

**VEGETABLE SUB-SECTOR GROWTH STRATEGY
DOCUMENT FOR EAST JAVA (EJ)
September 2017**

*Australia Indonesia Partnership for Promoting Rural Income
through Support for Market in Agriculture*

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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
GAP	Good Agricultural Practices
ha	Hectares
ILAF	Intervention Logic Analysis Framework
NASA	Natural Nusantara
EWINDO	East West Seed Indonesia
WHO	World Health Organization

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1. Executive summary

Indonesia's vegetable production has increased by an average of 2.7 percent per year, since 2003 from 7.37 million tonnes to 13.8 million tonnes in 2013. Despite being the largest vegetable producer in Southeast Asia, Indonesia's vegetable imports are constantly growing faster than its export. Consequently, the trade balance of the commodity tends to be deficit. According to Arsanti, et.al (2006), the increase import-export ratio over the years is mainly caused by decreasing competitiveness of local products since imports have a better quality and competitive price. There are 31 provinces in Indonesia that produce over 20 types of vegetables with 86 percent of all vegetables grown in the islands of Java and Sumatra. The major vegetable producing provinces are: West Java (23.7%), Central Java (18.8%), East Java (13.8%) and North Sumatra (8.6%); these four provinces account for over 64.9 % of total vegetable production in Indonesia.

Vegetable production in EJ contributes more than 13 percent of the total national production which accounted up to 1.1 million tons of vegetables (BPS, 2015). High contribution vegetables from the province include shallots, chili, cabbage, eggplant, tomato, beans and leafy vegetables. During 2004 until 2014, vegetables production in EJ grew by 3%/year, which was slower than national growth (BPS, 2015). In the other hand, EJ's vegetables consumption is 43.2 kg/per capita/year¹, which is slightly higher than national average of 40 kg/per capita/year, but still lower than WHO recommendation of 80 kg/per capita/year.

Despite of its position as the third largest vegetables producer in Indonesia, EJ has lower productivity compares to the western provinces. Productivity of potato, cabbage and shallot of EJ are slightly higher than national average. However, chili and tomato produced in EJ has lower yield than the national average. Primary production areas for highly perishable vegetables are located nearby the main population centre, such as Malang as the main EJ's production centre and Surabaya. Meanwhile, less perishable vegetables are produced in favourable agro-climatic regions such as Nganjuk and Probolinggo. EJ has adequate land to be utilized for 625,000 vegetable growers with other potential addition of 2.9 million paddy farmers who convert their land during dry season.

Vegetable farming in EJ is characterized with improper application of chemicals. Most of vegetable farmers heavily rely on chemical pesticides and fertilizer. In the effort of overcoming pest and disease attack, farmers often increase spraying frequency and dosage of chemicals without knowing that overuse chemical could cause soil fertility reduction. Similarly, the improper practice of applying heavy dosage of fertilizer will also lead to the soil infertility and low productivity.

Besides the poor farming practices, Post-harvest Handling of vegetable commodities in EJ didn't well-developed yet. Farmers apply simple post-harvest handling which often does not adequate to retain the vegetables quality during storage and transportation. Proper post-harvest practice commonly applied by collectors and medium/ large scale farmers for interisland trade. Besides constrain in post-harvest handling, existing storage infrastructure is another limitation in the sector.

¹ Source: Suroso, A.I., Firdaus, M., and Savitri, D. 2014. Demand for the Main Vegetables in Java Island

In addition to the aforesaid constrains, market prices of vegetables in EJ have been highly fluctuating since 2013 until 2015. When the market price high fluctuates and does not follow a seasonal trend, selling price of harvested crop is hard to predicted. This is worsened by long distribution as barrier for farmers in the rural areas to get timely market price information. Finally, farmers bear risk of low selling price due to lack of market information and low bargaining power against the buyer.

The lack of dissemination of agriculture knowledge, both in terms of quality and quantity, is the major contributor to the sector constrains. Competency of the market actors on GAP is generally also lacking due to limited of timely and reliable knowledge source can be accessed. Few portion of input distributors and retailers provide suggestion on application of products they are selling. Private agronomists generally cover suburbs areas and vegetable centres only. Meanwhile, public extension staffs as another important agriculture knowledge are lacking reach and capacity.

There is an opportunity to stimulate the productivity increases of vegetable crops in EJ where PRISMA could intervene. Vision of change for the vegetable sector in EJ is to (1) increase smallholder vegetable production and productivity during rainy and dry seasons (2) improve market performance for farmers. Aiming to reach the vision PRISMA works in the intervention areas to improve farmers' access to (1) quality input, (2) good farming knowledge, (3) good post-harvest handling practise knowledge, (4) off-season vegetables technology, and (5) financial services. which can increase their income and productivity.

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 the end of 2018. PRISMA works in East Java (EJ), 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 East Java (EJ).

3. Sector description

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 vegetable sector.

3.1 Sector Profile

3.1.1 Overall context

Global vegetable production has been experiencing a remarkable increase. Output has been growing by 2.9 percent annually between 2000 and 2012. Global vegetable

production volume has reached 1,394 million tons in 2014³. China led the vegetable production with over than 32% of world production. The world's fifth-largest vegetable producers were China, India, United States of America, Turkey and Iran (Islamic Rep. Of)⁴. This GSD divide vegetables into eight groups, that are: (1) **Solanum** for Chili, Tomato, and Eggplant; (2) **Allium** for Shallot, Onion, Garlic, and Leeks; (3) **Brassica** for Cabbage, Broccoli, and Cauliflowers; (4) **Leafy Vegetables** for lettuce, chicory, fresh vegetables, and spinach; (5) **Legumes** for long beans, and string beans; (6) **Cucurbit** for Cucumber, Squash, Luffa, Bottle gourd, and Bitter gourd; (7) **Potato** and (8) **Carrot**.⁵ The data is collected and processed from FAOSTAT (2014), and Ministry of Agriculture 2015.

Nevertheless, global vegetable consumption is estimated to be 20 to 50 % less than FAO's and WHO's recommended level 400 gr/capita/day⁶. Diet in most of developing countries is dominated with carbohydrates and fats, results in increasing rate of obesity and its associated diseases. Despite of this, **global vegetable consumption shows increasing trend due to extensive promotion of fruit and vegetable consumption, and expansion of middle class worldwide.** Vegetables is the most important source for micronutrients, fibre, vitamins, and minerals that are important for healthy diet.

Figure 1. Global vegetable production trend

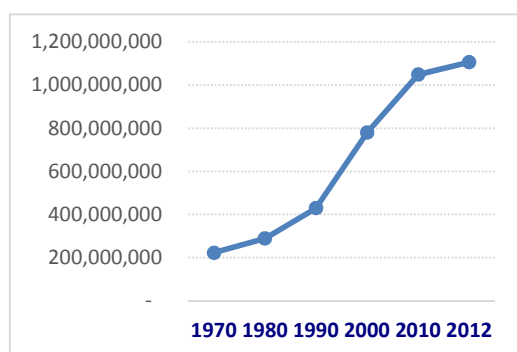
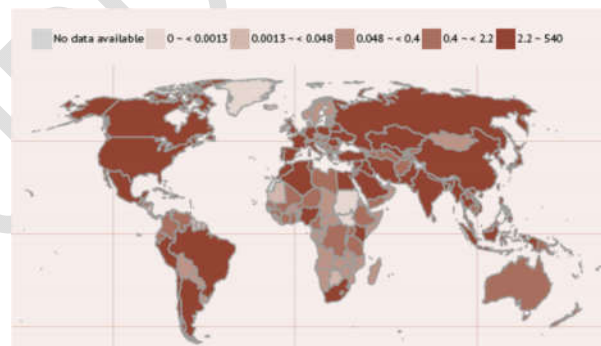


Figure 2. Vegetable producing countries, including melon (in million tonnes, 2010)



Indonesia is an archipelagic country comprising of over 17,000 islands; it is a lower middle-income country with a per capita income of US \$2,500. Indonesia has been growing at an average of 6%, with the industrial and services sector as drivers of its growth. The contribution of agriculture sector to total GDP is less than 15%. **In 2012, Indonesia was the 14th largest vegetable producer in the world and contributes to only 1 percent of the total global production.** In 2012, Indonesia produced a total of 10,762,704 tons of vegetables of which the total World production was 1,1 billion tons. Based on the BPS data in 2014 the Indonesian vegetable production reached 11 million tons consisting of 22 types of vegetables.

Indonesia is the biggest vegetables producer in South East Asia among the countries, yet its productivity is still lower than other countries such as Thailand and Vietnam. In

³ Global production number data in 2014 is based on FAOSTAT 2014

⁴ Source: <http://www.geohive.com/>

⁵ Based on PF1 Vegetable Workshop on 29th-30th April 2017, assisted by Joko Maryono, as vegetable expert.

⁶ 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>

the exception of carrot and legumes, Indonesia has higher productivity than others.⁷ As the biggest producer in South East Asia, Indonesia exports vegetables to the neighbour countries include (1) Singapore for almost all vegetables commodities; (2) Malaysia for almost all kinds of vegetables as well, except long bean; (3) Philippines for chili, onion, and tomato only; (4) East Timor for potato, tomato, onion, shallot, garlic, leafy vegetables, and chili; (5) Brunei Darussalam for chili, leafy vegetables, and tomato; (6) Thailand for potato, shallot, leafy vegetables, and chili; (7) Vietnam for tomato, shallot, leafy vegetables, eggplant and chili; (8) Cambodia for chili; and (9) Myanmar for chili. In the other hand, production level of several vegetables cannot fulfil domestic demand during low season. As the result, import of these vegetables is still required: (1) Potato from Singapore, Malaysia, and Myanmar; (2) Tomato from Malaysia, Thailand, and Singapore; (3) Onion from Thailand, Singapore, and Malaysia; (4) Shallot from Malaysia; (5) Garlic from Malaysia; (6) Carrot from Malaysia; (7) Chinese Cabbage from Malaysia and Singapore; and (8) Chili from Thailand and Singapore.⁸

Vegetable is categorized under horticulture, together with fruits, decorative flowers, and medicinal plants. Different from categorization made by Indonesia Ministry of Agriculture, several countries include sweet potato, soybean and taro into horticulture crops. Horticulture has important role on increasing farmer income, creating job, and inducing rural investment. The highest Indonesian vegetable consumptions are spinach, water spinach, long bean, tomato and eggplant.

