Australian Aid

VEGETABLE SUB-SECTOR GROWTH STRATEGY DOCUMENT FOR WEST NUSA TENGGARA (NTB) 2017

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Abbreviations

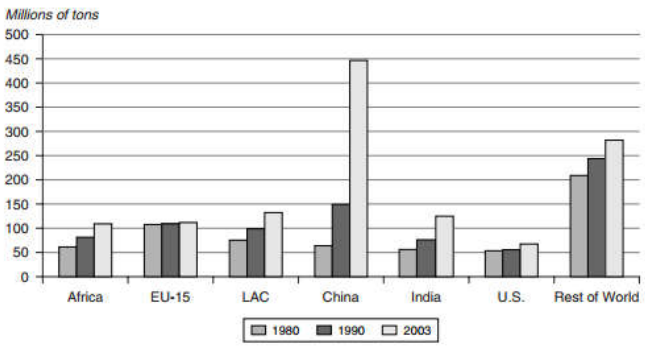
AIP-PRISMA	Australia-Indonesia Partnership for Promoting Rural Income through Support for Markets in Agriculture
PPI	Progress out of Poverty Index
CAGR	Compound annual growth rate
ha	Hectares
ILAF	Intervention Logic Analysis Framework
NTB	Nusa Tenggara Barat (West Nusa Tenggara)
ACIAR	Australian Centre for International Agricultural Research
EWINDO	East West Seed Indonesia
WHO	World Health Organization
WFP	Word Food Programme
GAP	Good Agriculture Practice
PSP	Private Sector Partner
ISP	Intermediary Service Provider

1. Executive summary

Global vegetable sector shows increasing trend lately due to extensive promotion of fruit and vegetable consumption, rising income and the expansion of the middle class worldwide. WHO and FAO suggest the amount of 400 gr consumption of fruits and vegetable per day. Apart from that, worldwide per capita consumption is estimated to be 20 to 50 % short of that minimum daily recommendation level a day.[1] Vegetables as the most important source for micronutrients, fibre, vitamins, and minerals are important for balance and healthy diet. Vegetable also the major income for small holder farmers. In most country, the production is too low than demanded with even the minimum intake required for a good health. Diet in most of developing countries are overloaded with more carbohydrates and fats, resulting in increased rate of obesity and its associated diseases. The production of vegetable need to be boost for fulfilling the demand of around 7.5 billion of world population.

Global production of vegetables grew by 30% between 1980 and 1990 as showed by figure 1, and 56% between 1990 and 2003, reaching 1,274 million tons in 2003, then reaching 1,394 million tons in 2014[2]. Much of this growth occurred in China with highest variance from 1990 to 2013. China is currently the world's largest producer of vegetables almost in all vegetables commodities around 32% of total global vegetables production in average for 2014. Vegetables in this analysist will be grouped into eight groups as follows: **Solanum** for Chili, Tomato, and Eggplant; Allium for Shallot, Onion, Garlic, and Leeks; **Brassica** for Cabbage, Broccoli, and Cauliflowers; **Leafy Vegetables** for Salad like lettuce, chicory, fresh vegetables, and spinach; **Legumes** for long beans, and string beans; **Cucurbit** for Cucumber, Squash, Luffa, Bottle gourd, and Bitter gourd; **Potato** and **Carrot**.[3] Allium group will slightly mentioned, but further elaboration is available in different document for Shallot GSD, while in this document elaborates more on seven other groups of vegetables. The data is processed from FAO Stat 2014, and for Indonesia data production, land and yield from Ministry of Agriculture 2015.

Figure 1 Production Fruit and Vegetables by Region (millions of tons)



Source: United Nations Food and Agriculture Organization.

[1] Diet, nutrition, and the prevention of chronic diseases. Report of a joint FAO/WHO Expert Consultation. Geneva, World Health Organization, 2003 (Technical Report Series, No. 916) Accessed from http://www.fao.org/3/a-i6807e.pdf

[2] For Global production number data in 2014 is based on FAOSTAT 2014

[3] Based on PF1 Vegetable Workshop on 29th-30th April 2017, assisted by Joko Maryono, as vegetable expert.

Solanum for Chilli, Tomato and Eggplant highest production is in China around 28% of world production for about 98 million tons' production. China has the biggest area also among all the nation for Solanum around 22% of the world acreage, 2.5 million ha. In terms of yield, Belgium is the highest with 460.3 ton/ha. The biggest exporter is Mexico for 2.3 million ton in 2014, while the biggest importer of Solanum is USA with 2.5 million tons. Compared to Indonesia, the production of Solanum in Indonesia is only 0.95% of the world with value 351 million tons. This production is in 0.3 million ha, which is 3% of the world acreage for Solanum.[4] The yield is far lower than Belgium as the highest yield in Solanum cultivation in the world. Although has produced 351 million tons of Solanum, it is not enough to fulfil the domestic demand, Indonesia still import 41,457 tons of Solanum, (chilli from India and China; tomato from China, USA and Italy; and there is no record for Eggplant imported). While export 18,770-ton Solanum (chilli to Saudi Arabian, Malaysia, and Nigeria; Tomato to Singapore, Canada, and Philippines; Eggplant to Japan, Singapore and Malaysia.[5]

Brassica for Cabbage, Broccoli, and Cauliflowers highest production is in China around 31% of world production for about 43 million tons' production. China has the biggest area also among all the nation for Brassica around 28% of the world acreage, 1.4 million ha. In terms of yield, South Korea is the highest with 74.12 ton/ha. The biggest exporter is China for 0.6 million ton in 2014, uniquely the biggest importer also China with 0.6 million tons, where the value of export exceeding import. Compared to Indonesia, the production of Brassica in Indonesia is only 1.12% of the world with value 1.5 million tons. This production is in 0.074 million ha, which is 1.3% of the world acreage for Brassica. The yield is far lower than South Korea as the highest yield in Brassica cultivation in the world, which is 21.13 ton/ha. Indonesia has produced 1.5 million tons of Brassica, but same as Solanum, Indonesia still import 42,297 tons of Brassica, (Cauliflower, Cabbage, and Broccoli from China and Australia as the highest importer countries). While export more around 68,958-ton Brassica (Cauliflowers and Broccoli to Malaysia and Maldives; Cabbage to Taiwan, Malaysia and Singapore; and Chinese Cabbage to Singapore and Saudi Arabia).[6]

Leafy Vegetables highest production is in China around 42% of world production for about 35.7 million tons' production. As well as the two-last groups, China has the biggest area also for Leafy Vegetables among all the nation for around 39% of the world acreage, 1.3 million ha. In terms of yield, Congo is the highest with 40.56 ton/ha. The biggest exporter is Spain for 0.7 million ton in 2014, while the biggest importer is Canada with 0.3 million tons. Compared to Indonesia, the production of Leafy Vegs in Indonesia is only 0.15% of the world with value 0.13 million tons. This production is in 0.045 million ha, which is 1.3% of the world acreage for Leafy Vegs. Indonesia's yield is 2.96 ton/ha, far lower than Congo. Indonesia still import 154-tons of Leafy Vegs (Lettuce from Australia and China, Chicory from USA, and Spinach from France). While export more, around 1,534-tons of Leafy Vegs (Lettuce to Singapore, Taiwan, and Brunei Darussalam; and Chicory to South Korea).

[4] Processed from FAOSTAT 2014 for Vegetable Global Data
[5] Processed from Ministry of Agriculture Data Export and Import Horticulture 2016 http://aplikasi.pertanian.go.id/eksim2012/hasileksporNegara.asp for Export Import Data for all horticulture commodities (Solanum, Brassica, Cucurbit, Carrot, Potato, Leafy Vegetables, and Legume). Export and Import destination country mentioned here, only the big three country in terms of export and import value in tons.
[6] Processed from Ministry of Agriculture Data Export and Import Horticulture 2016

Legumes highest production is in USA around 43% of world production for about 0.7 million tons' production. Not all legume is calculated in this case, only for peas, long bean and string bean, USA become the only other country which is become biggest producer of vegetables other than China for 7 other groups of Vegetables. USA has the biggest area also for Legume among all the nation for around 46% of the world acreage, 0.09 million ha. In terms of yield, Morocco is the highest with 26 ton/ha. The biggest exporter is Morocco for 0.09 million ton in 2014, while the biggest importer is Spain with 0.1 million tons. Compared to Indonesia, the production, acreage and yield is not recorded in FAO data, for long and string bean, but Indonesia export import data from FAO mentioned export for string bean and long bean 82 tons, while import 16,216 tons. Based on data of Indonesian Ministry of Agriculture 2016 import of Pease from Canada and USA; while export of long bean to Qatar and Singapore; and Peas to India and Kuwait.

Cucurbit highest production is in China around 39% of world production for about 64.2 million tons' production. China has the biggest area for Cucurbit among all the nation for around 27% of the world acreage, 1.5 million ha. In terms of yield, Iceland is the highest with 602.3 ton/ha. The biggest exporter is Mexico for 0.9 million ton in 2014, while the biggest importer is USA for 1 million tons. Compared to Indonesia, the production of cucurbit in Indonesia is only 0.5% of the world with value 0.8 million tons. This production is in 0.06 million ha, which is 1% of the world acreage for Cucurbit. Indonesia's yield is 14.3 ton/ha, far lower than Iceland. Indonesia still import 117-tons of Cucurbit (cucumber from Sri Lanka, India, and USA). While export more amount, around 8-tons of Cucurbit (cucumber to Singapore).

Potato highest production is in China for 20% of world production for about 95.5 million tons' production. China has the biggest area for Potato among all the nation for around 23% of the world acreage, 5.6 million ha. In terms of yield, Kuwait is the highest with 67.5 ton/ha. The biggest exporter is Netherland for 3.2 million ton in 2014, while the biggest importer is also Netherland for 1.7 million tons, with value for export greater than import. Compared to Indonesia, the production of potato in Indonesia is only 0.28% of the world with value 1.3 million tons. This production is in 0.07 million ha, which is 0.3% of the world acreage for potato. Indonesia's yield is 17.67 ton/ha, far lower than Kuwait. Indonesia is importing huge amount of potato for 106,229-tons from Germany, USA, and Netherland. While export, around 6,066-tons of potato to Singapore, Malaysia, and China.

