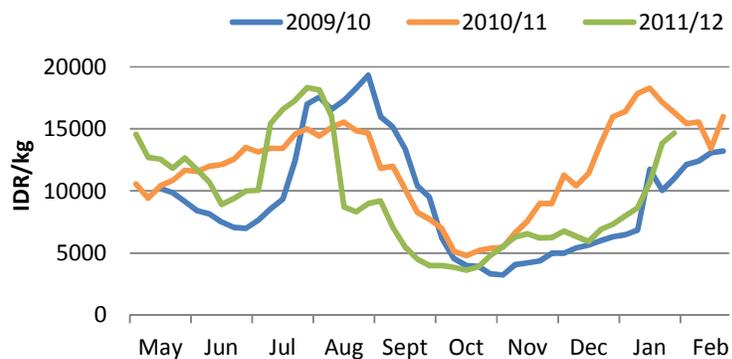
unusually long and heavy rainy season. Mango production has since recovered, with Indonesia recording its best harvest in 2012.

Indonesia has relatively favourable natural conditions for mango cultivation, and in recent years, productivity gains have become an important driver of growth. Whereas the expansion of area was the main driver of growth between 2003 and 2007, productivity gains have become a more important driver in recent years. The main variety, Arumanis, is unique to Indonesia and is also more responsive to early flowering technology than varieties grown in other parts of South East Asia. Arumanis is very popular among domestic consumers, who have a strong preference for local varieties of mango. Most Indonesian consumers appreciate Arumanis for its large size, nice aroma, firm flesh, low fibre content, and sweetness. This variety fetches the highest prices, after Gedong Gincu. Demand for mangoes in Indonesia is increasing as household incomes rise and food consumption diversifies to include more fruits.

Mango production in Indonesia is highly seasonal with long off-season months and large corresponding price fluctuations. Most mangoes are harvested between October and December, which is towards the end of the dry season. Only a small portion of harvest spill over are available to sell in September and January. Off-season mangoes are naturally occurring, however this is considered as uncommon and cannot be relied upon commercially. A small number of collectors are actively looking for mangoes throughout the year, however with low expectation in finding these off-season mangoes.

During this short peak season, the market is flooded with cheap mangoes. Peak season prices, which can drop below 2,000 IDR/kg in the main wholesale market in Jakarta, are approximately one-fourth to one-half of the average May to September prices. As a result, some mango producing areas, particularly Cirebon in West Java and Pemalang in Central Java, are placing increasing emphasis on getting an early crop.

Figure 2: Average Grade A price at Kramatjati wholesale market

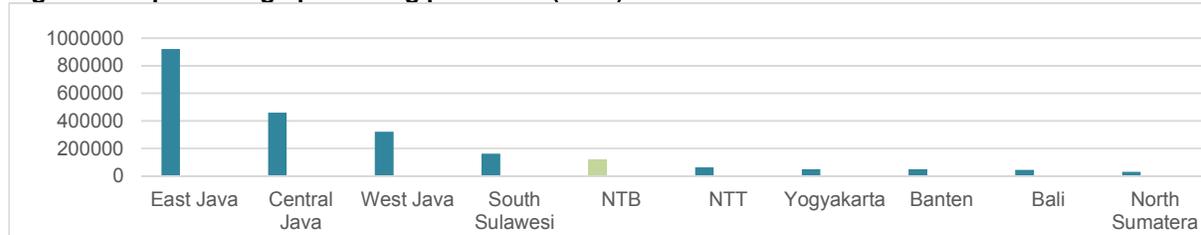


Despite some favourable export development conditions, Indonesia has a very marginal presence in the international mango trade and nearly all of its production is consumed domestically. Indonesia imports less than 1,200 tonnes of mangoes annually, and exports account for only 0.1% of domestic production. Singapore is the main destination market for Indonesian mangoes, followed by the UAE. Occasionally, some mangoes are exported to Malaysia and Hong Kong. Nevertheless, Indonesia has an abundant and very cheap supply of mangoes in between October and December, a period when northern hemisphere countries have no local production and limited access to alternative sources of supply. As a result, Indonesia would face limited competition in Asian markets from major exporters in the region (such as India, Thailand, Pakistan, and the Philippines). As these countries are also major mango consumers, they are potential export markets for Indonesian mangoes.

3.1.2 Local context

NTB ranks fifth in mango production compared to other provinces in Indonesia during 2014. This province contribute approximately 118,000 tonnes of mangoes of national production during 2014, which is 5% from the national production. This amount is produced from xxx million trees.

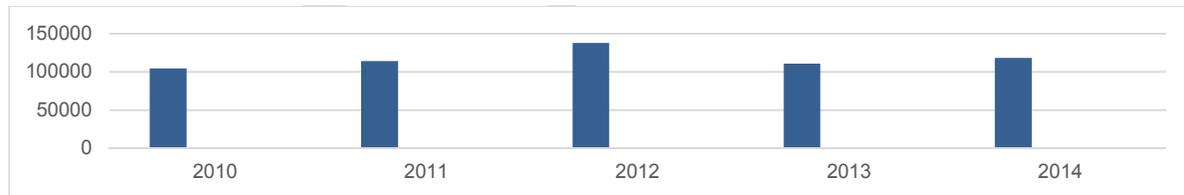
Figure 3: Top 10 mango producing provinces (2014)



Source: BPS (2016)

Mango production in NTB is fluctuating from 2010 – 2014. During 2014, overall mango production in NTB was grown by 7.04% compared to the prior year. This production growth was considered low compared to the national production that grew by 10.87%. Harvesting time of mango in NTB ranges from October to December, this period is a peak season of national mango production, where the aggregate national mango supply is high. Farmers in NTB have not yet been familiar with the off-season mango production technology yet. They also lack of access to the early flowering products. Consequently, farmers are only able to harvest their mangoes during the peak season and get a low price for their mangoes.