With 255 million inhabitants, Indonesia has a huge market potential for fresh vegetables. Even though Indonesia's vegetable consumption is only 57.7 gr/capita/day, much lower than FAO's and WHO's recommended level 400 gr/capita/day, but there is a progressive increase on the national consumption. In the exception of spinach, The National Economic Census/ SUSENAS (2016) also found that the higher income, the more vegetable consume by the household. Spinach and water spinach which has been largely consumed by low income society with less than IDR 150.000 daily income. Further, significant growth of Indonesian middle class (Boston Consulting Group⁹) compound with the rising of healthy lifestyle awareness contributed the increase of domestic demand of vegetables.



Figure 3. Quantity of Indonesia's Vegetable Export and Import during 2002-2012

Indonesia's import quantity is constantly growing faster than export which reflects imparity between domestic supply and demand. Over the past four years from 2010 to 2014, vegetables import grew by 8.3 percent per annum. Likewise, domestic spending on fresh horticultural products was 50% in 1994, has risen to 75% in 2004 and 100% in 2007 (Horticultural Producers and Supermarket

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.

⁹ Source: <http://news.analisadaily.com/read/pertumbuhan-masyarakat-kelas-menengah-indonesia-pesat/288252/2016/12/18>

Development in Indonesia Report, World Bank).

In addition to the increase of the demand, **Agriculture Department (2013) reported that the growth of domestic consumption has reached 2.91%/year since 1995, outstripped the growth of vegetables production which was only 2.13%/year.** Table 1 reveals the shortcoming of domestic supply of several vegetables include spinach, water spinach, long bean, eggplant, garlic, and cabbage. The increase of domestic consumption is triggered by the improved of awareness towards nutritional adequacy rate, the growth of population, and the high availability of vegetables, in the exception of garlic, in the market. Trend of vegetable consumption differ across the province which could be influenced by its local wisdom. The high consumption of leafy vegetables in West Java is influenced by their habit of consuming raw and steamed green vegetables.

Table 1. Domestic Vegetables Consumption and Production in 2016

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

In addition to vegetables availability in the market, availability constrain of garlic leads to consumption decreasing or replacement by other commodities or substitution from local to import. In the recent years, Indonesia became a net importer of garlic since production volume can't fulfil the domestic demand. To the worst, garlic planting area tend to decrease. Similarly, Indonesia also import shallot as the result of supply inadequacy during the off-season.

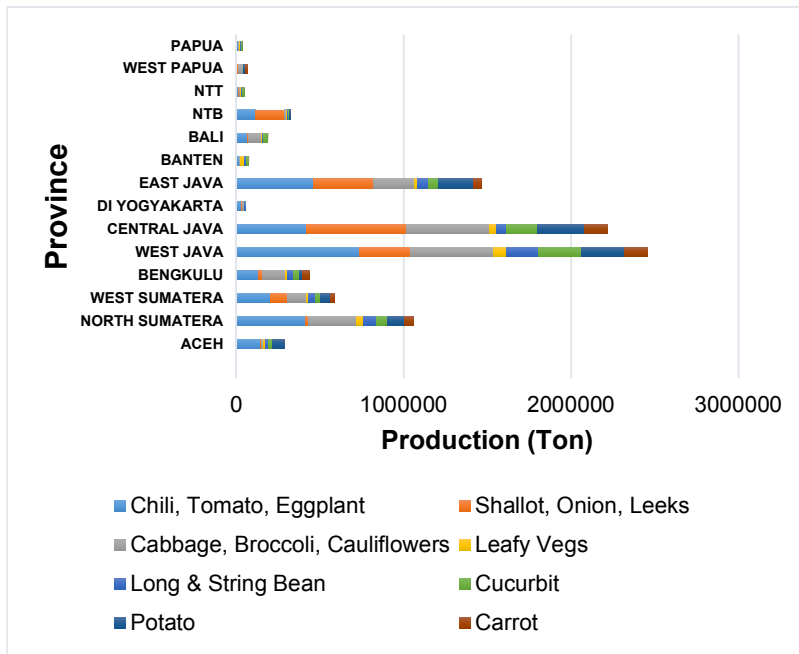


Figure 4. National Vegetable Production by Province 2015¹⁰

West Java produces the largest vegetable amount in Indonesia, followed by Central Java, and East Java. Table 1 shows NTB's vegetable production is dominated by Solanum and Allium, while NTT produces small amount of vegetables.



Figure 5. Vegetable Production and Harvested Area in Indonesia

Indonesia has rapidly been increased its production and farming land area since the drastic declining trend of farming land area in 2011. **Approximately 1 million hectares of Indonesia's land area is occupied by vegetable farm (2 percent 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.** However, 40% of

livelihoods are dependent on agriculture. 70% of farm households are marginalized and average land holding is 0.7 ha.

There are around 2.29 million people involved in the horticulture field sector in Indonesia (Population census, 2010 by BPS). This figure includes 44,850 people as employer and 132,601 employees (workers and staffs in horticulture companies and business). Compared this figure to those of the paddy, maize and roots/tubers sector there are 25.88 million people working in these commodities; and in estate/plantation crops there are 9.89 million farmers engaged in these sectors. Total employment in the agriculture sector is approximately 42.5 million in 2010 (BPS, 2012).

The total area under plantation with horticulture crops (vegetable, ornamental, perennial fruits and spice crops) was 1.92 million hectares in 2013 out of which only 1.1 million ha was used for cultivating vegetables (including melon and watermelon). According, to the BPS figures the average farm size for horticulture crops is 0.84 ha and for vegetable crops is

¹⁰ Processed from Ministry of Agriculture data 2015

less than 0.5 ha. Most farms are small-holder farmers that have limited technical skill and knowledge to perform good agriculture practices to optimize their yields required by the market demand.

In Indonesia, the average production area for vegetables is 44 m² per household (2010¹¹). According to an estimate, there is 22.4-million-hectare area of potential land available in Indonesia for vegetable production. For e.g. un-utilized dryland & lowland, 'sleeping land', homestead yard, etc. This availability of unused land is equivalent to around 1,000 m² per household. If only 10 percent of such land could be cultivated into vegetable farming in the next 10 years, then there could be an increase in vegetable production area by three folds from an existing 44 m² to 150 m². In other words, cultivated land area of vegetable production in Indonesia could potentially reach 3 million ha in 2022.

Government of Indonesia prioritized agriculture sector and reducing regional imbalances as one of its major development goals in the recent years, considering 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 ha translating to 5 million tons of food grains.

Indonesia's food security situation is delicately balanced with a demand and supply gap of 1.5 to 2 million tons, however the climate related shock such as El Niño could further widen the food deficit thus forcing the Government of Indonesia to import several million tons of food grains. Based on Indonesia's trade data¹², vegetable import value has increased by almost 10 percent from 432 million USD in 2010 to 644 million USD in 2014. This indicates a huge opportunity to meet the increasing domestic demand of vegetables by import substitution with the domestic production.

3.1.2 Local context

EJ has 37.5 million inhabitants and is one of the poorest provinces in Indonesia with the poverty rate that stands at 12.73 percent (Central Agency on Statistics/BPS, 2013) and heavily relies on Agriculture production as its source of income. Furthermore, according PPI study conducted by PRISMA, 63% of vegetable farmers in EJ are poor¹³.

¹¹ Source: PSEKP Seminar, 2012

¹² Source: <http://www.kemenag.go.id/id/economic-profile/indonesia-export-import/growth-of-non-oil-and-gas-import-commodity>

¹³ Accounted by 150% of National Poverty Index

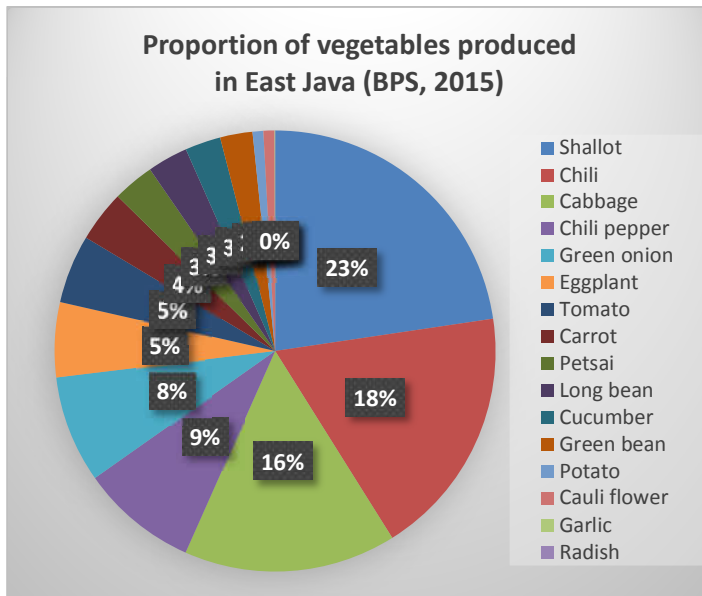


Figure 6. Proportion of Vegetables Produced in EJ in 2014

EJ is a major vegetable producing region that contributes more than 14 percent of the total national production, which accounted up to 1.1 million tons of vegetables in 2014¹⁴. High contribution vegetables from this province include shallots, chili, cabbage, eggplant, tomato, beans and leafy vegetables. As the main vegetable producing province in Indonesia, EJ has could fulfil the local demand by its production. Only few vegetables such as garlic should be outsourced. Primary production

areas for highly perishable vegetables are located nearby the main population centre, such as Malang as the main EJ's production centre and Surabaya. Meanwhile, less perishable vegetables are produced in favourable agro-climatic regions such as Nganjuk and Probolinggo¹⁵.

Despite of its position as the third largest vegetables producer in Indonesia, EJ has lower productivity compares to the provinces in the western of the country. Figure 5 compares productivities of some vegetables across provinces in Indonesia. Z-score method is used to determine productivity index which compares vegetables productivity of certain provinces with the national average. The more positive the index, the higher vegetable productivity of certain province than national average. The Figure reveals that productivity of potato, cabbage and shallot of EJ are slightly higher than national average. However, chili and tomato produced in EJ has lower yield than the national average.