Carrot highest production is in China for 31% of world production for about 17.4 million tons' production. China has the biggest area for Carrot among all the nation for around 23% of the world acreage, 0.4 million ha. In terms of yield, Iceland is the highest with 123.5 ton/ha. The biggest exporter is China for 0.5 million ton in 2014, while the biggest importer is Belgium for 0.2 million tons. Compared to Indonesia, the production of Carrot in Indonesia is not achieving 1%, around 0.88% of the world with value 0.4 million tons. This production is in 0.03 million ha, which is 1.7% of the world acreage for carrot. Indonesia's yield is 16.1 ton/ha, far lower than Iceland. Indonesia is importing huge amount of carrot for 42,666-tons from China and Australia. While export, around 5.7-tons of carrot to Malaysia and Singapore.

In Southeast Asia, Indonesia is the biggest producer among the countries, as well as the acreage for planting vegetables. However, for yields, Indonesia needs to improve its productivity so the large acreage for planting vegetables can deliver bigger amount of

vegetables. Exception for carrot and legumes, since not all Southeast Asian countries have these commodities produced in their country, Indonesia is still having better yield.[7] Indonesia exports vegetables to neighbouring Southeast Asia country such as Singapore for almost all vegetables commodities; Malaysia for almost all kinds of vegetables as well, except long bean; Philippines for chili, onion, and tomato only; East Timor for potato, tomato, onion, shallot, garlic, leafy vegetables, and chili; Brunei Darussalam for chili, leafy vegs, and tomato; Thailand for potato, shallot, leafy vegs, and chili; Vietnam for tomato, shallot, leafy vegs, eggplant and chili; Cambodia and Myanmar for chili. Indonesia import vegetables also from Southeast Asian country for Potato from Singapore, Malaysia, and Myanmar; tomato from Malaysia, Thailand, and Singapore; Onion from Thailand, Singapore, and Malaysia; Shallot from Malaysia; Garlic from Malaysia; Carrot from Malaysia; Chinese Cabbage from Malaysia and Singapore; and Chili from Thailand and Singapore.[8]

Based on the explanation above, Indonesian vegetable production, acreage, and yields compare to the world still left behind. Many aspects are potentially to be improved, to maximize available land and come up with several strategies to improve Indonesian vegetable yields. Indonesia tend to export raw vegetables to the world and the neighbouring country with lesser value of money compare to processed vegetable products Indonesia has imported from other countries. In some essential commodities, Indonesia is still struggling in doing self-sufficiency, and turning out of giving up to import mechanism due to unreasonable local production cost. This is applied to several strategic commodities like garlic mostly from China. However, the good news, compare to Indonesian neighbouring countries in Southeast Asia, Indonesia's vegetable production and acreage in all groups are the biggest. The biggest with notes that the productivity do not say so, Indonesian vegetable productivity lags compare to our neighbouring countries. It is a gap which need to be considered by the enabling environment in Indonesia for do not wasting the opportunities and revise the strategy to increase the productivity.

Indonesia opportunity in vegetable is also laying down on its population buying behaviour or on how market worked. Vegetable is still perceived as secondary needs for mostly Indonesian people. The urgency of consuming vegetable is not as important as rice, meat, housing, clothes, as the primary needs, even left behind technology for some millennial generation (smartphone with Wi-Fi). This condition is also let vegetable farmers to choose planting only several potential crops which have higher values in the market for example chilli, garlic, and shallot. Other group of vegetable market is not as promising as these golden commodities, due to the ability of the golden commodities causing inflation. There is a levelling in vegetable group itself, firstly fast moving strategic commodities (the golden commodities mentioned before) and second one is slow moving, which if available is okay but not consuming that vegetables also not a big deal by some people, where they still can find the substitution in local vegetables (raw jack fruit, cassava leaves, pumpkin leaves, etc.). Therefore, the concern is high in fast moving vegetables showed by high demand on this kind of vegetable and low for the supporting vegetables with steady growth. Further explanation on Indonesian vegetable

[7] Data of Production, Acreage, and Yield for Southeast Asian Countries derived and processed from FAOSTAT Data 2014

[8] Ministry of Agriculture Center Data and Information System, "Impor and Ekspor Komoditi Pertanian Subsektor Hortikultura (Segar & Olahan) 2016.

sector paradox will be elaborated more in sector profile both for Indonesian and respective province context.

Realising the facts in global and national vegetable sector for Indonesia, the vision of change is needed to improve access and growth for vegetable farmers, especially the poor farmers. Five vision of changes is formulated for vegetable sector, which are: 1) Improving access of vegetable farmers to quality inputs; 2) Strengthening dissemination of agricultural knowledge (GAP) and information; 3) Promoting and improving post-harvest handling; 4) Promoting off season vegetables and technology; 5) Improving access to financial services. Through these visions are actuated into several interventions related to the needs of every province and its local conditions: 1) Addressing limited access to quality input and dissemination of GAP by working with seeds company, chemical company, and local agricultural input shops to open access of quality input with GAP to farmers; and create a platform to easily disseminate the information (ICT). 2) Collaborating with SAFIRA to overcome the barrier in accessing financial services. 3) Working on post-harvest by linking the farmers to the market. This sector is still finding an opportunity to promote off season vegetable, because of its potency to highly increase farmer's income.[9]

NTB has 4,5 million inhabitants and is one of the poorest provinces in Indonesia with the poverty rate that stands at 16.48%, higher than the 10.96% national poverty rate (2015 Data of the Central Agency on Statistics/BPS) and heavily relies on Agriculture production as its source of income. Furthermore, based on PPI study conducted by PRISMA, 70% of vegetable farmers in NTB are poor. West Nusa Tenggara Province has been facing chronic poverty issue for decades. This has subsequently created a heavy reliance towards ensuring good quality of yields for subsistence food crops produced by local farmers. The Province, due to its remote geographical location, has also suffered stalled progress in development compounded by the climate-induced risks. In NTB, the proportion of rural household's dependent on agriculture is more than 80%; high prevalence of nutritional problems. In West Nusa Tenggara encountered a wide variety of issues such as nutrition, nutritional Less and malnutrition, as well as the problem of micronutrients. Based Health Research (Riskesdas) In 2007, the prevalence the province to review Chronic malnutrition (stunting) is 43.65%. (Rencana Aksi Daerah Pangan dan Gizi 2015).

Focusing on achieving the potential outlined above for the vegetable 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 a) Increased production and productivity of vegetable to substitute import of vegetables, b) Improved market performance for farmers by establishing innovative systems and techniques to improve their income. At the service level, it is envisaged that farmers will have improved access to: (1) Quality input, (2) better cultivation techniques, (3) good post-harvest management and marketing.

[9] Based on discussion in PF1 Vegetable Workshop on 29th-30th April 2017, assisted by Joko Maryono, as vegetable expert.

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 NTT, 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 vegetable sector to benefit the smallholder farmers in West Nusa Tenggara (NTB).

3. Sector description

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

3.1 Sector Profile

3.1.1 Overall context

Vegetable is categorized under horticulture, together with fruits, decorative flowers, and medicinal plants. In Indonesian government, it is managed under horticulture department in Ministry of Agriculture, but the grouping of horticulture in Indonesia compared to other countries might be different. In Indonesia maize, cassava, sweet potato, soybean and taro are belong to main crops, while in several other countries, they belong to horticulture. Baby corn, sweet corn and edamame belong to horticulture. So, horticulture in Indonesia generally characterized by commodity with high economic values and the cultivation process requires intensive process and skill. Indonesia land condition which are spreading and small size suitable to be planted by horticulture plants. In various country, horticulture has important role in increasing farmer income, creating job, and promoting investment in village level. Horticulture with spread and small size land, added with perishable condition of the products become a big challenge for farmers and trader in serving the customer. Pricing of horticulture product is high when its fresh and starting to be lower in a short time when the product no longer fresh and even become waste around 20-50% of mismanage and bad storing system.[10]

Indonesia position as the fourth largest market in the world with population 3.51% of world population, around 255 million people is a potential market to be supplied with local vegetable. Although the number of vegetable consumption in Indonesia now is still lower than 400gr/capita/day required by WHO and FAO, Indonesia 57,7 gr/capita/day[11], but progressively Indonesia is showing positive trend on vegetable consumption. Based on *Susenas (national economic census, BPS)* data March 2016, almost 97.29% Indonesian people consume vegetables in last a week when the survey is conducted. The conclusion is almost all Indonesian people consume vegetables, but still in low amount than suggested by WHO and FAO. The highest Indonesian vegetable consumptions are for spinach, water spinach, long bean, tomato

[10] Accessed from http://www.bbpp-lembang.info/index.php/arsip/artikel/artikel-pertanian/941-pasca-panen-sayuran
[11] Indonesian vegetable consumption, accessed from https://gaya.tempo.co/read/news/2017/01/24/060839202/penduduk-indonesia-ternyata-kurang-makan-sayur-dan-buah.

and eggplant, vegetable soup/*capcay*, and mix vegetable (*lodeh* and s*ayur asam*). *Susenas 2016* also mentioned the more income, higher number of vegetable consumes by the household, except for spinach and water spinach which has been largely consumed by less than IDR 150.000 income (medium to low income).[12]Increasing awareness of consuming more vegetables makes demand of vegetables is higher than supply. This fact is opening a potential market for farmers to improve their yields and other actors to maximize their role for not missing the opportunities and letting the demand satisfied by import products.