Figure 4: Mango production in NTB 2010 - 2014



Source: BPS (2016)

3.2 Sector dynamics

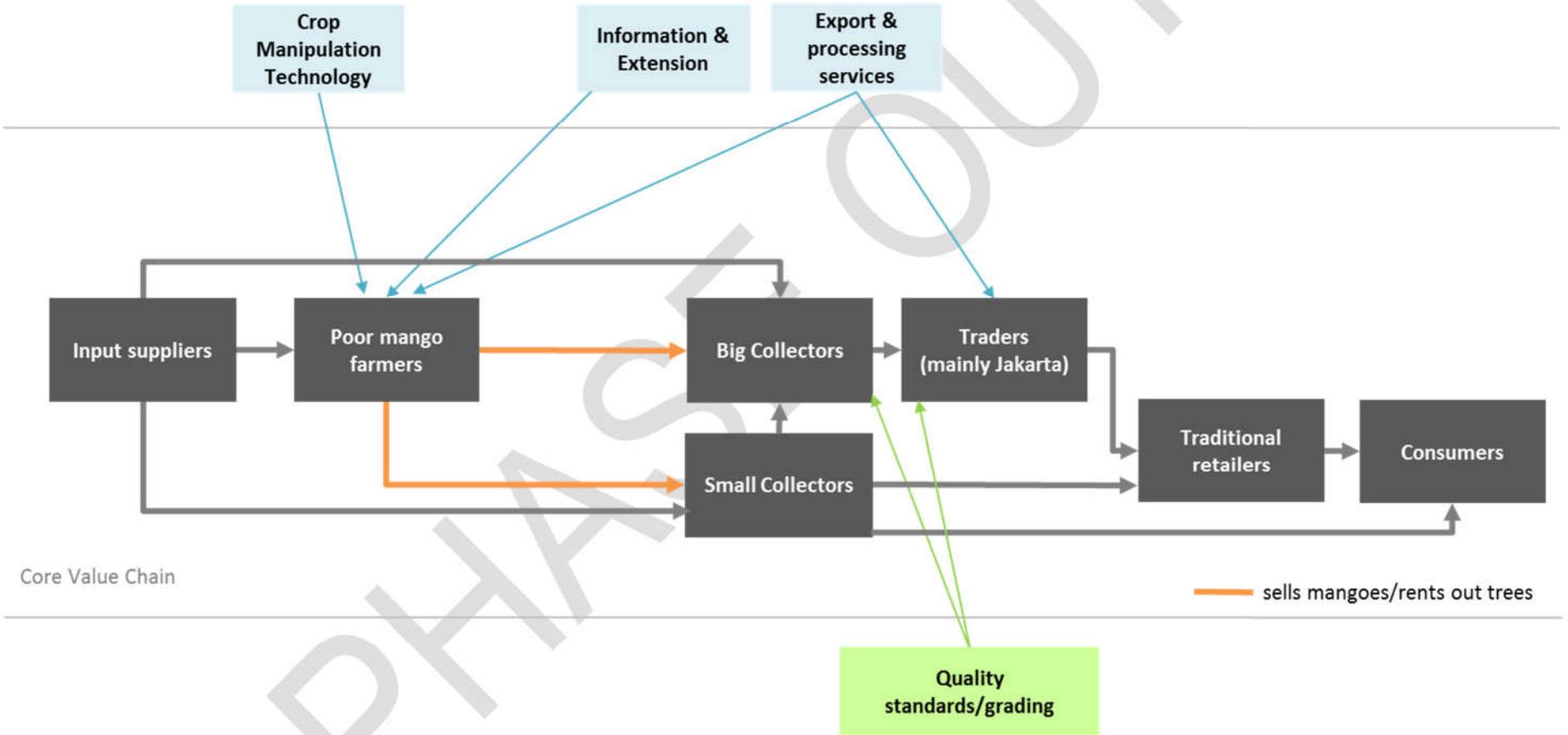
3.2.1 Market overview

Mango farming in NTB is characterised by small farm sizes, with most smallholder mango owners managing their own trees instead of renting them out. Additionally, there are some farmers renting-in productive land with mango trees in it where they also grow other crops, such as: maize, chilli, etc.

Smallholder farmers who grow their own mangoes tend to be passive in managing their trees, expending minimal effort to cultivate the trees and using limited external inputs. This is despite the availability of a wide range of chemicals in agro-input stores. There is no off-season production in NTB because farmers are not familiar with early flowering technology. The distribution of mango from NTB are limited to the domestic consumer because the farmers in NTB are lacking the necessary distribution channel for export. Mangoes in Indonesia are typically consumed fresh rather than being processed further. The tebasan selling system is prevalent, and the majority of mangoes are channelled to urban centres in Java, Bali, or other islands.

3.2.2 Sector map

Supporting Services



3.2.3 Core value chain

Inputs

The main sources of mango seedlings were from the government and private breeders, as well as to a lesser degree from grafting one's own trees.¹ There were a number of government initiatives that have provided free seedlings in the past. This includes initiatives in the early 1990s when the government introduced the Arumanis and Gadung varieties. Since most mango trees in East Java are between 10-30 years of age, they are still well within their productive lifespan. Mango trees can yield fruit for up to 50-80 years depending on the variety and condition of the trees. As a result of the long lifespan of mango trees, seedlings are only necessary if households are looking to add new trees.

High incidence of pests and diseases is a major problem for mangoes. For farmers who actively manage their crop, spraying chemicals is the most common control strategy. The use of chemicals to control pests and diseases is becoming more common in NTB but is still minimal compared to the intensive spraying programs employed in East, West and Central Java. The main mango pests are leafhoppers, which trigger flower drop; fruit borers, which lead to fruit drop; flatids, which cause sooty mould on fruit; and fruit flies, which result in ripe fruit breakdown. Anthracnose and stem end rot, both of which accelerate fruit rotting at ripening, are the most common diseases. Anthracnose also causes flower drop.