Figure 7. Vegetables Productivity Index of Provinces in Indonesia in 2013

¹⁴ Source: BPS, 2015

¹⁵ Source: USAid: A Rapid Assessment of the Horticulture Vegetable Sector in Indonesia

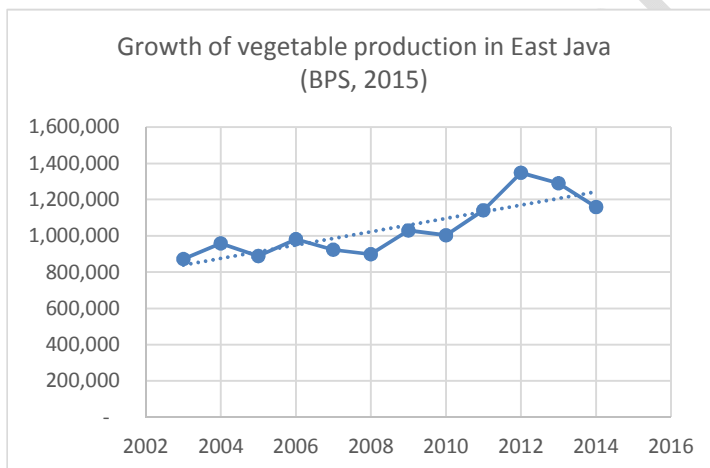
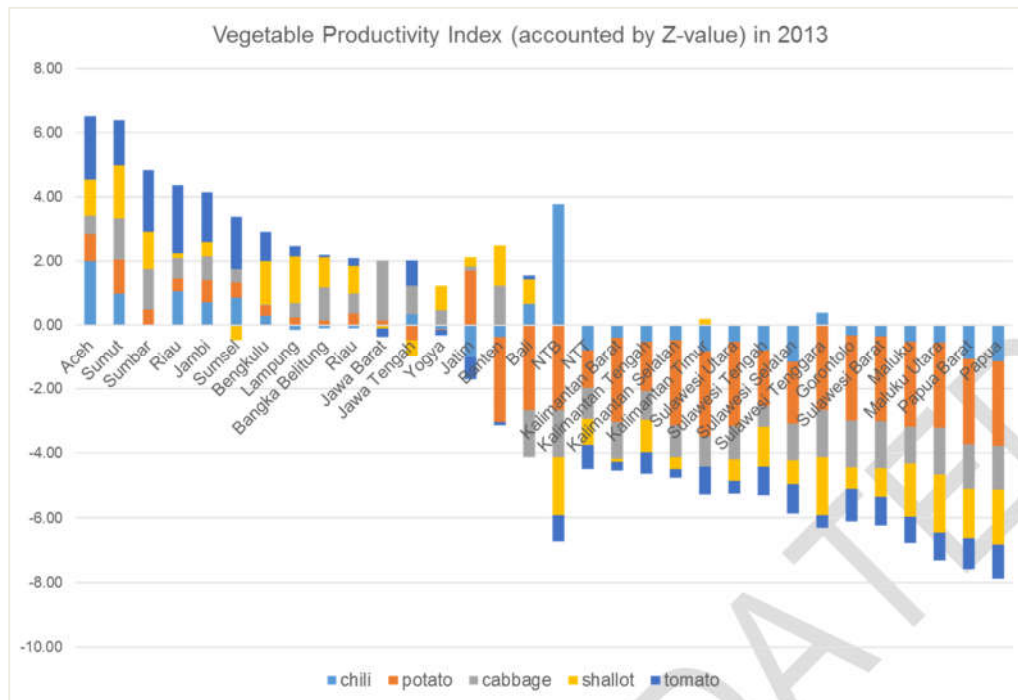


Figure 8. Vegetables Productivity Index of Provinces in Indonesia in 2013

During 2004 until 2014, vegetables production in EJ grew by 3%/year, which was slower than national growth (BPS, 2015). In the exception of shallot, carrot and cauliflower, production of all vegetables was significant increased. Shallot production in EJ was plunged in 2008, then it followed by a substantial growth in the next

years. Meanwhile, carrot and cauliflower only have a slight growth within the decade.

Consumption of vegetables in EJ was only 43.2 kg/per capita/year¹⁶, which is slightly higher than national average of 40 kg/per capita/year, but still lower than WHO recommendation of 80 kg/per capita/year. Nevertheless, EJ has adequate land to be utilized for 625,000 vegetable growers with other potential addition of 2.9 million paddy farmers who convert their land during dry season.

¹⁶ Source: Suroso, A.I., Firdaus, M., and Savitri, D. 2014. Demand for the Main Vegetables in Java Island

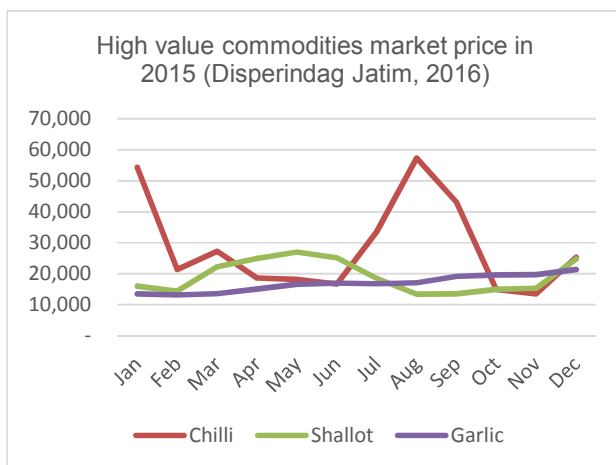


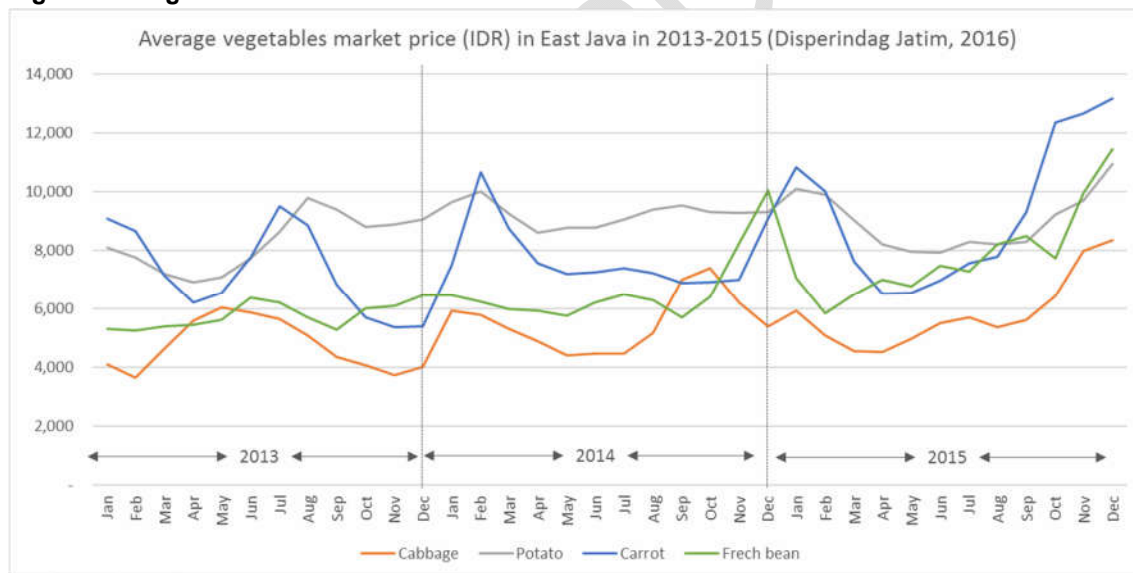
Figure 9. High Fluctuated Market Prices of Chili, Shallot and Garlic in EJ

Market prices of some vegetables such as chili, garlic, tomato and shallot in EJ have been highly fluctuating since 2013 until 2015.

The high fluctuation results in a difficulty for farmers to predict the market prices of their crops in the harvest period. Figure 9 shows that that the market prices of chili, shallot and garlic tend to not follow a seasonal trend, but vary significantly within the year and within seasons. Meanwhile, other vegetables such as

potato, carrot, beans and cabbage have lower market price volatility (Figure 10). Most of these vegetables have high price in the first beginning of the year a significant portion of farmers grow paddy. Then, most of the prices of vegetables decrease in the second quarter, followed by a slight increase or remains stable for the next quarters, and finally a sharp increase in the end of the year when farmers start to plant paddy in October or November.

Figure 10. Vegetables Price Trend in EJ¹⁷



Compares to NTB and NTT, vegetables farmers in EJ practice better postharvest handling. Farmers seem aware of the benefit of applying good post-harvest handling and take necessary efforts in grading and sorting. Further, some vegetable farmers in the production centre such as Batu sub-districts apply proper packaging to retain quality of the harvested crops and get a premium price from modern market.

¹⁷ Source: <http://pip.kementan.org/>

Vegetable farming in EJ is characterized by a balanced working division between male and female farmers. Activities such as planting, decision making, input purchase, planting, weeding, harvesting, and trading are conducted by both men and women. However, there is a significant difference between sub districts, where vegetable farming is dominated by male farmers who manage the whole farming activities by themselves.

3.2 Sector dynamics

3.2.1 Market overview

Vegetable farming in EJ is characterized by small to medium farm size households who practice mono-cropping system where vegetables are cultivated in the different land. Only small portion of farmers apply different system, where vegetables are mixed with maize or beans. The mixed-cropping system are typically applied for pest management control and soil quality improvement purposes.