The fact is progressive trend of Indonesian vegetable consumption not in line with Indonesian vegetable production for several kinds of vegetable. Demand of several vegetable commodities outstrips supply, like mentioned in figure 2, for commodities like spinach, water spinach, long bean, eggplant, garlic, and cabbage. As mentioned previously, Indonesia is depending on imports to satisfy the demand for certain vegetables. [13] Vegetable consumption in Indonesia has its own pattern of consumption and variation per province and even per district. People in West Java is famous of their habit of consuming green vegetables in raw or steam, this is the reason behind high demand of leafy vegetables in West Java. West Java has the biggest vegetable overall production in Indonesia, and followed by Central Java, and East Java in the third place. The picture is shown by figure 3, where NTB production of vegetables dominated by Solanum and Allium; while NTT vegetables production is small in almost all of kinds of vegetables. Oversupply in Java Island is sent to neighbouring island. Indonesian people has its own local vegetable to satisfy the demand of vegetable, although the position of vegetable in Indonesian diet still in a low portion than suggested by FAO and WHO. The way mostly Indonesian processed their vegetable are also reducing its important vitamins and minerals of using coconut milk and cook them in high temperature and for a long time. For example, people in West Sumatera used to eat cassava leaf as their common consumed vegetable, this kind of vegetable is easily found and not expensive for people there, it is cooked as cassava leaf with coconut milk. The levelling of diet for majority of Indonesian people, rice as the most important, followed by protein from meat, soybean *tempe* and tofu, egg, fish, and the last one is vegetables and fruits. For Indonesian people, eating without vegetables and fruits is still fine. Recently, in middle income Indonesian people this behaviour has changed due to shifting in their lifestyle to healthier lifestyle. Therefore, in the future the consumption of vegetable in Indonesia lately increased.

[12] Consumption per capita household a year based on national economic census 2016 http://aplikasi2.pertanian.go.id/konsumsi/tampil_susenas_kom_th.php and http://gizi.depkes.go.id/wp-content/uploads/2017/01/Paparan-BPS-Konsumsi-Buah-Dan-Sayur.pdf.

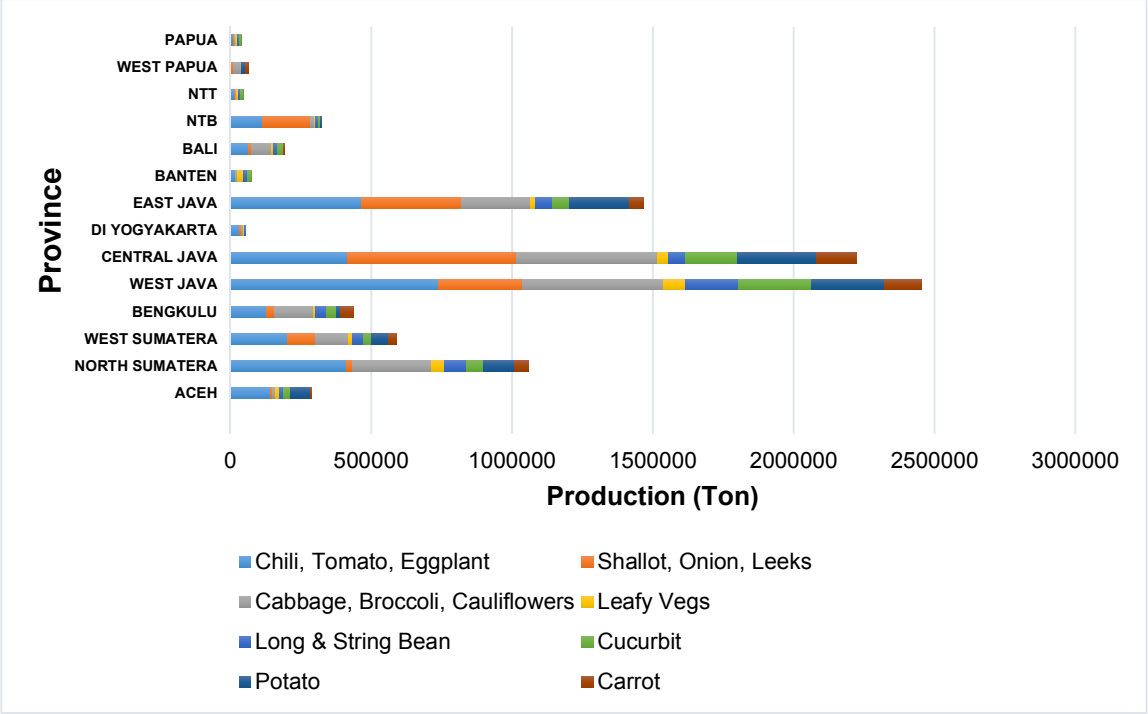
[13] Indonesian Population 2015 accessed from https://www.bps.go.id/linkTabelStatis/view/id/1274 ; Production 2015 Accessed from MoA; and consumption 2015 from http://gizi.depkes.go.id/wp-content/uploads/2017/01/Paparan-BPS-Konsumsi-Buah-Dan-Sayur.pdf

Figure 2. Consumption and Production Comparison 2016 Vegetables Commodities

Vegetable Commodities	Unit	Consumption/capita/year Estimation Number*	Indonesian Population Number**	Estimation National Consumption	Vegetable Production (Kg)***	Production-Consumption
Spinach	Kg	4.03	255,461	1,029,507.83	150,085	(879,422.83)
Water Spinach	Kg	4.44	255,461	1,134,246.84	305,071	(829,175.84)
Green Mustard	Kg	2.09	255,461	533,913.49	600,188	66,274.51
String Bean	Kg	1.14	255,461	291,225.54	291,314	88.46
Long Bean	Kg	3.34	255,461	853,239.74	395,514	(457,725.74)
Tomato	Kg	0.417	255,461	106,527.24	877,792	771,264.76
Cassava Leaf	Kg	2.66	255,461	679,526.26	NA	NA
Eggplant	Kg	2.74	255,461	699,963.14	514,320	(185,643.14)
Bean Sprout	Kg	0.88	255,461	224,805.68	NA	NA
Mix Vegetable Soup/Capcay	Pack	8.3	255,461	2,120,326.30	NA	NA
Mix Vegetable Lodeh/Sayur Asam	Pack	5.26	255,461	1,343,724.86	NA	NA
Raw Jack fruit	Kg	0.55	255,461	140,503.55	NA	NA
Shallot	Kg	2.713	255,461	693,065.69	1,229,184	536,118.31
Garlic	Kg	1.749	255,461	446,801.29	20,295	(426,506.29)
Red Chilli	Kg	2.96	255,461	756,164.56	1,045,182	289,017.44
Rawit Chilli	Kg	2.96	255,461	756,164.56	869,938	113,773.44
Cabbage	Kg	1.356	255,461	346,405.12	118,388	(228,017.12)
Cucumber	Kg	1.616	255,461	412,824.98	447,677	34,852.02

*Consumption 2015 Susenas
**Population 2015, BPS
***Production 2015 MoA
Cabbage and Cucumber use data consumption 2014

Figure 3. National Vegetable Production By Province 2015[14]



[14] Processed from Ministry of Agriculture data 2015

Challenge in Indonesian vegetable sector is in the ability to match the supply location with where the demand located by considering perishable status of vegetable. Indonesian part where produce vegetables are spreading in all over Indonesia for smaller land size, with farmer behaviour tend to plant high value vegetable and not aware of their geographical and soil potency and condition, GAP, crop planning and post-harvest handling (GHP). Knowing that the price of Chilli is increasing, most of the farmer prefer to plant chilli, instead of other vegetables. As the consequence, too much supply on chilli, instead of getting high price, the price is become lower. Case in segmented vegetable like broccoli, pokchoy, leafy vegetables, most of the farmer still difficult in finding the market to sell their product other than local market so no incentive for them to plant these vegetables, push their production and increase yield. Accessing big demand in the city urges trader to have a proper post-harvest handling, so the vegetable condition is still fresh and people the city still willing to buy. Indonesian farmer has overwhelmed with the challenge in planting vegetables like finding good input materials, cultivate the land, waiting for harvest time, pest and disease, and hiring staffs. So, considering that, post-harvest handling and marketing their product is surpassing their capacity. There is collector and trader help the farmer to distribute their product. By not in charged with this, let the bargaining power of farmer become low, compare to their product cannot be sold, it's better for them getting low price at least their initial capital spent for planting vegetables break event. Helping vegetables farmer with this devil circle, assisting them to solve input and planting problem, prevent pest and disease, linked with fair market actor with fair buying price, help trader dealing with perishable condition of vegetables are the potential target of vegetable sector.

Government of Indonesia keep on providing enabling environment by set regulation for import and export based on Indonesian local production capacity. Farmer who grouped into farmer's group supported by giving subsidy for seeds, fertilizer, and tools. President Jokowi, under Ministry of Villages, Disadvantage Regions, and Transmigration developed BUMDes allocates government funding from ADD (*Anggaran Dana Desa*-Village Budget Fund) and APBD (regional funding) to be managed autonomically by the government in village level. BUMDes stands for village owned enterprise is a government initiative to let village owned an enterprise where all or part of the funding owned by villagers itself through government funding or from village owned income to manage the asset, village resources, and services for the sake of its people in the respective districts. This policy is based on UU No 6, 2014 about village governance. The purpose of BUM Des is to improve village economic condition, optimize village assets, increasing rural people participation to manage their potency, promoting collaboration with external parties, opening opportunity to let rural people get accessed to market exposure, public service, working opportunities, to increase their income. Funds managed under BUMDes is used to be spent for supporting agriculture as well, where become a chance for PRISMA's partner to supply their product and procured partner's product by village level government. The amount for agriculture in every district is different, the elaboration on how this policy worked in each province or district is elaborating in local context based on local information. This policy is made to help farmers with financial problems.

Abundance problems faced by farmers, and actor along the long vegetable supply chain, with disparity of accessed available among province, different potency and geographical conditions. Each province has their own specific characteristic of farmer and vegetable market. These are the potential target for AIP-PRISMA to explore the market-based intervention in vegetable sector with potency of 1,122,000 HH vegetable farmers in Eastern Indonesia: East Java 625.000 HH; NTB 58,000 HH; NTT 92,000 HH; Papua 300,000 HH; and West Papua 47,000 HH. By addressing the problem with custom solution based on each province characteristics explored in this document, the aim of increasing 30% income of 300,000 Indonesian farmers will be achieved by 2018. The local context and market characteristics is elaborating further through local context, sector dynamics, analysis, and finally coming up with strategy for change.

Approximately 1 million hectares of Indonesia's land area is occupied by vegetable farming (2% of the total agricultural land) with a potential additional of 1.3 million hectares of which is converted from rice farming to vegetable farming during the dry season. Vegetable farmer[15] is defined as a person who cultivates any plant whose fruit, seeds, roots, tubers, bulbs, stems, leaves, or flower parts are used as food. According to the BPS figures the average farm size for vegetable crops is less than 0.5 ha. Most smallholder farmers have limited technical skills and knowledge to perform good agriculture practices in order to optimize their yields required by the market.