While fruit bagging is a cheaper, alternative strategy that would reduce the need to rely on intensive spraying, farmers are reluctant to adopt this technology. In Indonesia, fruit bagging is common in guava and carambola farms but much less so for mangoes. Since many of the smaller mango farmers are not applying any pest and disease control strategies, fruit bagging would be an additional cost for them. They find it impractical to do it themselves, especially since it can be dangerous to reach higher branches. At the same time, they are unwilling to hire outside labour. Small farmers have also noted that collectors will still buy their fruit if there is some damage, albeit at a lower price. Even large farmers who are actively spraying their trees have objected to fruit bagging because they consider it laborious and impractical when they have many trees.

Most smallholder mango farmers consider mango as a low priority crop. Investment in mango farming is not seen as profitable since mangoes are only harvested once annually and sold for a very low price. People who are able to profit from mango are usually medium to large collectors, or traders who benefit from the knowledge they have gathered over the years. Consequently, aside from fertilisers and chemical for pest and disease management, Paclobutrazol, a growth regulator that induces early flowering for off-season cultivation, is not widely available in NTB. Although Cultar, Syngenta's brand of Paclobutrazol, has been available in Indonesia, its market penetration in NTB is minimal. Farmers are lacking the knowledge regarding EFT procedures and its potential benefit. Between 2012 and 2013, Syngenta stopped supplying Cultar to Indonesia but has since reintroduced the product due to partnership with PRISMA. In addition to Cultar, there are also cheaper alternative brands such as Golstar and Getwell. These competitor

¹ Qanti (2014) Determinants of mango farmer choices of modern vs. traditional channel and farm technology intensification in Java Indonesia

products retail at lower price than Cultar, but are considered by some mango farmers as less effective.

Production

The mango sector is dominated by small farmers. Average farm sizes of small mango owners in NTB appear to be higher than in East Java, where farmers are more land constrained. During 2014, Sumbawa and Bima contributed the highest number of mango production in NTB amounting to 51,000 tonnes, followed by West Lombok and Central Lombok. Mango owners who are renting out their trees have also cited a number of benefits including advance cash payments; lower risks as they receive a guaranteed payment regardless of whether it is a good or bad production year; and the ability to easily earn a side income from mangoes when they do not have the expertise to effectively manage the trees themselves or do not have sufficient time given other primary business activities.

Most farmers will either manage their own farm or rent out their trees. Typical rental periods is 1 year, and most renters will pay 100% cash in advance for the right to own the entire production from the tree during that year. Prices, which can range from 50,000-100,000 IDR/tree, are estimated based on the size, condition, and yield potential of the trees, or in case of land-size basis, price is determined by the land size. No price adjustments are made after the harvest although some renters may give the owners a small amount of mangoes or money on an ad-hoc basis.

Tree/land-renting is more commonly found in Lombok rather than Sumbawa. However, this practice is not commonly done before. It has only been recently that tree/land renting becoming more popular due to increasing awareness on the benefits of this practice.

Beside tree/land renting, there is a some proportion of farmers who are engaged in sharecropping. It has been found in Sumbawa, however might not be limited only to that district. Sharecropping is a practice of sharing the profit of mango production between two parties; one of them is the passive-managing owner of the tree and the other one is the actively managing farmer appointed by the tree owner. Even though not directly cultivating the tree, the tree owner might have concern on method of cultivation, including the chemicals used, etc. Thus, these type of tree owner can also be the dissemination point of EFT technology.

Although many small mango owners will grow and sell their own mango, most of them are not actively managing their farms. They generally follow a low investment, low return model in the main October to December period. As discussed above, small mango farmers tend not to employ external inputs or other more intensive cultivation techniques. Despite the positive influence that simple agricultural practices such as pruning can have on fruit yield and size, mango trees are often left with minimal maintenance and care. A major contributing factor to why smallholders are not investing in their mango crop and pursuing intensification strategies is the very low market prices that they receive in the peak season.

The ability to profit from off-season harvest would lead to higher production incentives for smallholder farmers, but not all farmers are aware of this opportunity or have the technical know-how for successful development of early season production. As in other countries, the

main flowering-to-harvest period coincides with months of low rainfall. This is because rain at flowering causes fungal diseases that causes flower drop, while rain during the fruit development stages results in a high incidence of both pests and diseases. However, because of their more pronounced and longer dry season, parts of NTB are well suited to an extended flowering and harvesting period. Also, unlike other mango varieties, Arumanis can flower again after flower drop. Experience shows that farmers using early flowering technology are able to move on average 50% of production into the early season. In some seasons with more rain in the dry season, the treatment may fail to produce early fruit, but treated trees still produce higher volumes and better quality crop than without any treatment.

Harvesting & Trading

The most common selling system is the “tebasan” system where farmers and collectors negotiate a price for the mangoes on the tree several months or weeks before the harvesting period. The price is estimated based on all the mango trees owned by a household or on a per tree basis. The value of the transaction will depend on market prices, fruit quality, expected yields, size of the down payment, and timing of the sale. It will also depend on whether collectors are purchasing the produce for the entire season or for a specified harvest period. Farmers normally receive an initial deposit when the transaction is agreed, but some farmers may also be paid in full at that time. Early payment is one of the main reasons why many farmers opt to sell fruit on the tree. While purchases of fruit on the tree increase traders' exposure to risk, this system often generates higher profits for collectors than the alternative of purchasing the fruit after harvest. When mangoes are sold by tebasan, the collector will be responsible for all harvest related expenses.