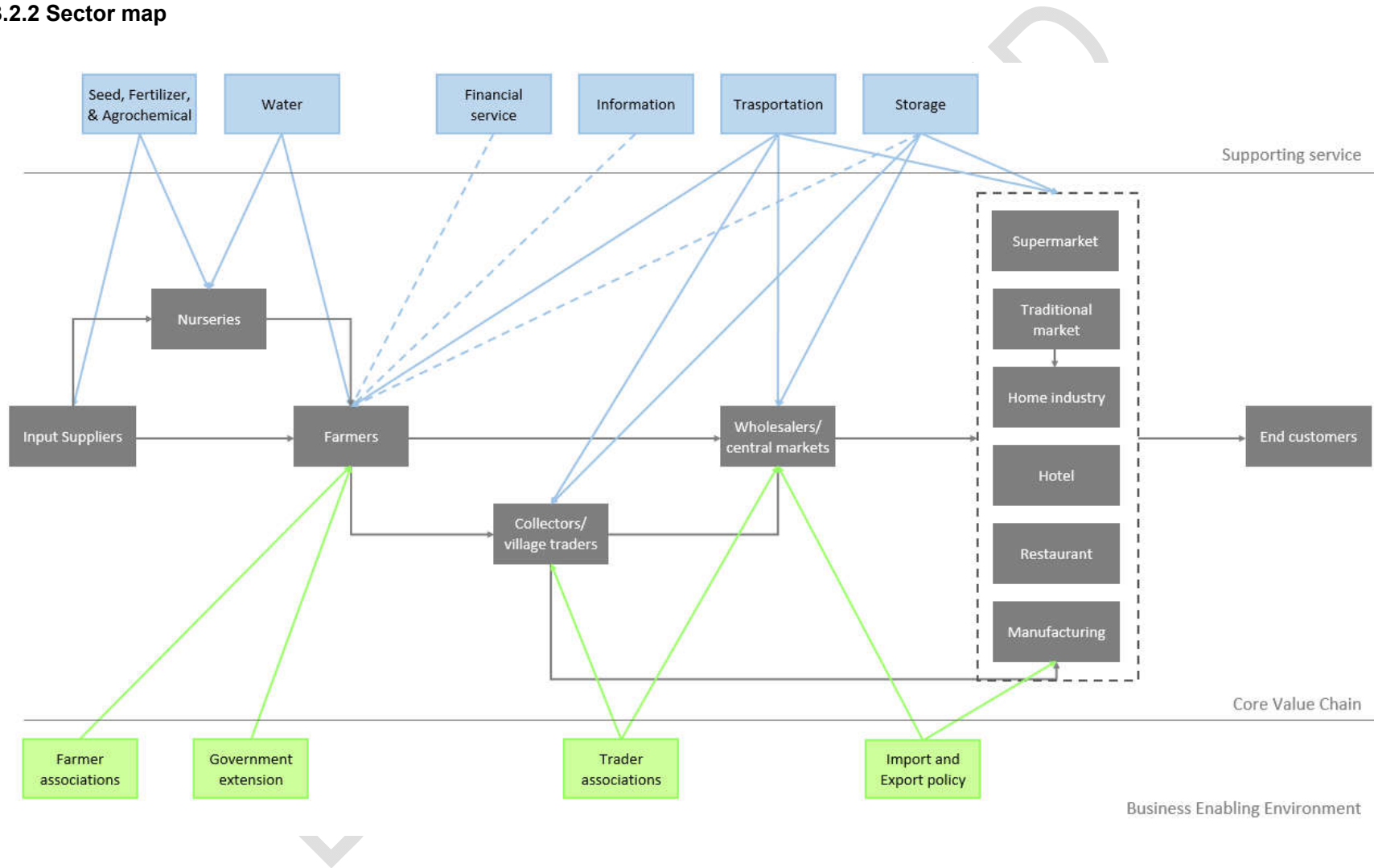
Vegetables in EJ are seasonal, mostly grew in individual household's land, and sold mainly to local markets and big cities nearby. Only high perishable vegetables from main producing centers are traded to other provinces such as potato, tomato, and bell peppers from Malang, and shallot from Nganjuk.

Vegetables sector is still dominated by multi-layer distribution system where the transfer of harvested crops from farmers to end customers takes place through multiple market actors¹⁸. The vegetable distribution chain involves several middlemen such as collectors, big traders, traders in wholesale market, and traders in retail/ traditional market. The multi-layer distribution system allows distribution of locally produced vegetables to other districts and long distance regions, and the chain even longer for vegetables produced in rural areas.

Even though traditional market is still largely available in the sub districts region, the supply chain of vegetables experiences a shift from traditional/ 'wet' market to a modern one such as retail shops, and supermarket. Further, e-commerce has lately entered the fresh modern market in the main population areas such as Surabaya.

¹⁸ Source: Soviana, S., & Puspa., J. 2012. *Multi-layer distribution system of Indonesian fruit-vegetable sector: Current challenges and future perspectives.*

3.2.2 Sector map



3.2.3 Core value chain

Inputs

The main sources of planting material are from input retailers, and only small percentage of farmers use retained seeds. Various kind of seed brands are widely available in input distributors and smaller shops in the main streets of urban and suburb districts. Panah Merah produced by East West Seed Indonesia is the most trusted brand in EJ, which is well-recognized by its high-quality seeds. Further, Panah Merah as the market leader offers a wide range of dry and wet season varieties of seeds which is adoptable to low and highland conditions. A smaller portion of farmers choose Kapal Terbang and BCA brands.

Besides seed, majority of vegetable farmers in EJ heavily rely on chemical pesticides for controlling pest and disease. The fast mode of action of chemical pesticides in killing pest is one of the most important factor influence farmers' decision in buying pesticide. Syngenta, Bayer and Nufarm are the major brands can be found in input retailers in EJ. In another hand, organic pesticides are less popular. Only small percentage of farmers apply organic products such as Petroganic and NASA brands.

Most farmers rely on Government's subsidised fertilizers which usually can be brought in input shops. Most common fertilisers used by framers are subsidised NPK, SP36, Urea, and ZA. However, as the enforcement of Agricultural Department policy, the subsidized fertilizer can only be distributed to cooperative member. This implies to the new administrative procedure which sometimes become burdensome to smallholder farmers. A small portion of farmers will also purchase unsubsidised fertilisers to substitute the unavailable subsidized fertilizer. Additionally, small number of farmers also utilize their livestock manure as organic fertilizer.

Compares to other regions in the eastern part of Indonesia such as NTT and Papua, EJ region has better access to water. EJ has favourable climate condition to support vegetable farming with annual rainfall average of 1,900 mm per year, and rainy season for 100 days¹⁹. Most vegetable farmers in the region have access to water through irrigation facilities and river basin areas. Farmers generally use surface irrigation during rainy season and only few use groundwater during dry season. Despite of its favourable condition for vegetable farming, water management is still an issue in some areas. Farmers are lacking of capabilities to effectively utilize groundwater resource when surface water (rivers, canals, dams) becomes dry during dry season.

Production

The vegetable sector is dominated by small farms, with most vegetable households owning less than 2,600 meter squares. Main vegetables crop planted by farmers in EJ are shallot, chili, cabbage, tomato and carrot. Vegetables is generally grown all year around in the main vegetable producing centres such as Malang, Jember and Banyuwangi subdistricts. Meanwhile, different planting pattern is applied in the other areas where vegetables are only cultivated after harvesting season of paddy and maize.

¹⁹ <http://www.javaindonesia.org/general/climate-weather-temperature-java-indonesia/>

In areas where there is adequate water, vegetables generally grow during the dry season since disease pressure is relatively low. By contrast, high humidity during rainy season brings high risk of fungus attacks. This means that many vegetables such as lettuce and tomatoes are difficult to produce during wet season. Only few vegetable crops suitable for rainy season include cucumber, eggplant, jack bean and long bean²⁰.

Some vegetables farming in EJ follow monoculture cultivation system where vegetables are separately grown from other crops. Besides monoculture, vegetable farming in some regions apply multi-culture system, where vegetable farmers protect their vegetable crops from pest attack by grow maize alongside the vegetable land. Besides, multi-culture system also used to improve soil fertility such as peanuts as border crop for shallot. Additionally, vegetable farmers also adopt crop rotation as a method of pest and disease control. Vegetables are well suited to being grown in rotation with staple crops to reduce pest and disease population present in the soil. Besides staple crops, farmers in Kediri and Blitar subdistricts rotate chili with peanut and potato²¹.

Table 2. Production calendars for vegetable farming in EJ

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lumajang	Paddy/ maize	Paddy/ maize	Paddy/ maize	Veg	Veg	Veg	Veg	Veg	Veg	Veg	Veg	Paddy/ maize
Malang, Jember, Banyuwangi	Veg	Veg	Veg	Veg	Veg	Veg	Veg	Veg	Veg	Veg	Veg	Veg

Vegetable choice planted is based on experience, and is also affected by peer farmers.

Planting decision is also a reaction towards current market price of vegetables. Farmers tend to be over-reacting towards spot market prices, and generally choose to plant high price vegetables. As planting decision among farmers is not well maintained, often, inevitable oversupply of one crop, which all farmers decide to grow, occur.

Since vegetable farming is highly dependent on water, climate variability and anthropogenic-caused climate anomalies lead to changes in farmer's crop choice.

Erratic climate pattern for years to years has been a significant challenge to the vegetable production. Heavy rainfall often causes severe disease attacks in majority vegetable crops such as tomato, chili, cabbage and shallot. Extreme climate condition during the end of 2016 cause chili farmers in Malang sub district bear 80% crop losses due to the disease attack.

Even though farming technique has been hereditary adopted from the parents, farmers in EJ are willing to adopt innovation and technology.

As the one of major vegetable producing centre, EJ has becoming the main marketing target of input companies where lots of demo plots and farmer meeting events conducted. Most of farmers in the suburbs have been exposed to the latest input innovation and GAP techniques promoted by the companies. However, the exposure generally does not reach out farmers in the remote areas such as Pacitan and Lamongan sub districts.

²⁰ Source: Duncan, K, et., al. 2012. *Vegetable Production Throughout the Rainy Season. ECHO Asian Notes*

²¹ Source: Latifah, et., al. 2011. *Problems and Prospects of Vegetables in Pagu Sub district of Kediri and Gandusari Sub district of Blitar, East Java. AIAT East Java.*

Despite of the high exposure of agriculture knowledge, most vegetable farmers practice improper farming techniques. High use of herbicide and pesticide chemicals is a major problem in the sector. In the effort of overcoming pest and disease attack, farmers often increase spraying frequency and dosage of chemicals. Further, many farmers tend to disregard the application recommendation stated on the packaging of the chemical products. Besides contributing to the environment pollution, the excessive use of chemical is not necessarily increase productivity of the crop. The increase application of chemical lead to increasing of pest resistance towards the product which means farmer will increase dosage of chemical even more in the next planting season. To the worst, the excessive application of chemical will cause soil fertility reduction which finally contribute to the reduction of crop productivity.