Government of Indonesia prioritized agriculture sector and reducing regional imbalances as one of its major development goals in the recent years, recognizing that agricultural growth is the key to reducing poverty and ensuring food security. The development goals of Government of Indonesia are disrupted due to periodic climate shocks that impacts agriculture sector and thus aggravating food security and poverty situations. On an annual basis, 300,000 ha of crop lands are rendered unproductive due to deficient years even in so-called 'normal years'. Periodic El Niño could amplify the area to 1 million unproductive ha translating to loss of 5 million tons of food grains.

3.1.2 Local context

NTB has 4,5 million inhabitants and is one of the poorest provinces in Indonesia with the poverty rate that stands at 16.48%, higher than the 10.96% national poverty rate (2015 Data of the Central Agency on Statistics/BPS) and heavily relies on Agriculture production as its source of income. Furthermore, according to a PPI study conducted by PRISMA, 70% of vegetable farmers in NTB are considered to be poor[16]. West Nusa Tenggara Province has been facing chronic poverty issue for decades. This has subsequently created a heavy reliance towards ensuring good quality of yields for subsistence food crops produced by local farmers. The Province, due to its remote geographical location, has also suffered stalled progress in development compounded by the climate-induced risks. In NTB, the proportion of rural household's dependent on agriculture is more than 80%; high prevalence of nutritional problems. In West Nusa Tenggara encountered a wide variety of issues such as nutrition, nutritional Less and malnutrition, as well as the problem of micronutrients. Based Health Research (Riskesdas) In 2007, the prevalence the province to review Chronic malnutrition (stunting) is 43.65%. (*Rencana Aksi Daerah Pangan dan Gizi 2015*).

[15] *Definition from Indonesia Ministry of Agriculture*
[16] *70 % poverty benchmark according to 150% of National Poverty Index and 88.4 % poverty benchmark according to $2.5 2005 PPP World Bank Index, however this data was generated by and Internal PPI Study conducted by PRISMA on September 2015.*

In 2015, NTB produced 314,589 tons of vegetables from 151,972 ha cultivated area[17]. NTB as a province has several problems hindering the economic growth of the agricultural sector in general.

Roads

There was a lack of good quality, paved rural roads to farmlands. Most were dirt roads offshoot from a main paved road leading to the farmlands. These dirt roads were fine during the dry season but were difficult to impossible to navigate during the wet season. Restricted access limited a farmer's income.

Water

In one area (Senggigi in NTB) the government provided the water supply to the farmers. Priority were given to rice, corn, soya bean and vegetables growers were the last to get water supplies. This created a problem for the vegetable growers therefore they dug their own wells. However, the water from the well was limited and thus they were unable to put more acreage under cultivation all year round. Most of the farmers used a sturdy, plastic sheet to make a make shift water tank right in the middle of the field. They pumped the water from rivers or deep wells to these tanks. From the tanks, they used 2 buckets on a stick to water the crops. Wastage of water was on the high side with these kinds of watering process. This was also a back breaking work and constituted a high cost of labour for watering. Another farmer invested in a large hose and flooded his farmland once a day – bigger wastage of water usage

Equipment

Mini Tractors to help till the land will be in heavy demand shortly. Labour was scarce in the farming community as young men and women moved to the urban areas. Tilling the land became a back breaking work for the older farmers. One solution is to rent mini tractors to till the land. One farmer was looking for capital to buy more hand-held tractors as his one equipment was fully used and the demand was still there – unfilled.

Planting Method

Inefficient planting methods were observed with string bean. The normal method was to plant one string bean to one stick whereas a simple triangle structure could grow five string bean plants – the land space needed using this planting method was only about one quarter for the same number of string bean plants. Farmers who planted correctly could grow more string beans in their fields or grow other crops.

Agro-chemical Usage

There was a lack of knowledge of proper and timely usage of fertilizer, pesticides and fungicides resulting in lower yield from lack of nutrients and/or infested/infected plants. The farmers tended to buy all the seeds, necessary fertilizers, pesticides, herbicides and fungicides at one time. When they bought different seeds and still had left over chemicals from the previous purchase, they did not ask for nor buy the right kind of chemicals for the new seeds purchased. They just applied whatever chemical they have left when there was problem with the new seed crop. There was a mismatch of usage and poorer yield per hectares resulted. Occasionally the farmer claimed to have a lack of funds to buy the right chemical when they bought new seeds.

[17] *Source: BPS NTB 2015.*

High end hotel vegetables (ruccola, parsley, mint etc) appeared to have great, growth potential in NTB because of increasing growth of hotels and its demand for such exotic vegetables (Bali has 2,600 hotels of three Stars and above while NTB has less than 200.) The demand for these vegetables will be small in volume but the value is high thereby farmers can earn a decent income from growing them, these vegetables will impact mainly the highland farmers and the estimated number may be less than 50 farmers – assume one farmer supplying four hotels, but the number can grow if NTB is able to supply half of the hotels in Bali, 1,300 hotels. This will generate 300 new such farmers in NTB. The interesting aspect of growing these high end hotel vegetables is that it does take too much space and can become a supplementary income for a farmer. Moreover, the Lombok Hotel Association (LHA), Bank Indonesia and other NGO (GIZ) are keen to develop a commercial sized trial plot, which can be used to train farmers as well.

Carrots (large sized and sweet variety) appeared to be an opportunity crop for the future in NTB. This can be grown by both lowland and highland farmers. A fresh fruit juice company (PT Squeeze) in Bali when first approached was reluctant to do vegetable juices, However, a week after the visit, he called and asked whether there is a constant supply of large sized and sweet carrots as the hotels he supplied, when asked, expressed an interest in fresh carrot juice. He estimated he can start with a container (20 tons) a month and can blossom to two containers a day (14,400 tons a year) or more. Assuming a yield of 20 tons per hectares it would mean 720 hectares of cultivation and assuming each farmer grows on 0.5 hectare two times a year (20 tons/year), then 720 farmers will be impacted. In Indonesia, in 2011, Carrot production was 526,917 tons and imports at 41,868 tons. East West has the right carrot seeds available for good quality carrots which can replace import which can impact another 2,000+ farmers growing carrots two times per year on 0.5 hectares of land.

Vegetable farming in NTB is characterized by a balanced work-task division between male and female farmers. In most districts, on-farm activities such as planting, weeding, harvesting, and trading are conducted by both men and women. Women are traditionally responsible for negotiating sale prices with traders and collectors.

3.2 Sector dynamics

3.2.1 Market overview

The clearly exported items from NTB were potatoes, small chilies and shallots. The potatoes were grown by contract farmers for Indofood chip-making factory in Semarang. The estimated number of farmers was around 100+ farmers and the Indofood representatives were apparently on the lookout for more farmers but constrained by the lack of seedlings imports.

Small white chilies (cabe rawit putih) were exported out of East Lombok (Selong) to Jakarta. The collector worked with around 500+ farmers currently. He claimed there were no other competitors like him in size.

Shallots were exported out of Bima and East Lombok to Java, especially if prices hit above Rp40,000 / kg. It reached a peak at Rp100,000+ / kg that all seed stocks were sold rather than

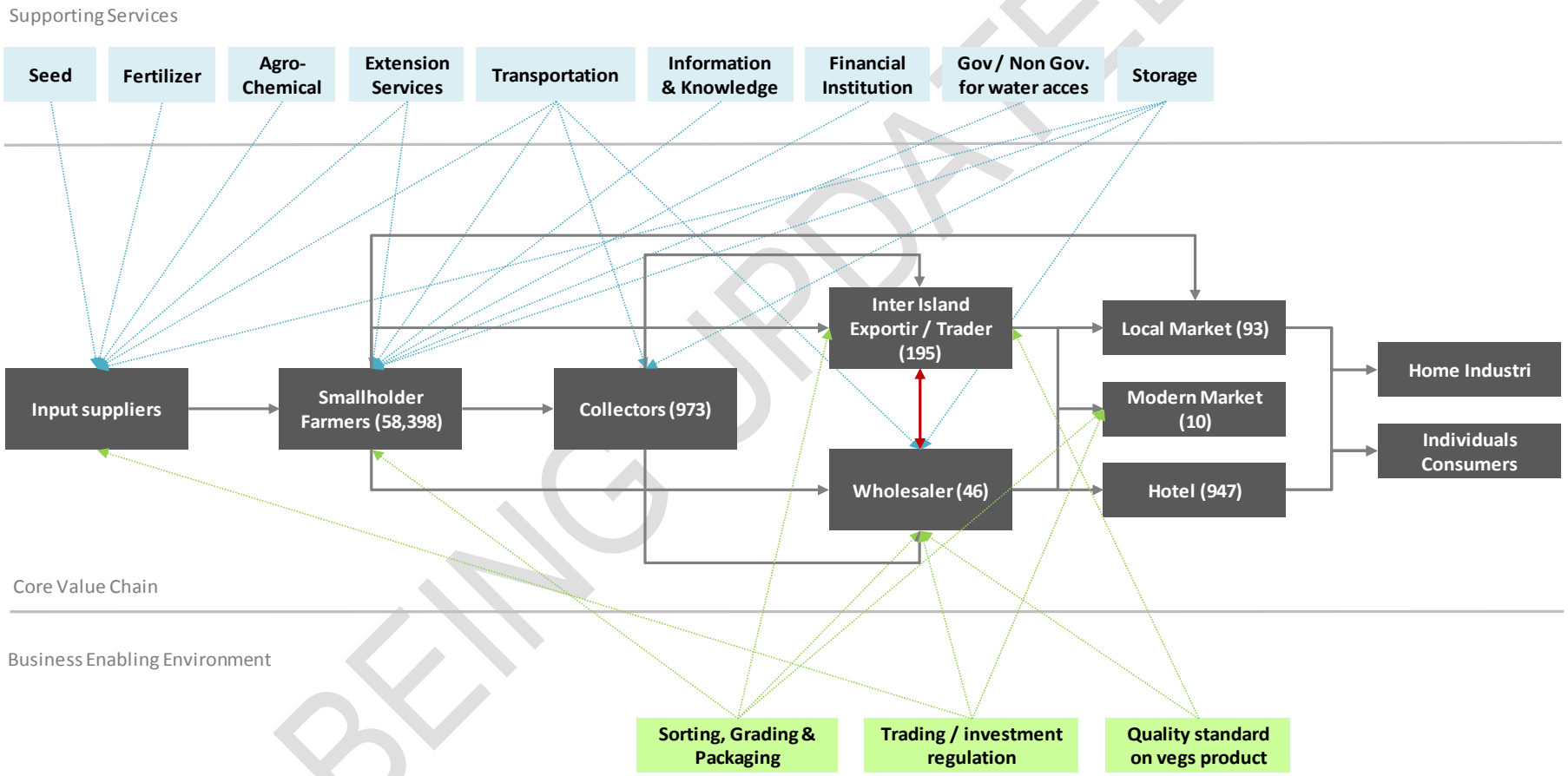
kept for next season growing. Thus there was a shortage of seed stocks in Indonesia for the next growing season. The number of farmers was difficult to determine as they were mainly in Bima. East Lombok had only less than 50 farmers according to a shallot farmer interviewed. Furthermore, in East Lombok, they could only grow two seasons and stopped growing during the wet season because of fear of rot.