For off-season production, it is more common for farmers to sell their produce by the kilo rather than by tebasan. Mango farmers sell their mangoes fresh, unsorted, and ungraded to village collectors. When mangoes are sold by the kilo, farmers are typically responsible for harvesting the crop. Since harvesting methods can impact on fruit quality, harvesting is mainly done by male labourers who are skilled in mango picking. Although consumers appreciate mangoes that are harvested ripe, tree-ripe mangoes are very susceptible to fruit flies, diseases, and compression losses during transportation. Hence, mangoes are typically harvested at 70-90% maturity. For Sumbawa, however, selling by kilo system happens throughout the year, not only during the off-season.

Female farmers play a significant role in making decisions around mango sales, including the timing, sales method, buyer, and price. In the mango value chain, women are not only active as farmers but also as small collectors. Since male and female village collectors will come directly to the farms, there is no need for female farmers to search out collectors or go to the markets to sell the mango crop. Female farmers will usually be responsible for conducting the price negotiations and selecting the mango collector who offers the highest price. This means that farmers rarely have an allegiance to any particular collector, preferring to sell to whoever provides the best offer. Regardless of who sells the mangoes in the household, income from the sales is usually kept and managed by women.

Most mango harvested in NTB is consumed fresh within the island and channelled to traditional wholesalers and retailers in urban markets such as in Java and Bali. Large

collectors will typically have close links to wholesalers in urban markets across Java, and they may receive seasonal advances from these wholesalers. Despite poor quality management systems and a high incidence of fruit flies and rotting diseases, physical losses are relatively small. This is because mangoes generally reach the consumer within one week after harvest. It takes longer for infected mangoes to start rotting and for these issues to become a serious problem. Most mangoes are sold through traditional retail outlets, as the modern retail sector still accounts for a fairly small share of the mango market.

Since the majority of mangoes are consumed as fresh fruit or fresh juice, the Indonesian mango processing industry is still at a very early stage. There is evidence on the existence of farmer group producing derivative mango-products in North Lombok, but this is a small-scale, home-based enterprise. Some dried mango, mango candy, and other mango-based products can be found in urban shops and supermarkets but in very small volumes. These are often imported. Several brands of locally produced mango juice can also be found in shops and supermarkets, but the local product content is minimal. While limited domestic demand is certainly an important factor hindering the development of a mango processing industry, supply-related factors also play an important role. These include short harvesting seasons, poor product development and marketing expertise, difficulties by small enterprises to break into the modern retail segment, and strong competition from imports.

Similarly, the mango export sector has also failed to graduate from its early infancy stage despite very favourable export conditions. The international mango trade is based on yellow- and red-skin varieties. Arumanis, the main commercial variety in Indonesia, has green skin when ripe. While this is often perceived as a major reason why mango exports have not developed, export trials to regional markets have shown a favourable market response to Arumanis, opening possibility for green-skin mango such as Arumanis to compete in international market. A more crucial aspect in developing export market is good relationship between different market actors. So far, no standardized quality assurance has taken place to make farmers constantly send mango of the same quality or grade. This results in low trust from market in buying mango from Indonesian farmer and low level of sustainability in Indonesian mango export market.

A more serious barrier to the development of mango exports is the dependency of exporters on expensive air transportation. Exporters have so far failed to capitalise on sea freight opportunities because they lack the required knowledge around post-harvest technologies which would preserve fruit quality. Exporters also face constraints around poor quality management at farm level, lack of market access protocols with some Asian countries, and a lack of business linkages beyond current markets. Improvement in delivery time is necessary to shorter the time required from farm to abroad sales point.

3.2.4 Supporting functions / services

Knowledge flows along the mango value chain are lacking, and smallholder farmers have few channels for obtaining information on new technologies or good agricultural practices (GAP) in mango farming. Farmers mainly get their information through peer farmers and farmer groups. However, the knowledge base sustaining such interactions is generally poor as peer

farmers often have similarly low levels of knowledge or awareness of right technologies and management practices in mango farming. Prior to PRISMA's engagement in the sector, agrochemical companies have not worked with mango growers in NTB. Mango had not been regarded as an important potential market and have therefore focused their extension efforts on other crops. As a result, their staff lack the incentive and the necessary technical expertise to promote specific product solutions for mangoes.

At the same time, input dealers also have limited to no knowledge of mango cultivation whereas local traders either lack new knowledge or are unwilling to share what knowledge they have. In the absence of embedded service provision, business interactions between farmers and collectors are largely restricted to the sale of mango fruit. As wholesalers focus more on trading instead of cultivation, they are also considered a weak source of technical know-how in the sector. Finally, government advisory services are poorly equipped to transfer know-how in mango farming because extension staff lack critical expertise.

Consequently, serious knowledge gaps exist in both crop manipulation for early-season production and mango cultivation in general. Where farmers are aware of the potential for off-season production, incorrect information, for example Paclobutrazol application methods and the impact of growth hormones on tree health, is often exchanged. Misuse of Paclobutrazol has led to failure or negative impacts (overdosing causes flower compaction). Farmers are often unaware of the need to use a combination of chemicals (including fungicides and fertilisers) when inducing early season production. Although fungicides (such as Amistartop) can be used to address flower drop and fruit set failure during the early flowering period, overuse of Amistartop can also lead to failure of the treatment.

Farmers also have limited knowledge about fertilisation and pest and disease management. Effective control of specific diseases or pests requires using the right product at the right time. However, mango farmers often spray their trees too late when large populations of insects have already developed. At the same time, fertilisers are often being used without sufficient understanding of mango nutrition and soil composition. For example, most mango farmers are applying excessive doses of nitrogen but insufficient amounts of potassium. The use of pre-mix foliar nutrients to spray applications is a straightforward means that could have positive impacts on flowering, fruit set, and fruit size.

Dissemination of technology is also restricted due to farmers' low exposure to EFT. Regarded as a new technology, many farmers keen to look for proven hard evidence before deciding to apply. One reason is the habit of not cultivating mango trees that has developed over the years. Word-of-mouth and success story from other farmers are considered an effective way of social marketing to further advancing the technology to more farmers.