Women and men are both actively engaged in vegetable production as either farmers or as labourers (and sometimes as both). The use of hired labour is common in many subdistricts in EJ, while involving family member in production activities is only common in the rural areas. In a vegetable household, househusband usually do production tasks includes spraying pesticides, fertilising, watering, and transporting harvested vegetables. Meanwhile, housewife take role in price negotiation in the market. Decisions regarding what agricultural practices to use are mainly made by male members of the household. Besides, vegetable farming in some subdistricts also characterized by female farmers who do all of production, harvesting and trading tasks.

Harvesting & Trading

Vegetable farmers in EJ generally apply simple harvest and post-harvest method. The household usually hire labour and/ or involve family members during the harvesting time. Both female and male farmers equally engaged in the harvesting activities such as picking, washing, bruising, strapping, and packing. Traditional harvesting practice is applied by the household in which the use of automation harvesting tool is limited.

In term of post-harvest handling practice of vegetable commodities, EJ is better off compared with NTB and NTT. Depending on type of vegetables, most vegetable farmers in EJ apply simple postharvest handling practices to their commodities. Perishable vegetables which are locally sold to nearby areas are sorted, graded, bundled and packaged before it is collected by village traders. Meanwhile, the one which goes to interisland trading should be specially treated to retain its shelf life. However, good post-harvest handling practices of vegetable commodities in EJ didn't well developed. Most common post-harvest practice applied for the interisland commodities are films wrapping and coatings which usually conducted by collectors and medium/ large scale farmers.

Meanwhile, more advance handling techniques to maintain vegetables quality such as temperature, humidity, controlled atmosphere management practices didn't apply by EJ farmers yet. Cold storage infrastructure is a serious limitation within EJ's vegetable supply chain. The existing storage and transportation facilities are still relatively poor (particularly at the upstream, where villages are not always connected with adequate road infrastructure). Cool-storage and trucks are still not widely implemented yet²². Such facilities are not affordable by

²² Source: Soviana, S., & Puspa., J. 2012. *Multi-layer distribution system of Indonesian fruit-vegetable sector: Current challenges and future perspectives.*

small farmers and thus, only small number of medium/ large scale vegetable growers have applied proper cold chain practices for the interisland vegetables. Further, since sufficient post-harvest handling practices are lacking, it is not a common practice for farmers to store their vegetable for longer periods of time to take advantage of higher prices in the following days.

Vegetables supply chain in EJ experiences a shift from traditional markets ('wet market') to modern one. Substantial growth of retail chains has significantly influence to reduction of traditional market in the province from 2,066 to only 1,402 in 2011 and 2014, respectively. While retail chain expansion presents an opportunity for vegetable sector to grow, it also demands for better quality, better accessibility and availability of products. However, there is still a bottleneck on the supply side to produce uniform quality, large volume and regular availability of vegetables. In term of quantity, small holder farmers have difficulty to fulfil constant and large volume of vegetables since they are usually grow individually. Hence, large scale buyers such as supermarkets, food manufacturing, hotel and restaurant tend to procure vegetable supply to large collectors, wholesalers and import agents.

Besides good quality, recent trend on healthy food consumption stimulate better pest control practices to reduce level of pesticide residue of vegetables. Given the opportunity, small portion of farmer shift to organic farming. While the rest are still applying traditional pest control practices where farmers continue to increase level of pesticide in attempt to minimize pest and disease attack. **Excessive levels of pesticide residues have now reached such a level that buyers in the prime export markets sharply reduced their demand for vegetables²³.**

Wholesalers and collectors are the main buyers of vegetable farmers. Most of farmers sell their harvested crops to collectors who usually come to village, or sell directly to wholesalers in central markets. Further, in a case of scarcity of certain vegetable in the market, collectors come to the farmlands and buy the crop even before harvesting time. In contrarily, when vegetable supply is high, farmers sell their vegetables directly to market. To the worst, when supply of tomato was incredibly surpassing its local demand, price dropped into its lowest price into IDR 300 in 2015²⁴, farmers choose to not harvest and sell their ripped tomato.

Good transportation infrastructure in EJ implies to the decent market access of vegetable production. However, the long distribution chain seems imply to poor information flow and information asymmetry among players within the chain. Each market actor is likely to have information only from its direct buyers. While information from indirect customers is often unknown, such as end-customer preferences and current market price are less likely to reach rural farmers. Moreover, low education of most of small holder farmers limits their ability to obtain such information²⁵.

Asymmetric information between farmers and buyer (collectors) commonly occur in the rural areas. Farmers are lack of market information such as the latest market price and availability of a commodity in the market. Only farmers with a good networking to market actors can access market information. As the result, farmer bear a lower bargaining power against collector, and they generally accept any price given by collector. This fact can be worst during

²³ Source: USAid: *A Rapid Assessment of the Horticulture Vegetable Sector in Indonesia*

²⁴ <https://m.tempo.co/read/news/2015/08/17/090692701/fluktuasi-harga-tomat-karena-kekeliruan-operasional>

²⁵ Source: Soviana, S., & Puspa., J. 2012. *Multi-layer distribution system of Indonesian fruit-vegetable sector: Current challenges and future perspectives.*

harvest period when farmers avoid to keep unsold perishable vegetables. In contrarily, when vegetable quantity in market is low, farmer able to have better bargaining power in selling the harvest.

Together with men, women take responsibility of vegetable selling. However, since women are better negotiators and are responsible for managing the household finances, there is a preference for women to conduct the sales of vegetables.

3.2.4 Supporting Functions / Services

East Java's farmers are well connected to the good quality seeds. There are several big vegetable seed producers who market their products in East Java, such as PT East West Seed Indonesia under market name Cap Panah Merah, PT Benih Inti Subur Intani (BISI) International Tbk. under market name Cap Kapal Terbang, and PT Branita Sandhini (Monsanto Group) under market name Seminis. Besides the big producers, there is also a lot of local vegetable producers in East Java, that has head offices in East Java, such as PT Benih Citra Asia (BCA) under market name Bintang Asia, PT Aditya Sentana Agro Indonesia under market name Cap Bunga Matahari, PT Agri Makmur Pertiwi under market name Benih Pertiwi, and PT Aura Seed Indonesia under market name Aura Seed. Additionally, East Java is the third largest vegetable seed producers in Indonesia in 2013²⁶, which makes the access to vegetable seeds easier for the farmers.

One of the most common financial access for farmers is in form of credit from traders with their harvest as payment. Farmers, especially in rural areas, borrow money from traders with "Yarnen" scheme, where the farmers should sell their harvest to the lenders / traders. This scheme enables traders to have higher bargaining position of the harvest selling price (farm-gate price), which is generally lower than the market price. There is another alternative financial access from the financial institution, such as bank, cooperation, and credit union, available in the market. But, farmers in rural areas hardly get access to the financial institutions. On the top of that, farmers in rural area generally avoid borrowing money from the financial institutions because the perception of complicated paperwork to get the credits. Unlike their rural counterparts, farmers in suburb area have better financial access and they are familiar with the credit application process from the financial institutions.

Good agricultural practice on vegetable farming is commonly gotten from parents and peer farmers. Farmers in East Java have known the standard farming practice from their ancestors as well as the other peer farmers. Farmers in suburban area also have good access of good agricultural practice from regular events held by input producers, which usually are demo plots and farmer meetings. Some of the input shops in East Java also provide agricultural knowledge, especially in pest and disease control. Government extension staffs only contribute to small percentage of agricultural knowledge dissemination to the farmers, and they usually focus on staple crops.

Even though the more advanced farmers can access farming related information, such as weather and market price, through various information and technology platform, the

²⁶Source : Directorate General of Horticulture

majority farmers still get access to information through traditional information channels.

The advanced farmers spend some time in their day to monitor and access the farming related information from local and national news, radio, TV, and internet. They gather that information from various channels, then their farmers usually ask them about the farming related information. That is also the source of information to decide which crop should they plant for the season.

Because of the perishable nature of green leafy vegetable, post-harvest processing plays a great deal in the transportation process to reach end-market.

The post-harvest processing is very important especially for the inter-island trading and exported vegetables. The bad post-harvest processing causes high rejection rate in the receiving country for the exported vegetables. The most common practice to treat the vegetable before long transportation process is by covering the vegetable in special type of cement to prevent it from rotting before arrival. This practice has been done mostly by traders who practice inter-island or export trading. During rainy season, not only they'll cover the vegetable in cement, but also they cover it with paper.

3.2.5 Supporting Rules and Regulations (Enabling Environment)

Indonesia's main vegetable exports comprises of three main crops, which are cabbages, shallots, and potatoes.

The three main crops represent almost 78% of the total vegetable exports volume. The major market of the vegetable exports is Malaysia (47%), Taiwan (29%), and Singapore (23%)²⁷. As one of the biggest export market of Indonesia's vegetable, Singapore does not impose any quota restriction for goods imported under open general license. Import permits issued by the Singapore Agri-Food & Veterinary Authority are required for a specified list of plant and animal products. Importers must submit an inward declaration to the Import and Export Office, Trade Development Board. Fresh fruit and vegetables are subject to random inspections for pesticides and chemicals by the AVA²⁸.

An Indonesian company involved in the export of agri-food products will need to have a range of permits issued from the Ministry of Trade, the Ministry of Agriculture and other agencies.

Based on the MOIT Decree No. 146/MPP/Kep/4/1999 on goods/commodities, horticulture products are free to be traded and are not monitored. All the exported product should possess a certificate of origin (SKA) issued by Ministry of Industry and Trade (MOIT) and trade contract.

Indonesia's vegetable import volume is higher than the export volume.

The main vegetables imported is garlic, shallot, onion, and carrot. These four vegetables comprised 98% of the total volume of Indonesia's vegetable import in 2008. The major suppliers of the four main imported vegetables are China (garlic, onion, and carrot), Thailand (shallot), Philippines (shallot), New Zealand (onion), Netherlands (onion), and India (onion).