Tomatoes were coming in from Java to NTB currently although the statistics indicated that some exports were also happening. There did not seem to be any specific village growing tomatoes in significant tonnage. No large collectors of tomatoes were identified in the marketplace either, except for the 'importer' of tomatoes from Java. The roadside 'market trader' also mentioned that they rarely processed tomatoes grown in Lombok.

Vegetable Farming Value Chain: Vegetable farming in NTB comprises of a value chain, which involves input retailers, farmers, collectors, traders, and customers. The chain starts by farmers purchasing agriculture inputs, cultivation, and then harvest. Farmers then sell the harvested crops to collectors or directly to traders in the local market. The crops are then traded in traditional markets or sold to modern markets, hotels and restaurants. If there is oversupply and if quality allows it is channeled to markets in other provinces.

3.2.2 Sector map

Figure 1. Sector map



3.2.3 Core value chain

Inputs

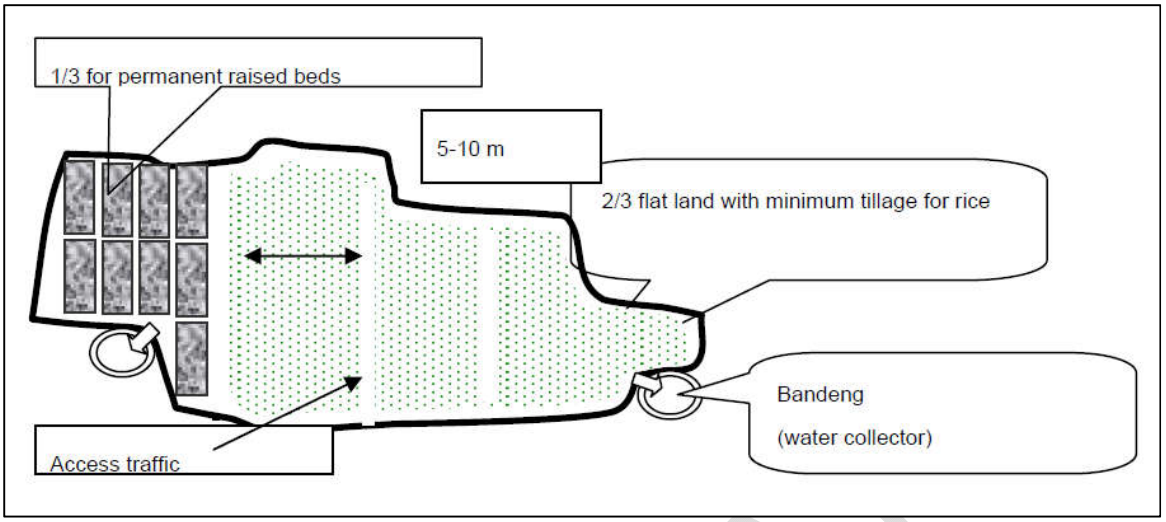
The provinces of Nusa Tenggarra Barat (NTB) is characterised by relatively high level of rural poverty, which has historically been related to poor conditions for agriculture due to highly variable rainfall patterns and poor soil quality. In light of this, both the Indonesian government and many international donor agencies have been focusing their efforts on improving the capacity for water management on these islands, and on helping farmers make better use of the water resource through growing high value crops. This has been pursued through various activities and projects, most of which include some form of investment into water infrastructure assets (dams, canals, reservoirs, wells) and/or a technology innovation that enables better management of soil moisture regime (e.g. permanent raised beds, conservation tillage, etc.).

Key approaches to improve water management in Lombok has been:

- Traditional irrigation systems, where large scale publicly owned infrastructure assets (dams and canals often built with international donor funding) are used to irrigate crops during the dry season. The extent of these systems in the two islands is limited, and they cover only relatively small land areas.
- Embungs, or community dams, are constructed (again often through international donors) in order to capture very intense runoff during the wet season. The stored water is then used for livestock water consumption, which was the original intention of an AusAID funded project in the early 1980s to build embungs in Eastern Indonesia, but also for domestic purposes in the households, as well as for watering of some crops, typically vegetables and nurseries. The embungs are typically managed by the community at a village or sub-village level.
- Deep wells, that are increasingly being constructed in Lombok and is perceived as a more secure water supply. The wells can be privately owned, or communally owned by villages. They are utilising the groundwater for household water needs, livestock consumption and small scale irrigation.
- Soil / water management technologies, such as permanent raised beds, that are used to improve the water regime of certain types of soils (vertisols).

On the island of Lombok (NTB), a raised bed cropping system, sometimes referred to as the ACM cropping system, involving a combination of flat land and permanent raised beds with water harvesting and redistribution, has been developed and is currently being trialled with a small number of local farmers. The system is effectively based on the notion that 1/3 of the field is under permanent raised beds that are used to grow high value vegetable crops, while 2/3 of the field is under the traditional rice / soybean system (gogorancah).

Figure 4. ACIAR Cropping Model (ACM)



Source: Kusnarta et al. (2004)

However, based on some evidence from the field, there are concerns about whether this new cropping system is likely to be adopted by the wider farming community in Lombok, raising questions as to whether some actions can be taken to encourage greater technology uptake. Some of the pre-identified key issues that might be binding and preventing farmers from up taking this technology were: potential resource constraints (land, labour, capital); potential constraints for market engagement (uncertain prices and marketing channels, logistical issues (e.g. transportation), market reaction to increased supply; potential constraints in production (need for annual maintenance of PRBs, lack of technical knowledge and extension support, production uncertainty); and social constraints (gender issues, traditionalist behaviour).

The main sources of planting materials are from input retailers, and only small percentage of smallholder farmer's use retained seeds. Various kinds of seed brands are widely available in input distributors and smaller shops in subdistrict areas. *Panah Merah* seed is one of the more trusted brand used by farmers in NTB, based on sales. It offers a wide range of dry and wet season vegetables seeds with different types of varieties, which is adoptable to low and highland conditions. Before a farmer adopts a type of variety, he or she generally makes decision based on a real performance of a crop he/she can see in a demo-plot or neighbour's field.

Other main inputs used by vegetables farmers are fertilisers and pesticides. Most farmers use subsidised fertilisers on their farms where they are used and will access other chemical inputs using the same network of private input retailers as other crops. Most common fertilisers used by farmers are subsidised NPK, SP36, Urea, and ZA. However, as the enforcement of Agricultural Department policy, that subsidized fertilizer can only be distributed to cooperative members, limits access by many smallholder farmers. Some farmers purchase unsubsidized fertilisers or utilize livestock manure to as organic fertilizer. A number of chemical brands (including Rainbow, Nufarm, Syngenta, Bayer, GDW) are sold by the input distributors.

Integrated pest management inputs are limited. Pesticides and other chemicals are generally purchased on cash payment.

Production

Vegetable planting patterns are based on previous experience, peers, traditional knowledge; creating risk of over-supply, under-supply and at-risk crop choices. Often, a farmer follows other farmers' decision to cultivate certain kinds of crops. Without market analysis or systemized crop choices inevitable oversupply of one product and under-supply of other products occurs. Without information on rainfall patterns, timing or intensity, the majority of farmers continue to reply on traditional signs and signals associated with rain onset. Climate variability and loss of traditional signs (extinction, change, loss of knowledge transfer) create risks in choice of crop patterns to farmers, including vegetables.

Table 1. Production calendars for vegetable farming in Lombok and Bima & Dompu
In both Lombok and Bima & Dompu much localized planting cycles also exists.

Lombok

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Corn	Corn	Veg	Veg	Veg	Veg	Fallow	Fallow	Fallow	Fallow	Fallow	Corn

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Corn	Corn	Corn	Corn	Fallow	Fallow	Fallow	Fallow	Fallow	Fallow	Prep	Corn

Bima & Dompu

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Veg	Veg	Veg	Fruit	Fruit	Fruit	Fruit	Fruit	Fruit	Fruit	Veg	Veg
Corn	Corn	Fallow	Fallow	Fallow	Fallow	Fallow	Fallow	Fallow	Fallow	Corn	Corn

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Corn	Corn	Corn	Veg	Veg	Veg	Veg	Veg	Veg	Veg	Veg	Corn

Women and men are both actively engaged in vegetable production as either farmers or as labourers (sometimes both). In most districts, men and women are responsible for planting, weeding, harvesting. Males are usually responsible for inputs: pesticides, fertilising, and transporting harvested vegetables. Women are responsible for negotiating prices in the market and food provision at the household level, including consumption of vegetables and level of processing of food consumed. Decisions regarding agricultural practices to be applied are mainly made by male members of the household. In some sub-districts on Lombok women are responsible for all production, harvesting and trading.

Harvesting & Trading

Most vegetables harvested in NTB are consumed fresh on the island. Vegetables are highly perishable and have a short shelf life, and therefore farmers sell their crop immediately after harvesting. Farmers lack sufficient post-harvest handling practices, and storing facilities for vegetables for longer periods of time in order to take advantage of higher prices when the demand is higher. Vegetable processing enterprises are not available to absorb the local oversupply where it exists.