3.2.5 Supporting rules and regulations (enabling environment)

Relevant enabling environment factors in mangoes include quality standards and grading.

At present, the average Indonesian consumer is not particularly demanding as far as fruit quality is concerned. Most consumers are not particularly bothered about skin blemishes or marks, and price is still the main determinant of mango purchasing choices. In Indonesia, mangoes are graded according to size. There are three broad grades, with prices varying according to season. Indonesia produces approximately 30% Grade A (highest quality, weighing $\geq 450\text{g}$), 30% Grade B (weighing between 400 and 450g) and 30% Grade C (weighing $\leq 400\text{g}$) in a season. Sorting and grading is done by large collectors. The higher quality grades are mainly traded in large urban markets while grade C fruit is traded in rural areas and small- and medium-sized towns. Small amounts of grade C are also absorbed by the nascent processing sector. Grade classifications are not fixed, and during the off-season months, when supplies are limited, grade B mangoes may be sold as grade A.

The grade of the fruit has significant influences on prices in wholesale markets. Grade A mangoes can reach prices as high as IDR 15,000/kg in the off-season whereas Grade C mangoes may only fetch IDR 400/kg in the peak season. However, since most smallholder farmers sell ungraded mangoes and mainly sell fruit on the tree, these producers capture very little of the quality price differentials in the market and have limited price incentives for investment in quality.

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 mango 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 two key problems can be summarised as:

- Poor farmers receive low prices for their mangoes
- Poor farmers experience low productivity when they manage their own farms

Poor farmers receive low prices for their mangoes. Poor mango farmers lack access to technologies that would allow them to produce mangoes in the off-season when mango prices can be four times higher than prices in the peak season. At the same time, poor farmers also lack access to alternative end markets (such as export markets or markets for processed mangoes) that could absorb the oversupply of mangoes in the peak season. If developed at scale, alternative markets in the peak season can have a positive impact on market prices during those months.

As a result of the low prices received for mangoes, poor mango owners are often reluctant to invest in their mango trees, and they treat mango as the lowest priority crop. They will typically rent out their trees to traders or if they grow their own mangoes, they will rely on a natural harvest and expend minimal to no effort or resources to maintain their trees. Unless poor farmers can have access to higher prices for mangoes, they will continue to have limited incentives to invest in mango trees, which in turn will keep them trapped in a low-return, low investment model in the main harvest season.

Poor farmers experience low productivity when they manage their own farms. As discussed above, even when poor mango owners choose to manage their own trees instead of renting out their trees, most of these farmers will be passive about the management of their trees. It is uncommon for these farmers to invest in external inputs (including fertiliser, pesticides, insecticides, fungicides, growth hormones) or employ basic tree management practices (such as pruning). In instances where farmers are actively managing their trees, farm yields are still relatively low since they lack access to good agricultural practices (GAP) in mango farming, particularly around pest and disease management. Losses from pest and disease attacks are significant, which makes mango farming even less attractive for farmers.

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 knowledge of and access to early flowering technology in NTB
- Infant export and processing industries for mangoes in Indonesia
- Limited provision of information and extension services because of weak public provision and lack of private alternatives

Limited knowledge of and access to early flowering technology in NTB

Crop manipulation technology already exists in Indonesia. The technology is relatively low cost, straightforward to implement, and uses widely available chemicals. However, the availability of Paclobutrazol, the main growth hormone used to induce early flowering, is very minimum in NTB. In order to ensure more effective off-season production, the use of fungicides, such as AmistarTop, is critical for controlling fungi-based diseases which then reduce losses from flower drop. AmistarTop is readily available at agro-input stores since it is already being used in rice production.

Although the technology exists and is available, uptake has mainly been among large collectors or within more advanced mango production zones. While some smallholder farmers are unaware that early flowering can be induced by using chemicals, others simply do not know what chemicals to use. Farmers are also often unaware of the need to complement Paclobutrazol with other chemicals (such as fungicides and insecticides) to improve the success rate. Since chemical companies do not regard mango farming as an important potential market, they have not actively promoted the use of these chemicals for off-season mango production or provided any embedded services to assist farmers with successful application of crop manipulation technologies.

Infant export and processing industries for mangoes in Indonesia

Although Indonesia enjoys unique competitive advantages in Asian markets on account of its geographical location, the timing of its main mango harvest, and very low mango prices during the peak season, the lack of cold chains and inability to meet the high quality standards required to access export markets has meant that the export sector is largely underdeveloped. The processing industry is also in its early infancy. The few existing processors tend to be small, home-based enterprises. Since processors can only afford to buy fresh mango during the short peak season, this can inhibit investment in larger processing facilities. Other major constraints for the processing sector includes poor product development and marketing expertise, difficulties meeting quality requirements of the modern retail segment, and strong competition from cheaper imported substitutes (for example with mango pulp).

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

Information and extension services are important to ensure farmers have access to information on GAP in mango farming, particularly given the potential for high losses from pest and disease attacks. There are, however, few reliable sources of information for mango farmers. Since mango is considered to be among the lowest priority crops, agro-chemical companies and existing government extension agents tend to have limited technical knowledge and skills on mango

farming. Finally, traders with more advanced knowledge about mango farming are perceived as unwilling to share information on what chemicals or practices they use.

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 stimulate production of mangoes during the off-season when prices are particularly high and to promote the development of alternative end markets to absorb the oversupply of mangoes in the peak season. Despite high market prices for mangoes harvested during May to September, most farmers in NTB are only producing mangoes during the peak season when prices are a fraction of off-season prices. There is potential for AIP-PRISMA to tap into the prospect of shifting 50% of total production to an earlier harvest time to enable farmers to get a better price during off-season months. There is also scope for growth in exports and processed mangoes, which could improve returns from peak season mango production.