Indonesia imposes restrictive policies on several imported horticultural products, that includes certain fresh and frozen fruits and vegetables, processed vegetables, dried fruits, jams and jellies, and fruit juices.

The regulation requires importers to obtain an import recommendation called "RIPH" from the Ministry of Agriculture before requesting import approval from the Ministry of Trade. Per Regulation 47/2013, RIPHs are only issued twice a

²⁷ Moorey, 2009. *Indonesia Investment Market Horticultural Product*

²⁸ AVA Website: <http://www.ava.gov.sg>

year, once for a period from January through June and another for a period from July through December. Additionally, Regulation 16/2013 indicates that each shipment must undergo a pre-shipment technical survey and abide by specific packaging and labelling requirements. Applications for importer registration as well as import approval must be submitted through INATRADE, Indonesia's online trade licensing system. A new item introduced in MOA Regulation 47/2013 states that fresh horticultural products cannot be imported after six months from the date of harvest²⁹. The Indonesia's Regulation No. 27/Permentan/PP.340/2009 on "Food Safety Surveillance for Entry and Exit of Fresh Food of Plant Origin" requires imports to be accompanied by a certificate of analysis covering residues for pesticides, heavy metals and mycotoxins.

Agricultural policy in Indonesia focused for decades on achieving food self-sufficiency and price stability, especially in rice. The government used a wide variety of policy instruments in pursuing those goals, but mainly subsidies to purchased inputs. A typical example is a large subsidy for fertilizer, but water (irrigation systems), fuel, credit, tree planting materials, and pesticides were also subsidized. Indonesia's largest farm input subsidy was for many years a fertilizer subsidy. Recently during the last 5-7 years, seeds subsidies take places using money from national as well as local government budget (CHCG, 2012).

Besides provides pesticide and fertilizer subsidy for farmers, the Government, under The Villages, Disadvantaged Regions and Transmigration Ministry allocates a large amount of fund, namely ADD (Anggaran Dana Desa-Village Budget Fund) and APBD (regional funding) to be utilized for empowering villagers through establishment of Village-run enterprises (BUMdes). The fund is fully managed by the local government at the village level which is regulated in UU No 6, 2014 about village governance. The purpose of BUMdes establishment is to promote potency of the village, and reinforce village economy through business activities that is managed by local villagers. Based on the Government regulation, type of business can be run by BUMdes are trading, credit, goods and services business. BUMdes are also allowed to have business in various sectors, include agriculture and non-agriculture. In May 2017, there are 1,022 BUMdes across Indonesia, 287 of it are in East Java³⁰.

Fund allocated for agriculture business activities of BUMdes is decided and legalized through RKPdes (*Rencana Kerja Pemerintah Desa*) and AD/ART (*Anggaran Dasar dan Rumah Tangga Desa*). Amount of BUMdes budget for agriculture can vary from **IDR 50-100 million** which may depend on the villages' potency and previous year village's budget absorption. While the Government program provides opportunities for BUMdes, but challenges also present. Many BUMdes are not effectively managed or remain become informal organizations. There is an urgency to develop the capacity of human resources of BUMdes before it run the business.

The number of East Java's government extension staffs for agriculture had been the highest in 2013 and 2014 compared to the other provinces. But, the number of extension staffs had been reduced from 2013 to 2014 by almost 7%. This trend happened also in the other provinces in Indonesia. Total number of government extension staffs in East Java in 2014 was 2,464, contributed to almost 9% of total number of government extension staffs in Indonesia.

²⁹ Source: <http://www.bryantchristie.com/blogs/indonesia-issues-new-import-regulations-horticultural-products>

³⁰ Source: <http://new.pamsimas.org/media.php?module=detailberita&id=1588&cated=27>

The female proportion to male for government extension staffs in East Java had also increased in 2014 to be 33% female and 67% male.

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 AIP-PRISMA seeks to support through interventions in the vegetable market system in NTT. 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 and high production cost
- Farmers experience low selling prices

Farmers experience low productivity and high production cost: Farmers experience low productivity of vegetable due to improper application fertilizer and pesticide. Farmers apply insufficient fertilizer due to its limited availability in the market. Farmers generally rely on subsidizer fertilizer which is limited for member of farmer groups only. Set of administrative procedure which is required for accessing subsidized fertilizer often make a burdensome for farmers. In another hand, there is also limitation on availability of unsubsidized fertilizer in the market. The government monopoly on subsidized fertilizer seems depress fertilizer market to grow.

In contrarily, when fertilizer is accessible, farmers apply improper dosage. Farmers perceive that heavy use of fertilizer will essentially increase productivity, without aware of the risk of productivity decline due to level of nutrient given is exceed the crop's tolerance threshold³¹. Farmers tend to increase the usage of inorganic fertilizer to improve soil fertility without knowing which soil nutrient is lacking. While the subsidized fertilizer has its standardized quantity of nutrients, dosage level and type of fertilizer should be applied may vary for different type of soils and crops. Additionally, the low price of inorganic subsidized fertilizer may also contribute to the excessive application. Besides lack of understanding of proper application of fertilizer, farmers unaware of quality of fertilizer they bought.

Likewise, farmers also apply excessive pesticide to their vegetable crops. Even though vegetable farmers in EJ have better access to agricultural knowledge compares to NTB and NTT, knowledge on pest and disease control is still lacking. Vegetable farming practices in EJ are handed down generation to generation in which farmers used to apply excessive chemicals to overcome the pest and disease. Similar to fertilizer application, farmers tend to disregard the recommended usage level, and generally perceive that increasing dosage and frequency of spraying chemical is the only way to reduce the pest attack. Besides, it is also common practices that farmers spray without proper observation, and tend to mix pesticides which could destroy natural predators. These improper crop protection practices are inefficiently cause pesticide resistance, and the increase of failure rate in the following season.

³¹ Source: <http://www.smart-fertilizer.com/articles/timing-fertilizer-application>

Such continuous improper chemical application lead to soil quality degradation which finally implies to the low productivity crops. Besides, the inefficient excessive chemicals practice also leads to high cost of production. Further, limited access to extension services on pest control and pesticide practices further exacerbates this situation as discussed on the weaknesses of services and regulation section.

Farmers receive low selling prices: Low vegetable prices are mainly caused by low bargaining power and crop oversupply.

1. Farmers have low bargaining power in negotiation selling price

Insufficient post-harvest practices compound with limitation on cold chain services lead to the low quality postharvest vegetables. The low postharvest quality limit the selling access to modern market such as super markets, hotels and restaurants. Farmers generally lack of knowledge and resource to invest in the proper postharvest practices to fulfil the modern market needs.

Besides, poor post-harvest knowledge, the uncertainty of where to sell harvests beyond the traditional market further weakens farmers bargaining position and impacts prices. Vegetables sector in EJ is also characterized by multi-layer distribution system where various market players are involved the crop distribution from upstream to downstream. Smallholder farmers generally sell their crops to village collectors. Smallholder farmers' capacity limitation on selling crops to other districts or long distance regions restrict them to access alternative market channels where they can have better selling price.

Furthermore, rural farmers are usually tied to '*yarnen*' loan scheme to local traders, where farmers should sell their harvest to the money lender. Under the *yarnen* scheme, capital lender usually specifies the selling price, with the farmer agree to deliver the crop at the harvest day. Farmers who tied up in the arrangement have limited market option and are unable to benefit the higher selling price.

2. Crop over supply during certain period

Vegetable planting pattern are traditionally based on experiences, and affected by peer farmers'. As planting decision among farmers is often not well managed, oversupply is inevitably avoided. Further, farmers incur higher risk when they don't have access to weather forecast, while they only rely on past knowledge associated with incoming rainfall for crop planning. Together with other variables such as market price and land variations, traditional practice of relying on past knowledge are not sufficiently accurate for farmers to make a better decision on crop choices.

Besides poor crop cycle management, difficulties of growing during off-season is another challenge. Failure risk is increase during wet season due to high disease incidences. Therefore, farmers grow vegetables during dry season, and avoid off-season cultivation. Even though the off-season planting will result higher selling price of harvested crop, but available technology for minimizing potential risk associate to disease problems during wet season is limited.

4.2 Weaknesses in Services and Rules/Regulations

There are several services and enabling environment factors which affect the underlying causes of the problems highlighted above. 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 number of market actor who produce, promote, and distribute unsubsidized fertilizer
- Market actors have limited knowledge on GAP
- Limited number of market actors who provide GAP knowledge and market information
- Limited number of market actors who promote off-season vegetables technology

4.2.1. Limited number of market actor who produce, promote, and distribute unsubsidized fertilizer

With the high number of subsidy by the government has suppressed the fertilizer market. Urea market is fully subsidized, while for NPK, the government subsidize 50% of the potential market demand. The government subsidy program lead to farmers' high dependency to subsidized urea and NPK fertilizer. In the result, most of fertilizer producers focus on Business to Business (B2B) market to gain economic of scale of the sales. Producers perceive retail market of fertilizer is less attractive than B2B segment such as Plantation and the Government. As the result, only small numbers of unsubsidized fertilizers are available in the market. The fertilizer producers also spend less investment in agronomist resources and promotion activities for retail market of unsubsidized fertilizer.

Similarly, input shops also have lack of incentive to promote and distribute unsubsidized fertilizer due to the market monopoly by the subsidized one. The farmers' high dependency on subsidized urea and NPK further deteriorate the attractiveness of the fertilizer market. As the result, input shops put minimum effort in promoting and distributing the unsubsidized fertilizer.

Likewise, organic fertilizer has minor share in the market. Only small number of market actors produce, promote and distribute the organic fertilizer. Market is less attractive since farmers' lack of awareness of the importance of essential nutrients which are not available in the subsidized fertilizer. As described earlier, diverse dosage and nutrients are required for different growth stage of the crops and soil quality.

4.2.2. Market actors have limited knowledge on GAP

Vegetable farming practices generally learned from parents, experiences and is effected by peer farmers. Farmers also adopt farming techniques which is promoted by input producers. However, despite of the farming knowledge exposures, promotion on proper and responsible usage of fertilizer and pesticide is still lacking. In the effort of increasing productivity and overcoming pest and disease attack, farmers often increase fertilizer and pesticides usage, and tend to disregard the suggested dosage.