Post-harvest handling practice of harvested vegetables is limited. Simple postharvest handling; washing, sorting, bundling, and packaging is applied before the harvested crop is collectively transported to the nearest traditional market. Meanwhile, farmers in rural areas where difficult terrain hinders access, have their products collected from the roadside by a collector in an open truck before they are taken to market. These farmers may not practice pre-sorting or packaging of harvested crop due to the limited awareness and knowledge or skills or resources to invest in these activities. Their harvested crops such tomatoes stacked in baskets without materials to minimize crop damage during transportation may be damaged which influences the selling price. These farmers are more susceptible to barriers in access to markets due to floods and geographic terrain. Meanwhile, for farmers whose land is in close proximity to good transportation networks this factor is less of a limitation.

Asymmetric information between farmers and buyer (collectors) commonly occur. Farmers have a lack of market information such as the latest market price and availability of a commodity in the market. Only farmers with good networking with market actors are able to access market information. In some cases, buyers establish exclusive deals with select farmers on prices and supplies and exclude other farmers from the market. As the result, marginalized farmers have a low bargaining power with collectors and generally accept any price offered.

The majority of vegetable production is sold to local collectors in the market. In rare cases, when certain vegetables are scarce in the market, collectors or middleman come to villages collecting available harvest.

Local vegetable supply is inadequately to meet demand in NTB; inter-island and provincial trade occurs when specific vegetables availability is low. Some collectors are channelling vegetable such as leafy vegetable to traditional wholesalers and retailers in nearby urban markets in Mataram and Bima. Additionally, inter-provincial trade is channelled to the main market in the NTB province capital in Mataram (Lombok) during the low production season between the November and February. Short shelf life vegetables such as green leafy, fruit vegetable are sourced from Bali to off-set under supply.

3.2.4 Supporting Functions / Services

Commercial or private seed nurseries/producers are uncommon in NTB since farmers typically cultivate vegetable seeds for their own cultivation. Farmers normally grow vegetables from seed they purchase in input retailers. The seedling produced from the seed is transplanted, then cultivated.

Farmers rely for their livelihood on income generated from the foregoing harvest, and it is uncommon for vegetable farmers to borrow capital from financial institutions such as credit unions, ccooperatives or pawnshops. Farmers traditionally keep their money in the form of livestock such as cows and chickens. Households that depend on subsistence agriculture will keep harvested maize as their savings for immediate needs in the future. Some of them who has cashew trees (Bima & Dompu) or mango trees (Lombok) will rely on it. Despite widely available financial institutions such as cooperatives and rural banks which providing credit, it is rare for vegetable farmers to get additional capital from these institutions. Interest rates, collateral requirement and administrative procedures hamper smallholders in applying for

loans. Furthermore, farmers have limited knowledge of financial products and institutions that are available in their districts. There are a number of banking and non-banking institutions including BRI, Bank Mandiri, and credit unions with presence at village level.

Knowledge flows along the vegetable value chain are lacking, and smallholder farmers have few channels for obtaining information on new technologies, good cultivation practices or necessary natural resource management necessary to maintain vegetable farming. Farmers mainly get their information through farmer groups. However, sustainability of such interactions has generally been poor as farmer groups may not utilize these resources for vegetable farming. Prior to PRISMA's engagement in the sector, only Ewindo, Nufarm and GDW provided direct extension services to farmer group in NTB.

Input dealers also have limited knowledge about vegetable cultivation and local traders lack new knowledge and capacity. In the absence of embedded service provision, business interactions between farmers and collectors are largely restricted to the sale of vegetable. Wholesalers are also a weak source of technical know-how in the sector.

Agriculture extension services by the government at the sub-district level (PPL staff) are the main source of knowledge for individual farmers and farmer-groups. The agricultural extension (PPL) in NTB consist of 1,531 personnel, of which 815 are Government employees, 597 contracted workers, and 119 are self-help *swadaya*[18]. Not to mention compounded the government advisory services are poorly equipped to transfer know-how in vegetable farming because extension staff lack critical expertise and are over-stretched.

3.2.5 Supporting Rules and Regulations (Enabling Environment)

Agricultural policy in Indonesia seeks achieving food self-sufficiency and price stability, especially in rice. The government uses policy instruments in pursuing these goals. A typical example is subsidies for fertilizer, fuel, credit, tree planting materials, and pesticides provided to farmers'. Indonesia's largest agriculture subsidy for many years has focused on fertilizer, however, in the last 5 years seed subsidies have also been provided.

The Ministry of Agriculture of Republic Indonesia regulation 358/Kpts/OT.140/9/2005 has enforced technical and quarantine requirement for import fruits and vegetable to Indonesia. The rule legislates physical quality standards of crops and assigns eligible ports for incoming crops. Yet as only 1% contribution of the province is allocated towards vegetable production, results currently have minimal impact to the sector.

In term to support, regulate and ensure the development of potential vegetable industry in Indonesia generally, where, vegetables are included in the horticulture category, the Indonesian Government issued the Law No. 13 of 2010. The legislation includes arrangements on aspects; (1) Planning, Utilization and development of resources, (2) Horticultural development, (3) Distribution, trade, marketing, and consumption, (4) Financing,

[18] *Source: Agency of Agriculture Extension and Human Resources Development, 2013*

guarantees, and investment, (5) Information Systems, (6) Research and development, (7) Empowerment, (8) Institutional, (9) Supervision, (10) Community Participation

The most interesting thing, nowadays GOI very concerned to endorse and support the local seed producer (company), where in the article No. 100 of law No. 13 of the year 2010, regulates the restriction on foreign investment in horticultural seed industry at a maximum of 30% started in 2014.

The Indonesian government, to secure the availability of goods and protect the farmers, through the Minister of Trade Regulation No. 63 / M-DAG / PER / 09/2016 regarding "Price References of Purchases from Farmers and Price References of Sales to the Consumer, it has set a reference price for seven commodities for which such including shallot and chili which are the vegetable group. The reference price for each of shallot and chili are;

Shallot
1. The reference price of purchases shallot from farmers is Rp 15,000 (Fresh shallot with leaves), Rp 18,300 (Dried shallot with leaves), Rp 22.500 (Dried bulb without leaves).
2. Consumer sales reference price is Rp 32,000;

Chili
1. The reference price of purchases chili from farmers is Rp 15,000 (big red chili / curly red chili), Rp 17,000 (small red chili)
2. Consumer sales reference price is Rp 28,500 (big red chili / curly red chili), Rp 29,000 (small red chili)

4. Analysis

4.1 Problems in the Core Function and underlying causes

The problems and underlying causes are specific to the poor target groups that PRISMA seeks to support through interventions in the vegetable 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:

- Farmers experience low productivity
- High production cost
- Farmers receive low prices for their harvested vegetables.

Farmers experience low productivity: Farmers experience low productivity of vegetable cultivation due to the limited land and water management and traditional farming practises, and lack of fertilizer and integrated pest management techniques.

1. Water and soil

Some area in NTB have a constrain on water. The problem of water availability can be characterised as one of unfavourable distribution. During the rainy seasons a lot of water passes through the rivers and drains to the ocean. In the fields these torrential rains, combined with

storms, create deep erosion gullies in the denuded areas. Particularly on the steeper slopes this led to landslides. However, after a short period this water has all drained from the land and is not stored anywhere, leaving the farmers without soil moisture or sources for irrigation. Changing rainfall patterns due to climate change and climate related phenomena as El Nino are exacerbating the problems of water in NTB.

2. Farming practice

Vegetable farming techniques in NTB are handed down generation by generation based on "dry land farming", or rain fed "un-irrigated farming". Farmers have limited knowledge on good agriculture practices and combined with environmental and climatic factors contribute to crop failure, harvest losses and lower vegetable yields. Traditional farming practices that were effective in the past no longer hold up to climate change and environmental degradation factors that farmers face in the present. Limited access to extension services further exacerbates this situation. These are compounded by lack of water and soil retention measures such as terracing, limited water source availability due to dropping groundwater tables, poor seed quality and fertilizer / pest management and necessary financing systems that support poor farmers. Lack of access to climate information/projection prevents the farmers from making informed decisions regarding the planning and harvesting of vegetables, including choices on appropriate drought-resistant vegetable varieties. The agro-business is further constrained by inferior quality commodities, over supply of specific commodities, limited post-production processing and market access as discussed below. The business as usual farming practice is insufficient to address agro-climatic challenges faced.

3. Poor access to fertilizer and Integrated Pest Management Practices

The enforcement of new administrative procedure by Agricultural Department policy limit access for some smallholder farmers. Quantity of subsidized fertilizer is limited, sold only to farmer group members. Systematic techniques and effective practice in IPM are limited

High production Cost

The high cost of production is closely related to the limited knowledge of farmers how to use the inputs on the right way. The paradigm of more fertilizers and pesticides will give more results is the one of the fatal errors that are quite common among farmers in NTB. Coupled an access to the input itself, the long long distribution chain contributed to making the production cost becomes high.

Farmers receive low prices for harvested vegetable

Low vegetable prices are mainly as a result of oversupply of vegetables, cropping cycles are based on traditional knowledge and farmers lack access and information to positively influence decision making on crop choices (climate, market, seasonal and land variations), weak bargaining power of farmers, poor post-harvest knowledge and techniques and inability for smallholder farmers to access both traditional and modern markets such as super markets, hotels, restaurants or hospitals.

1. **Over supply as farmers have lack of information to influence crop choices (climate, market, seasonal information).**

Lack of access to climate information prevents farmers from making informed decisions on planning and harvesting of vegetables, including choices on appropriate drought-resistant vegetable varieties. In addition, lack of market information, commodities and demand, pricing and value chain are currently inaccessible for farmers, systematic organizing of specific commodities and rotation techniques to minimize this risk are not applied. Local commodities experience fluctuating prices; farmers do not have access to market information to monitor.

2. Farmers have limited post-harvest practices knowledge and techniques.

Farmers do not usually practice pre-sorting or packaging of harvested crop due to limited awareness, knowledge, skills or resources to invest in these activities. Fresh vegetables have a short shelf life because of a lack of sufficient post-harvest handling practices, with no packaging to protect products on route to markets and no cold chain to maintain quality.