Based on our calculations, there is an untapped market worth of 4 MT of Paclobutrazol to sell in NTB.

Table 1: Business potential in target area

# of trees in NTB	817,061
# of productive trees in NTB	430,865
# of mango farmers HH in NTB	40,919

Categories	Percentage of # of Household out of the whole population	Number of HH	Percentage of # of trees out of the whole population	Number of trees	Number of Productive Trees
Number of farmers owned <10 trees	7.02%	2,872	1.08%	8,854	4,669
Number of farmers owned 10 -25 trees	37.43%	15,315	17.96%	146,712	77,366
Number of farmers owned 26 -50 trees	38.60%	15,793	37.31%	304,861	160,764
Number of farmers owned 51 -100 trees	14.04%	5,743	29.80%	243,495	128,403
Number of farmers owned >100 trees	2.92%	1,196	13.85%	113,139	59,662
Total	100.00%	40,919	100.00%	817,061	430,865

Our Target

Number of HH	18,186
Number of productive trees	82,036

Market Potential

1-25 trees	
Number of HH	18,186
Number of productive trees	82,036
Number of Paclobutrazol needed in NTB	820 Kg
>26 trees	
Number of HH	22,733
Number of productive trees	348,829
Number of Paclobutrazol needed in NTB	3,488 Kg
Total	4,309 Kg
Potential Paclobutrazol Sales in NTB	4 Ton

5.2 Vision of change

Focusing on achieving the potential outlined above for the mango 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 increase smallholder farmers' productivity and selling price received by smallholder mango farmers in both the peak and off-season, but with an initial focus on off-season production. At the **service level**, it is envisaged that farmers will have improved access to: (1) crop manipulation technology, (2) export and processing services, and (3) information and extension services. We envision that crop manipulation technology and information and extension services will be commercialized through chemical companies and collectors while export and processing services may potentially be developed through traders and existing or new processing enterprises.

5.3 Intervention Areas

It is crucial that interventions are designed to be '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 are necessary to transform the mango sector in NTB:

- **Intervention Area 1:** Increase production in the off-season
- **Intervention Area 2:** Promote alternative end markets in the peak season
- **Intervention Area 3:** Introduce better practices and more effective and affordable pest and disease management

Intervention Area 1: Increase production in the off-season

More widespread introduction of crop manipulation technologies would allow smallholder mango farmers to benefit from higher prices in the off-season. The experience of mango farmers in Cirebon and Pemalang, West Java shows that significant increase in the profitability of mango farms provide farmers with the incentives, as well as financial means for further on-farm investment in areas such as fertilisation, pruning, irrigation, and pest and disease management. In short, successful development of early-season production is a first critical step towards greater intensification in mango farming.

In order to increase production in the off-season, PRISMA has been working with Syngenta to improve access and knowledge of crop manipulation technologies. Farmer-to-farmer activities, EXPOs, and farmer field days have been conducted to expose farmers to the use of a combination of chemicals for effective off-season mango production — Cultar, AmistarTop, and Actara. During the pilot phase, Syngenta is targeting larger farmers and collectors who serve as early adopters and can be entry points for later adoption by more risk averse small farmers. Some of the larger farmers and collectors are also introducing off-season technologies to rented trees. In these cases, smallholder mango owners can reap benefits through higher rental prices. In addition to these on-going activities, there is potential to develop a collector-agent model which could support smallholder farmers with embedded information and services to use this technology. Other potential intervention ideas include introducing smaller package sizes or combination packs of the three chemicals.

To further increase the prevalence of EFT, it is also possible to work with the government to utilize the public extension service. The government normally work with local farmer groups and do day-to-day monitoring and help solve agricultural problems. However, government extension services commonly work with priority crops and only have knowledge for these crops only. To work with them means to equip them with the necessary knowledge for further dissemination to farmers. Different types of extension services are also identified on the field: there are people who focus more on cultivation (under the institution of extension service) and people who focus more on pest and disease management (under the Agricultural Ministry). The collaboration of these two inter-related institutions are crucial to the success of the program.

Women are influential decision makers in household money management, and will often be involved in deciding whether or not to invest in crop manipulation technologies for mangoes. In households that have already applied early flowering technology, women have been involved in pouring Cultar and in operating spraying machines for Amistartop. Women are also important channels for sharing information on the benefits of this technology to their peers. Any intervention that introduces new technologies or farming practices needs to be accessible to women since their improved farming practices, knowledge, and opinions will impact on household income from mango and on wider adoption of such practices.

Intervention Area 2: Promote alternative end markets in the peak season

Limited development of mango exports or processed mango products are examples of missed value chain upgrading opportunities. Exports can drive the development of more productive, higher-value mango chains, with benefits to all chain participants. If developed at scale, it can have a positive

impact on market prices during the critical peak season months. Similarly the development of mango processing industry at scale could also help address depressed prices during the main season while generating employment opportunities, particularly for women.

In the short to medium term, there is potential for exporters to expand supplies to current markets, particularly Singapore, Malaysia, Hong Kong, and United Arab Emirates. Vietnam and Thailand are potential markets, but may require bilateral market access protocols which can take time to develop. There is potential to work with existing mango exporters (such as PT Sumber Buah in Cirebon, PT Alamanda in Bandung, and PT Sumber Bumi in Probolinggo), companies and traders with a history of supplying mangoes to supermarkets, or fruit exporters that are not yet involved in the mango trade. Potential interventions include quality management at farm level, post-harvest technologies to preserve fruit quality during transport, and consumer awareness campaigns to promote Arumanis or other Indonesian mango varieties in export markets. Exporting to United Arab Emirates (UAE) might be possible since they are more accustomed to green-skinned mangoes. Thus, minimal market education will be necessary.