Competency of the market actors on GAP is generally also lacking due to limited of timely and reliable knowledge source can be accessed. Only few portion of input distributors and retailers

provide suggestion on application of products they are selling. Knowledge promoted by input sellers generally based their customers' experience, which sometimes insufficient to solve severe pest and disease attack problems. In the other hand, skewed incentive structure may distort the information and knowledge are provided to the farmers.

Meanwhile, government extension staffs only provide general knowledge on farming practices. Further, large portion of extension staffs in many districts are focusing on staple crops, and only limited GAP knowledge is provided to vegetable farmers. In the exception of vegetable producing centre, District Government assigns extension staffs to disseminate GAP knowledge to vegetable farmers. However, there is still a limitation in public extension staffs' capacity on pest & disease control. Extension staffs' pest and disease knowledge usually limited to certain pesticide brands.

Besides pest and disease control, knowledge related to proper fertilizer application is also lacking. Timing and frequency of fertilizer application could be vary based on nutrient required by different type of soils, commodities and plant growth stage. However, market actors' knowledge related to the proper usage across these different types of conditions are still limited. Further, rigorous physical observation is required to determine proper fertilizer dosage.

4.2.3. Limited number of market actors who provide agriculture knowledge (GAP & GHP) and market information

Number of market actors who are providing timely and reliable GAP knowledge to vegetable farmers in EJ is insufficient. GAP knowledge of vegetable farming usually provided by private agronomists from input producers such as EWINDO, Syngenta and Nufarm. Even though quality of GAP provided by the agronomist is reliable, but only very few of vegetable farmers can reach them. Coverage of private agronomist generally very limited to suburbs areas and vegetable centres.

Similarly, the presence of public extension staffs in EJ is also lacking and hence transfer of knowledge is limited. There are only 4,812 public extension workers for the whole province, with total 4.2 million farmer households should be reached. It is mean that a single public extension worker should cover 873 farmer households. Further, as local government generally prioritize staple crops, only few percentage of extension workers who provide the GAP knowledge to vegetable farmers.

Input sellers and fellow farmers are the other knowledge source can be accessed by farmers. Input retailers usually only provide general knowledge related to products they are selling, and only few of them are willing to provide consultation service to farmers. While, fellow farmer as one of the farmers' most trusted knowledge source is easier to be accessed. However, knowledge provided by fellow farmers may not be timely and reliable.

Lack of GHP knowledge cause inferior quality of vegetables which effect to its accessibility to reach bigger market. In the other hand, exchange of market information is very underdeveloped, where asymmetric market information become one of barrier for farmers to benefit the higher price. Traders are unlikely to share market price information to farmers. While, other players such as input kiosk, extension staffs, and agronomist have lack of incentive to share the market information. The only possible market information source is fellow farmers.

4.2.4. Limited number of market actors who promote off-season vegetables technology

Rain shelter is the common technology used during wet season. However, due to its high investment and maintenance cost, the use of rain shelter is usually limited for seedling cultivation. Market of the rain shelter for vegetable farming is underdeveloped. Therefore, market competition is lacking, and retailers are not proactive in reaching small-farmers.

Grafted seedling is another technology can be used during the off-season. Even though grafted seedling is not new agriculture technology in Indonesia, however commercialization of this technology is still limited.

4.3 Cross Cutting Issues (Gender and Environment)

Preliminary observation shows no sign of gender issues within the sector's context. There may be gender issues within the vegetable sector in EJ that we are simply unaware of which be kept updated with observations from field visits, and FGD gender as the intervention progresses.

Few environmental issues in the vegetable sector have been described in the previous sections. Improper application and overuse of chemicals is a common issue in the sector which directly affects to the increase pest resistance and reduction of soil fertility. As a result of this, farmers need to increase intensity of fertilizer and pesticide usage in the following cycle. Meanwhile, reduction of soil productivity effects to the decreasing of productivity.

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

With 625,950 vegetable farmer household, EJ has a significant potential for vegetables sector to grow. The sector analysis has provided substantial opportunities to positively impact the lives of poor vegetable farmers by increasing productivity, reducing cost, and improving vegetables quality. The major opportunities are around improving farmers' production, and post-harvest practices, and also market access.

There is market opportunity to stimulate production of vegetables during the rainy season when prices are particularly high. Despite of high market prices for vegetables harvested during rainy season, a large number of farmers in EJ only produce vegetables during dry season. There is potential for AIP-PRISMA to tap into the prospect of shifting production to rainy period to enable farmers to get a better price during low season months. There is also a potential to promote market outlook assessment for improving planting decision management. Besides, there is also scope for implementing better post-harvest handling to add economic value of the harvested vegetables.

It has been calculated that the increase in productivity (10-15%) combined with increase selling price can unlock a potential of additional vegetables market of over IDR 2 billion in 2018.

Table 3. Market potential of vegetables sector in EJ³²

Description/Years	Total Business in the target area (s)	Projected up to 2017	Projected up to 2018
Average Selling price per kg (IDR)	17,000	18,700	21,505
Current Value of Production (million IDR)	97,283,180	107,011,498	123,063,223
Total value of potential production (million IDR)	102,147,339	108,081,613	125,244,088
Total value of potential production (AUD)	10,214,733,900	10,808,161,298	12,524,408,776
Total potential value of increased production (million IDR)	4,864,159	1,070,115	2,180,865
Total potential value of increased production (AUD)	486,415,900	107,011,498	218,086,506

5.2 Vision of change

Focusing on achieving the potential outlined above for the vegetable sector in EJ, a vision of change can be outlined for both the sector and service levels. The vision of change at the **sector level** is to: (1) increase smallholder vegetable production and productivity during rainy and dry seasons (2) improve market performance for farmers. At the **service level**, it is envisaged that farmers will have improved access to: (1) quality input, (2) good farming knowledge, (3) good post-harvest handling practise knowledge, (4) off-season vegetables technology, and (5) financial services.

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 EJ:

Intervention Areas	Approved, on-going, or completed interventions and intervention concepts
Intervention Area 1: Improving access to quality inputs	Strengthen promotion and expansion of distribution of good quality fertilizer
Intervention Area 2: Strengthening dissemination of agriculture knowledge (GAP) and information	Encourage market actors, especially at the level of service provider to provide GAP knowledge and market information
Intervention Area 3: Promoting off-season vegetables technology	(1) Strengthen promotion of off-season vegetables technologies, (2) Introduce GAP for farming during rainy season.
Intervention Area 4: Improving access to financial service	Promoting viable business model of financial support for vegetables farmers

Intervention Area 1: Improving access to quality inputs

³² Projection 2017 and 2018 is calculated based on current intervention with Ewindo, NASA, and Rainbow

Inappropriate application of fertilizer is one of fundamental issue contributing to low yield of vegetable crops in EJ. Hence, this intervention area specifically addresses adoption of good fertilizer application and good quality fertilizer. The efforts of improving access to quality fertilizer may involve promoting good practice on fertilizer application and good quality unsubsidized fertilizer.

Current intervention works on expanding private partner's market and distribution network of organic fertilizer in EJ. PRISMA is supporting PT. Natural Nusantara (NASA) to accelerate penetration of their organic fertilizer products to vegetable farmers. Farmer meetings, trainings, demo plots and market promotions are conducted to educate farmers on the organic fertilizer that can substitute and/ complement the use of chemical fertilizer. NASA's wholesalers and distributors are involved in conducting the promotional events in the new districts.

Further, aiming to address soil quality degradation issues, PRISMA is exploring new interventions to promote soil treatment products. The products contain certain nutrition required for supporting vegetative and generative growth of the crops. PRISMA works with PT. Agrosid to promote soil nutrition product, called Trico-G which bundled with good quality seeds. Besides, the team also explore the bigger scale intervention in soil treatment with FMC and Novelvar.

Intervention Area 2: Strengthening dissemination of agriculture knowledge and information

This intervention area addresses adoption of appropriate agricultural inputs and good farming practices among vegetable farmers in EJ. Further, this intervention also aim to leverage GAP knowledge of market actors across the vegetable value chain includes input retailers, nurseries, lead farmers, extension staff, and traders. Market actors will be then expected to disseminate the knowledge to smallholder farmers.

Current interventions focus in engagement with input producers to strengthen promotion of quality inputs and its application techniques. PRISMA collaborates with NASA to develop mobile application which will be utilized as an educational platform to improve NASA's distributors' knowledge. Comprehensive knowledge on good cultivation practices, pest and disease symptoms, and NASA's product information will be presented in the application. Many NASA's agents (up to thousands of wholesalers and distributors) will be involved in the dissemination of agriculture knowledge provided through the Mobile Application.

Besides, PRISMA is also partnering with PT. East West Seed Indonesia (EWINDO) to develop mobile application, called SIPINDO, which provide wide-ranging agriculture knowledge. The application enables farmers to access farming knowledge, pest & disease control management, and timely market information. Further, timely information about market prices, weather, and crop planting pattern can be also found by farmers to better manage their crop planting plan.

Besides GAP, this intervention area also aim to improve farmers' good post-harvest practices (GHP). With the adoption of GHP, to retain quality of fresh harvested vegetables can be retained which result to increasing its market value. The GHP intervention area comprise (1) supporting farmers to effectively engage with market actors aside the traditional vegetable chain, (2) supporting capacity building of post-harvest handling practices include proper sanitation,

packaging, storage and transportation, (3) supporting farmers' collective efforts on selling the harvested vegetables to wider market channels.

There may be a potential to collaborate with BPTP and universities to seek innovation of post-harvest handling practices. Besides, a possibility of linkage between vegetable farmers and processing companies need to be further assessed.

Intervention Area 3: Promoting off-season vegetables technology

Promotion off-season vegetables may involve: (1) supporting promotion of suitable of vegetable seed for rainy season, (2) supporting education to farmers towards the opportunity of gaining better market price in rainy season, (3) supporting farmer capacity building for good agricultural practices of vegetable farming in rainy season. 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 in rainy season and information on better practices are accessible to women and tailored to their needs.