3. Farmers have weak bargaining power and are unable to access modern markets.

Traditionally farmers only sell to collectors from the traditional market where the price offered by collectors is generally accepted.

These factors result in lower selling prices for farmers. The uncertainty of where to sell harvests beyond the traditional market further weakens farmers bargaining position and impacts prices.

4.2 Weaknesses in Services and Rules/Regulations

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:

Services weaknesses that constrain farmers to gain high productivity:

- Water scarcity and low quality of soil due to environmental and climatic conditions combined with unsustainable management of natural resources
- Limited access to materials and capacity to establish low cost and efficient agricultural irrigation systems and know-how on water protection and efficiency is limited
- Limited provision of information and extension services, which provide good land management and cultivation techniques and planting choices
- Few commercial providers of fertilizer or IPM inputs, particularly given the strong government presence in this area

Services weaknesses that constrain farmers receiving high prices of harvested vegetable

- Lack of extension services or private sector to provide knowledge on post-harvest handling
- Provision of market information and diversification of vegetable commodities to meet market demands and climate /environmental conditions and value chain is limited

Water Scarcity and low quality of soil due to environmental and climatic conditions combined with unsustainable management of natural resources: water is a finite resource and on Bima and Dompu is at critical level, natural environment and vegetation cover contribute to improved soil quality and surface water availability or loss. Surface water can be harvested through techniques to improve Retention, Recharge and Reuse when government, private sector and society recognize and value their natural resource assets. Poverty, uncontrolled or unregulated utilization of natural resources despite national and provincial directives on sustainable natural resource management, and lack of incentives schemes to engage government, private sector and community in natural resource management continue to exacerbate and reduce effective functioning of the ecosystem in providing services such as water and soil necessary for any land-based livelihood options.

Limited access to materials and capacity to establish low cost and efficient agricultural irrigation systems and know-how on water protection and efficiency are limited. Irrigation systems, connecting water sources and springs to farmer fields using gradient fed piping systems are not funded under government programs, where present they are often old, out-dated and broken, constructed from poor quality materials, operating inefficiently. NGOs and in limited cases communities will fund the establishment of these systems. Cost of establishing efficient systems is beyond the scope of most communities both financial and technically; access to suppliers of quality piping materials is limited and is currently only sourced from Surabaya, technical know-how in irrigation construction is available locally but is not organized; capacity to implement low cost and practical water protection and efficiency techniques is limited.

Limited provision of information and extension services which enable access to good land management and cultivation techniques and vegetable production activities. Information and extension services are important to ensure farmers have access to information on good land management, cultivation and post-harvest techniques. However, few reliable sources of information are available for vegetable producing households. Knowledge flows along the vegetable value chain are lacking, and smallholder farmers have few channels for obtaining information on new technologies or good cultivation practices in vegetable farming. Only a limited numbers of government extension service staff cover NTB districts, input dealers also have limited extension staff and have limited knowledge of vegetable cultivation; local traders either lack new knowledge.

Few commercial providers of fertilizers or IPM inputs, particularly given the strong government presence in this area. Farmers who use fertilisers rely mainly on the government distribution programs. Nevertheless, these programs are often unable to supply sufficient quantities of fertiliser. The programs also experience delays in distribution and problems with the quality of inputs. The distribution of subsidised fertilizer under government programs creates disincentives for private sector input supply companies to invest in new products and create new distribution channels.

Lack of extension services or private sector to provide knowledge on post-harvest handling. To access the modern market, an essential key is fulfilling the quality standards required. However, farmers usually do not practice pre-sorting or packaging of harvested crops due to the limited awareness and knowledge of post-harvest handling. Hence, farmers cannot

benefit better price from accessing either traditional or modern markets. Meanwhile, most market actors who supply vegetables to the modern market are traders with a wide network of local collectors and traders. When local supply is not adequate to fulfil demand, traders try to source vegetables from other islands. If post-harvest handling of local vegetables is improved, price improvements will be evident. Nevertheless, there are no private sector or extension service providers focusing on improving post-harvest handling techniques.

Provision of market information and diversification of vegetable commodities to meet market demands and climate /environmental conditions and value chain is limited: Farmers do not have access to information to make informed crop or planting choices. Production should be organized to meet market demand and secure farmer investment choices, instead farmers face significant risk of harvest failure. Value chain from farmer to markets is not established, yet market product availability indicates under and over supply.

4.3 Cross Cutting Issues (Gender and Environment)

4.3.1. Gender

In NTB there appears to be significant gender division in production roles. This is more marked in Lombok, where production responsibility appears to be highly differentiated, with vegetable production generally in the female domain while the production of staple crops along with water resource management for irrigation and commercial crop production being predominantly the responsibility of men.

The production of vegetables is primarily for household consumption with any excess sold in local markets. Since women are taking care of the whole process, including marketing, they seem to have some discretionary rights over the proceeds from vegetable production. The vegetables are generally not cultivated on main plots and are usually produced on other available land such as around the house, on sawah dikes or alongside of roads which are not suitable for main crops. The production of rice and other commercial crops such as soy beans, tobacco, long beans & water melon takes place on the main, most valuable production plots.

With this recognition of the gender breakdown of activities in vegetable production, it is quite clear that women in NTB need to be targeted by extension programs seeking to introduce technologies to enhance high value vegetable production. However, to date, extension efforts have been directed differently, with men having been the primary recipients of these extension efforts.

On the commercial crop production and water resource management are in the domain of the men. Male household members will most likely be responsible for the production of high value vegetables, but women will still contribute to most aspects of production as well as taking primary responsibility for marketing.

4.3.2. Environment

Understanding the characteristics of NTB environment would lead to primary question of how to use water efficiently for vegetable farming while not further depleting the resources of the area or creating environmental risks such as landslides and erosion.

As the management of water infrastructure capital assets (including embungs, deep wells, irrigation canals, and even permanent raised beds) seems to be a key for sustainable management of available water resources, better understanding of the major constraints Prevent that adequate management is required. This includes evaluating the role of alternative property rights regimes, water allocation mechanisms, cost of maintenance, and jurisdictional responsibilities for the maintenance of this infrastructure.
While the issue of water management infrastructure is relevant for NTB provinces, it seems to be particularly subject to significant in relation to the use of communal water storages (embungs).

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 vegetables if effective land and water management practices and good agriculture practice is strengthened. There is potential for PRISMA to tap into the prospect of expanding production to support food security staples such as rice and corn with vegetable production during the rainy season, and expand the growing season without undermining the carrying capacity of the supporting natural resources, improving post-harvest handling to add economic value and productivity of land. Based on our calculations, there is potential to unlock an additional AUD 11,235,321 in NTB.

Table 2. Market potential calculation

Description/Years	Total Business in the target area (s)
Existing Production (MT)	314,589
Potential New Production in Existing Areas (MT)	15,729
Total Potential Production (MT)	330,318
Average Selling Price vegetable per kg (IDR)	7,500
Current Value of Production (million IDR)	2,359,417.5
Total value of potential production (million IDR)	2,477,388
Total value of potential production (AUD)	235,941,750
Total potential value of increased production (million IDR)	117,971
Total potential value of increased production (AUD)	11,235,321

5.2 Vision of change

Focusing on achieving the potential outlined above for the vegetable 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 a) Increased production and productivity of vegetable to substitute import of vegetables, b) Improved market performance for farmers by establishing innovative systems and techniques to improve their income. At the **service level**, it is envisaged that farmers will have improved access to: (1) Quality input, (2) better cultivation techniques, (3) good post-harvest management and marketing.

5.3 Interventions areas and pathways to systemic change

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 are necessary to transform the vegetable sector in NTB

Table 3. Intervention Areas

Intervention Areas	Approved, on-going, or completed interventions and intervention concepts
Intervention Area 1: Improving access to quality inputs	Establish and strengthen the distribution channel of quality input hat that able to reaches farmers through the sustainable business model.
Intervention Area 2: Strengthening dissemination of agriculture knowledge (GAP) and information	Encourage market actors, especially at the level of service provider to provide the services of knowledge about GAP.
Intervention 3: Promoting and improving post-harvest handling	Encourage market actors, especially at the level of service provider to provide the services of knowledge about GHP.

Intervention Area 1: Improving access to quality inputs
This intervention area has key objectives (1) Establishment of a new agro-input shop that could cover the farmers. (2) Improve extension services that enable production of integrated solutions to vegetable farming, (3) improve productivity and efficiency in all stages of on-farm and off-farm activities.

1.1 Establishment of a new agro-input shop that could cover the farmers. The emergence of new retail businesses in areas that are very isolated will be able to help farmers in accessing goods and information.

Intervention Area 2: Strengthening dissemination of agriculture knowledge (GAP) and information. Local retailers will be capacitated and supported in providing on-farm and off farm information in the production of vegetables.

2.1 Improve Productivity and Efficiency. Activities utilizing extension service capacity in aim to increase productivity may involve: (1) farmer capacities to apply water and land management, and water access through irrigation and organizing farmer groups to focus agricultural land in larger plots to efficiently utilize water resources, (2) farmer capacities to access to market and season plating information and inform decision making on crop choices; crop rotations to balance food staples and quick growing vegetables in the rainy season, and low water requiring vegetable crops to be planted in dry season, (3) Good agriculture practice and input management, (4) farmer capacities in post-harvest management, vegetable collection systems and transportation. Since women are involved in the planting of vegetables and influence decisions around seed and pesticide usage, as well as trading practices, it will be important that exposure to the benefits of vegetable planting during the rainy season and information on better practices are accessible to women and tailored to their needs.

Intervention Area 3: Promoting and improving post-harvest handling. Local governments and investors with medium upward capacity are encouraged to see the market potential of cold storage and through good post-harvest handling will make the sustainable supply from farmers.