It is also imperative to introduce the potential of export markets to farmers and to educate the importance of building strong relationship with related traders. Farmers also need to understand the importance of supply sustainability with acceptable grade and quality.

While it is unlikely that the processing sector will reach a scale where systemic price effects can be envisaged in the near future, there may be potential to support existing or new processing ventures with the view to encourage replication. For example, PT Suryajaya in Probolinggo previously tried to export canned mango but was not able to develop a stable product with a long shelf-life and uniform size and colour. Promindo Utama CV in Cirebon appears to be successfully supplying mango pulp to juice companies, such as PT Surya Mitra Pasifik (Berri brand) and Unilever (Buavita brand). There is also PT Polowijo Gosari, which is looking to develop a processing facility in Gresik.

Intervention Area 3: Introduce better practices and more effective and affordable pest and disease management

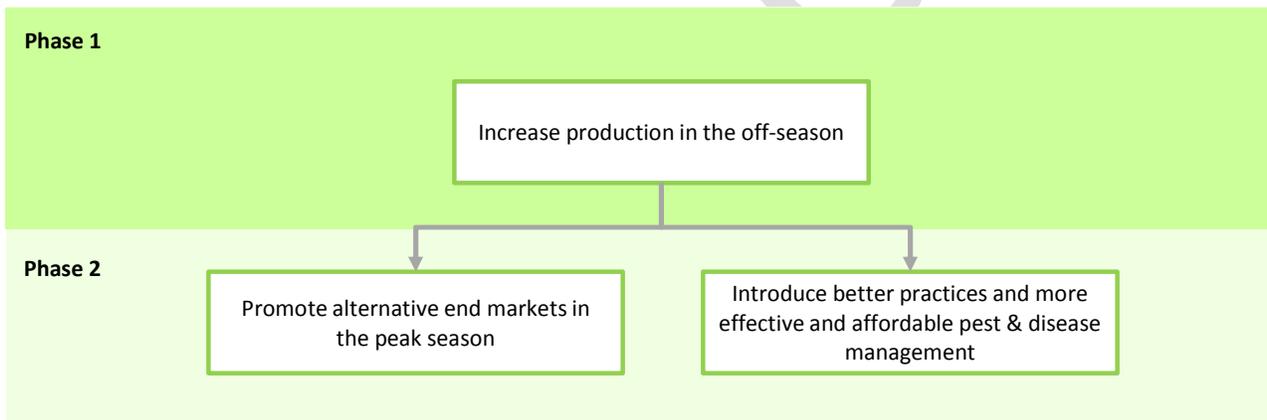
Improved tree management practices and better pest and disease management can have a significant positive impact on productivity. Relevant practices include improved pruning, pest control, fertilising, and irrigation. Potential interventions may include the provision of spray services or embedded information by input retailers or collectors. The development of appropriate information products for wide distribution will be important. For example, pest and disease calendars and charts showing fruit defects, as well as their causes and solutions, could be particularly useful to farmers. As with Intervention 1, both women and men should be targeted when introducing new practices in mango farming.

The safety factor of pest management are also a crucial aspect to be addressed. Current practice done by farmers displayed risky application of chemicals that might cause short-term or long-term hazards. For example, mango farmers are still not used to wear the required protection gear or applying chemicals from a safe distance. Current study shows that the risk could be mitigated through utilizing safety equipments to prevent direct exposure with chemicals or using spraying

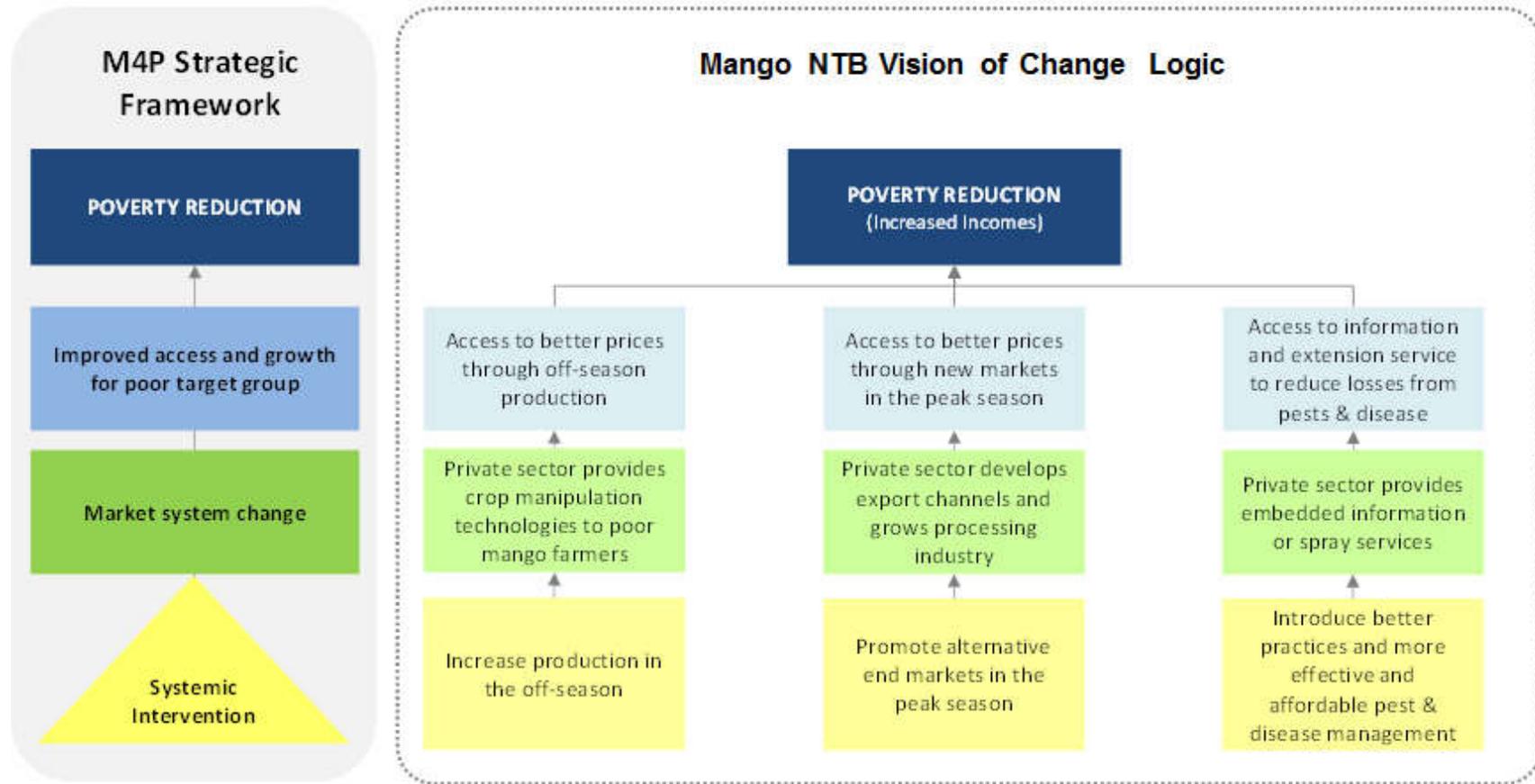
technology that allows farmers to apply chemicals from a distance. It is uncommon in Indonesia to find a sprayer that is specifically designed for big and tall tree such as mango. Some mango farmers who administer pest management tackle this problem by modifying hand sprayer with water hose and long bamboo post. However, these hand-made devices are not commercially available to farmers and no standardized quality assurance have been applied. Producing affordable and standardized sprayer for mango farmers can mean a more effective and efficient chemical and labor use, and also increased safety.