Good cultivation practices during rainy season may involve promotion of vegetable seeds for rainy season, good pest control practices, and utilization of agriculture tools. Appropriate vegetable seeds can be promoted to be grew during rainy season includes (1) vegetables seed with high resistance to high humidity, (2) vegetable crops that are productive throughout the rainiest months, (3) grafted seedling, and (4) seed treatment using with *Trichoderma sp.* and *Gliocadium sp.* Additionally, rain shelter and plastic row covers can be used to protect the vegetable crops from wet condition.

Intervention specifically promotes off-season planting didn't commences yet. However, as mentioned earlier, PRISMA is working with Agrosid to introduce seed treatment using *Trichoderma sp.* and *Gliocadium sp.* There may be other potential off-season technologies can be adopted from research institution where further exploration is need to be conducted.

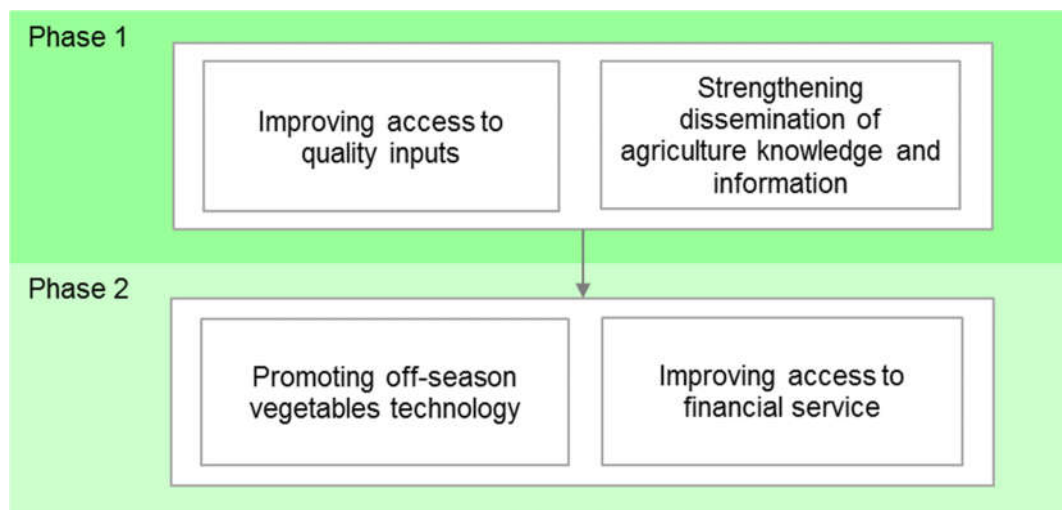
Intervention Area 4: Improving access to financial service

The goal of this intervention area is to stimulate vegetable production through favourable loan scheme for purchasing of agricultural inputs. The introduction of affordable loan scheme may involve supporting (1) education on credit union or cooperative product loan to farmer, and (2) create linkage between financial institution and vegetable traders.

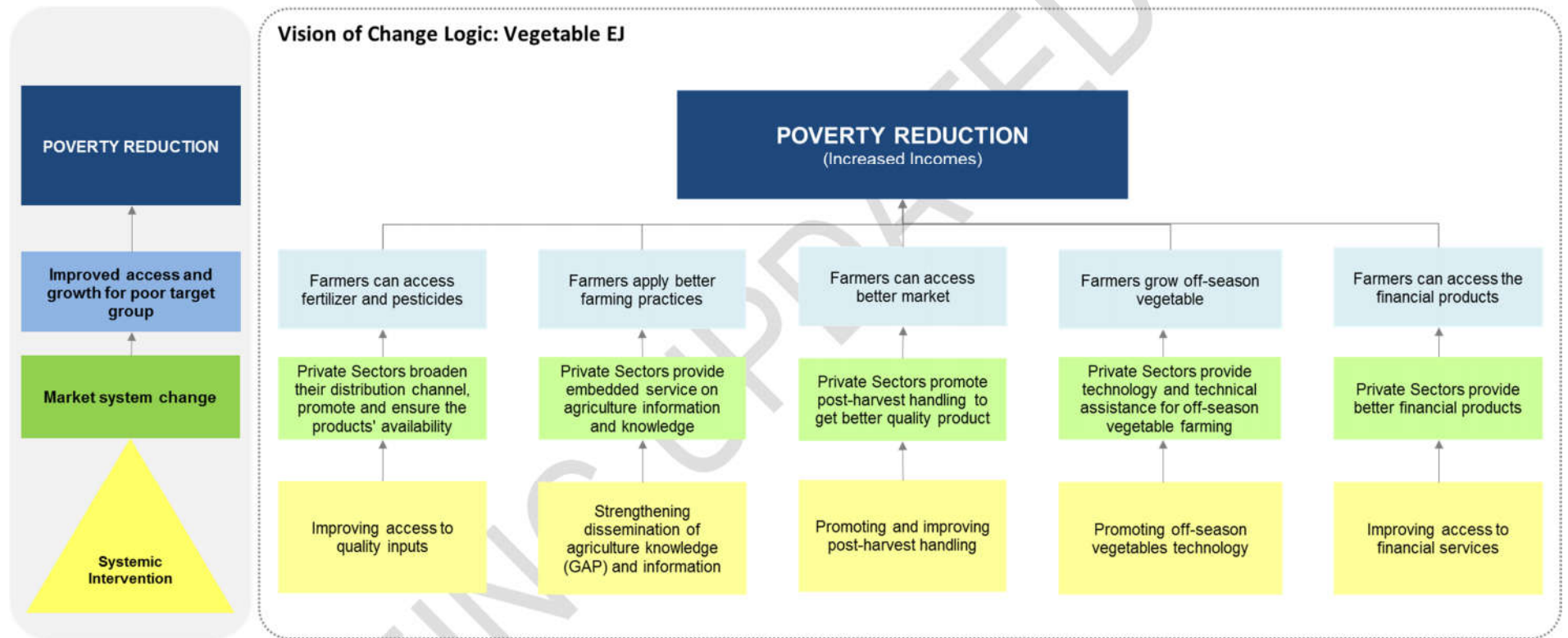
Potential partner is BPR Arta Kencana who is interested to expand their financial service coverage to agriculture sector. The financial access will be introduced into current intervention with NASA where loan product is required. Aiming to improve its product availability, NASA plans to channel its products to input shops where certain financial product is required to support the consignment scheme. Based on loan applied by input retailer to BPR Arta Kencana, NASA will deliver the products to input retailer. Not only BPR Arta Kencana which will provide the loan, distributor also provide in-kind loan to farmers. Further, collaborating with SAFIRA, value chain finance (VCF) training will be also provided to input retailers and other related market actors to minimize risk of nonperforming loan.

5.4 Sequencing and prioritization of interventions

The first phase interventions are focused to address fundamental underlying constraints in the sector, that are access to quality fertilizer, and agriculture knowledge & information. The improvement of access to inputs and knowledge are expected to solve low productivity and high production cost problems of vegetable farming. Further, the second phase will be continued with off-season technology and access to finance interventions.



5.4 Sector Vision of Change Logic



Intervention Logic Analysis Framework (ILAF)³³

(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 and high production cost	Farmers have limited access to fertilizer and pesticide	Fertilizer	Limited number of market actor who produce, promote, and distribute unsubsidized fertilizer Limited number of market actors who provide GAP information related to fertilizer and pesticide	Intervention Area 1: Improving access to fertilizer and pesticide	· Agrosid · NASA	
	Farmers lack on GAP knowledge	Information & knowledge	Market actors have limited knowledge on GAP Limited number of market actors who provide GAP knowledge			
Farmers experience low selling price	Farmers can't reach bigger market	Information & knowledge	Limited number of market actors provide the post harvest handling practices (GHP) knowledge	Intervention Area 2: Strengthening dissemination of GAP and GHP knowledge	· EWINDO · NASA · RAINBOW	
	Farmers lack of market information and planting decision	Information	Limited number of market actors who provide market information			
	Farmers have limited financial capability	Farmers have limited financial capability	Technology	Market actors have limited knowledge on off-season vegetables technology Limited number of market actors who promote off-season vegetables technology	Intervention Area 3: Promoting off-season vegetables technology	· Balitsa · Agrosid · NASA
			Financial institution	Lack of financial institutions provide simple loan application to vegetable farmers	Intervention Area 4: Improving access to financial service	· EWINDO · NASA · Financial institution

(1) Problem/ Symptom	(2) Underlying cause	(3) (4) Services and Enabling Environment
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³³ Adapted from *Toolkit for Market System Analysis, International Development Enterprises (iDE), 2012*

		Enabli Enviro
Farmers experience low productivity and high production cost	Farmers have limited access to fertilizer and pesticide	Fertiliz
	Farmers lack on GAP knowledge	Informa knowle
Farmers experience low selling price	Farmers can't reach bigger market	Informa knowle

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Farmers lack of market information and planting decision	Informa Techno
Farmers have limited financial capability	Financi instituti

Annex 2. Identified market actors

Market actors	Institution	Contact	Position
Finance			
Extension Service			
Input	Toko Riski, Jember	Riski	
	PT. Inti Makmur, Jember	Abdul Fatah	Owner
	Tani Mulyo, Lumajang	Ngatin	Owner
Trader	Tunjung market	Luluk	
Government			
Farmer / Group			

Annex 2a. Gender Roles Analysis

No	Activity in production	Task Division		Explanation
		M	F	
1	Decision on the commodity to be planted	√	√	Discuss between male and female. Decision made by women based on economic reasons.
2	Buying inputs	√	√	Discuss between male and female. Decision made by women based on economic reasons.
3	Select vegetable variety	√	√	Discuss between male and female. Decision made by women based on economic reasons and experience.
4	Land preparation	√		Dominated by men.
5	Planting	√	√	Conducted by men and women.
6	Weeding	√	√	Conducted by men and women.
7	Pest control	√		Dominated by men.
8	Harvesting	√	√	Conducted by men and women.
9	Packaging	√	√	Conducted by men and women.
10	Transporting	√		Transportation from field to home, and home to market usually conducted by men.
11	Selling vegetable	√	√	Discuss between male and female. Decision made by women based on economic reasons

Annex 4. Investigation Team

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