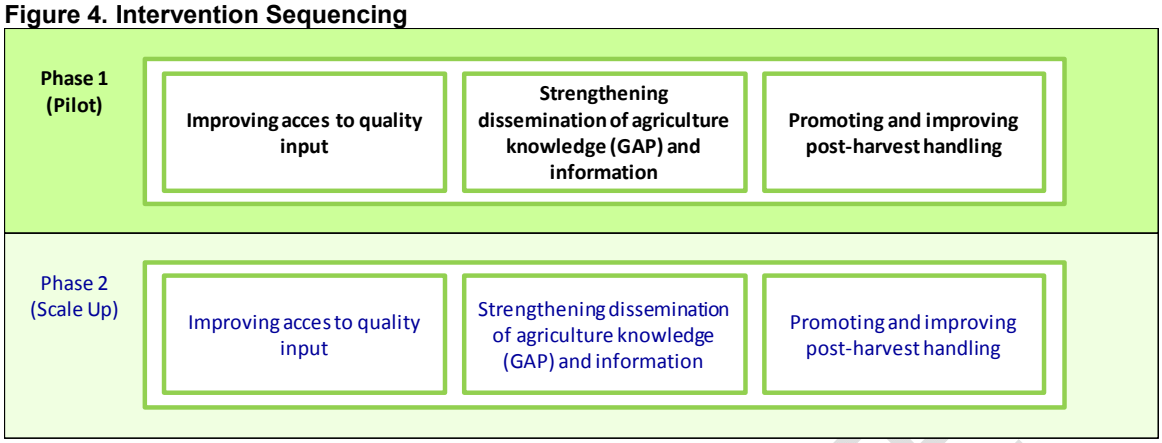
3.1 Cold Chain.

There was no evidence of a cool chain system for fresh vegetables. Fresh vegetables have a short shelf-life because of a lack of sufficient post-harvest handling practices, ie no packaging to protect the product and no cool chain to maintain product quality. Most vegetables (potato and cabbage) are packed into large sacks (up to 70 kgs) and loaded onto open vehicles whereby they are sent to markets. Tomatoes were packed in open buckets and piled on top of one another. Product deterioration and wastage is a problem for the customer but little feedback is provided along the supply chain. There is a need for more suitable packaging to protect the product from farm to market, reduce damage and increase returns. There is an opportunity for a private company to set up a modern, vertically integrated, vegetable business involving a packing and cold storage facility. All sorting, trimming and shrink wrapping could occur at the farm's packhouse. The product could then be sent to the hotel and resort chefs and modern supermarkets by refrigerated truck with less wastage and can sell at a lower retail buying price than competitors. While this may be considered a closed supply chain there is an opportunity of expanding the supplier base by involving a wider range of growers. Existing "inti" entities can also perform the same role for selected vegetable crops.

5.4 Sequencing and prioritization of interventions

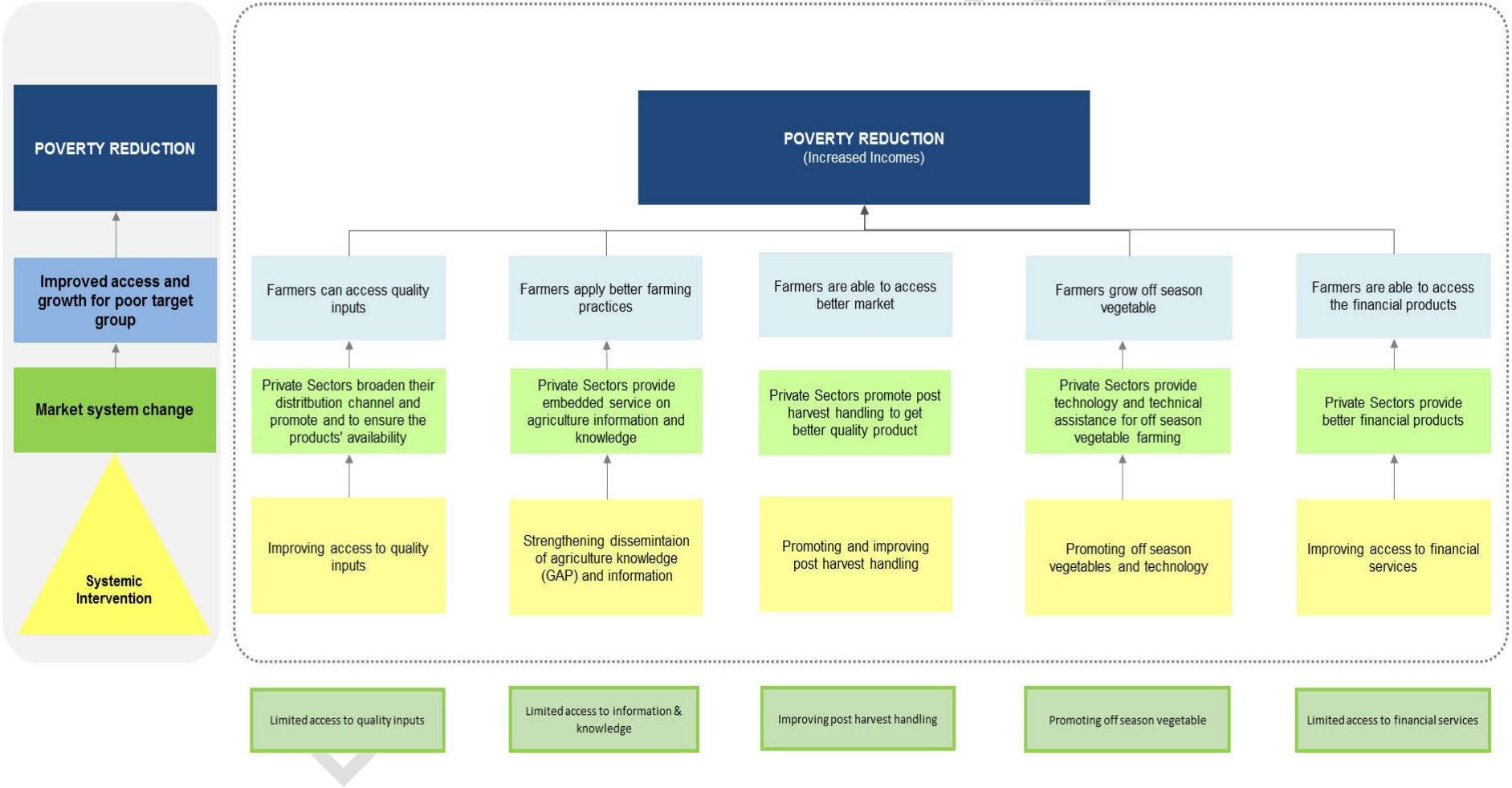
It is recommended that the interventions in the NTB vegetable sector be implemented in simultaneous for Lombok and Bima & Dompu. The first phase of the strategy will focus to introduce and eager the participating of the market actors. The second is the scale up to the other district within Lombok and Bima & Dompu.

Figure 4. Intervention Sequencing



5.5 Sector Vision of Change Logic

Figure 5. Sector logic



Annex 1. Intervention Logic Analysis Framework (ILAF)[19]

(1) Problem/ Symptom	(2) Underlying cause	(3) (4) Services and Enabling Environment	(5) Service weaknesses/ underlying causes	(6) Intervention Areas	Service Provider/ Partner
Farmers experience low productivity	Farmers don't have access to good quality inputs	Seed, Fertilizer, and Agrochemical	Low profitability to establish independent input shops in rural area Limited input market players in NTB	**Intervention Area 1:** Improving access to quality inputs	· Rainbow · Behn Meyer · Nufarm · NASA
	Farmers don't have enough knowledge on GAP	Information	Market actors have limited knowledge on GAP Limited number of market actors who provide GAP information	**Intervention Area 2**: Strengthening dissemination of agriculture knowledge (GAP) and information	· Rainbow · Behn Meyer · Nufarm · NASA
	Minimal input usage for vegetable farming	Information	Market actors have limited knowledge on the business case of vegetable farming Limited number of market actors who provide the business case of vegetable farming		
Farmers experience low selling price	Farmers can't reach bigger market	Information	Market actors have limited knowledge of post harvest handling information to farmers Limited number of market actors who provide the post harvest handling knowledge	**Intervention Area 3:** Promoting and improving post-harvest handling	· Rainbow · Behn Meyer · Nufarm · NASA
	Farmers lack of market information and planting decision	Information	Limited number of market actors who provide market information	**Intervention Area 2:** Strengthening dissemination of agriculture knowledge (GAP) and information	

[19] *Adapted from Toolkit for Market System Analysis, International Development Enterprises (iDE), 2012*

Annex 2. Gender Roles Analysis

No	Activity In Production	Task Division		Explanation
		Male	Female	
1	Decision on Seed to be planted	V	V	Discussed and decided together by husband and wife. However more male as decision maker.
2	Buying Inputs	V	V	Join Decision but percentage of male as decision maker is higher.
3	Land Preparation	V		Mostly done by male labors. The female do that However, when the husband is overseas.
4	Planting	V	V	Mostly done by female labors. But in some areas done by male
5	Weeding	V	V	Both but Mostly done by female labors.
6	Pest Control	V	V	Spraying mostly done by male and caterpillar picking by female.
7	Reaping	V	V	Both. It's about the same percentage.
8	Drying	V	V	Both. It's about the same percentage.
10	Transporting	V	V	Mostly done by male labors.
11	Selling	V	V	Some areas said that this activity done by female but some said by male. The money from sales will most likely be managed by the female.

Gender in Decision Making – *Decision making in shallot production.*

Decision Maker	Seed	Input	GAP
Male	55%	65%	61%
Female	14%	11%	15%
Both	31%	24%	24%

Breakdown of labor cost & male-female composition

Job	Cost (%)	Man-days (%)	Male Man-days (%)	Female Man-days (%)
Ploughing	15.32%	12.88%	94.33%	5.67%
Planting/Transplanting	17.19%	20.16%	26.73%	73.27%
Fertilizing	2.55%	2.34%	88.99%	11.01%
Spraying	13.11%	15.89%	100%	
Irrigating	9.40%	6.96%	93.83%	6.17%
Weeding	20.21%	20.18%	28.72%	71.28%
Reaping	14.56%	14.77%	44.19%	55.81%
Transporting	1.13%	1.46%	70.59%	29.41%
Drying	6.53%	5.37%	57.60%	42.40%

Annex 3. Identified market actors

Market actors	Institution	Contact	Position
Finance			
Extension Service			
Input			
Trader			
Government			
Farmer / Group			

Annex 4. People Interviewed

Date	Location	Represent	Name of interviewed	Position	Contact Details

Annex 5. Investigation Team

Irwan Hermantria – Principal Business Consultant, AIP-PRISMA