5.4 Sequencing and prioritisation of interventions

It is recommended that the interventions in the NTB mango sector be implemented in two phases. In the first phase, the focus will be on *increasing production in the off-season*. This will allow farmers to benefit from the higher prices in the off-season. The second phase will involve improved prices for peak season production through the *promotion of alternative end markets in the peak season* and higher productivity for both seasons through the *introduction of better practices and more effective and affordable pest and disease management*. As farm incomes rise, farmers will have more incentives to invest in more intensive tree management practices and pest control strategies.



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 Areas	Service Provider/Partner
Poor mango farmers receive low prices for their mangoes	Poor farmers lack access to technologies that allow them to produce mangoes in the off-season	Crop manipulation technology	Early flowering technology exists but not being promoted across NTB.	Intervention Area 1: Increase production in the off-season	<ul style="list-style-type: none"> • Chemical companies (Syngenta, etc.) • Collectors
	Poor farmers lack access to alternative markets in the peak season that could absorb the oversupply of mangoes	Export & processing services	Lack of cold chains and high quality standards required to access export markets has meant that the export sector is underdeveloped. The processing industry is also in its early infancy.	Intervention Area 2: Promote alternative end markets in the peak season	<ul style="list-style-type: none"> • Traders/Exporters • Processors
Poor mango farmers experience low productivity when they manage their own mango trees	Poor farmers have limited access and knowledge of good agricultural practices in mango farming, including pest and disease management	Information and extension services	Poor public provision of extension services and lack of private alternatives.	Intervention Area 3: Introduce better practices and more effective and affordable pest & disease management	<ul style="list-style-type: none"> • Collectors • Chemical companies • Input retailers

Annex 2: Identified market actors

Function	Market actors	Company's name	Contact details	Remark
Private Partner	Input Producer	PT Syngenta Indonesia	<p>Mr. Arvianto Perkantoran Hijau Arkadia tower C, 9th floor Jl. TB Simatupang Kav 88 Jakarta 12520, Indonesia Ph: 021 3042 1000 Fax: 021 7883 6323</p> <p>Mr. Nur Hidayat Regional Office East Java Pondok Blimbing Indah Blok K2 No. 6 RT 008 RW 011 Kel. Purwodadi Kec. Blimbing Malang, East Java 65125 Ph / Fax: 0341 414308</p> <p>Mr. Khusaeri Regional Office West Nusa Tenggara Jl Gelatik No. 24 Perumahan Monjok Baru, Mataram 83122 Ph / Fax: 0370 639 280</p>	

Annex 3: People interviewed

No	Date	Location	Represent	Name of interviewed	Contact details

PHASE OUT

Annex 4: Investigation team

Ivan Iskandar – Business Consultant, PRISMA

Suandi Darmawan – Senior Business Consultant, PRISMA

Brena Dwita – Business Consultant, PRISMA

Fauzi Ahmad – Business Consultant, PRISMA

Taya Kadhita – Business Consultant (Result Measurement), PRISMA

Bodhiya Mulya – Business Consultant (Result Measurement), AIP-PRISMA

Annex 5: Gender Table

No	Activity in production cycle	Task division		Explanation
		M	F	
1	Agreeing to do EFT	√	√	Discussed and decided together by male and female farmers.
2	Pruning	√		Mostly done by male labors. However, when male labors will dig the ground, the female can be involved in pouring the substance.
3	Fertilizing	√		Mostly done by male labors. The female However, when male labors will dig the ground, the female can be involved in mixing and pouring the chemicals.
4	Cultar application	√	√	Mostly done by male labors. However, when male labors will dig the ground, the female can be involved in mixing and pouring the chemicals.
5	Pest & disease management	√		Mostly done by male labors.
6	Harvesting	√	√	Mostly done by labors of both male and female employer. However, it has been found that some female collectors climb the trees herself.
7	Deciding the selling method and to whom to sell	√	√	Discussed and decided together by male and female farmers.
8	Negotiating price		√	Mostly done by female farmers. The money from sales will most likely be managed by the female.