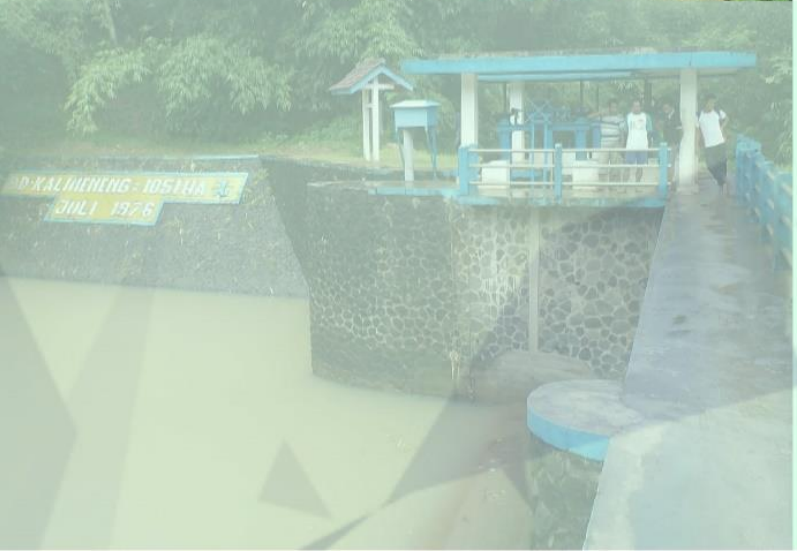
Lao People's Democratic Republic
Department of Irrigation
Ministry of Agriculture and Forestry

MARKET ASSESSMENT



OP05-CS01

LOAN IMPLEMENTATION CONSULTANT - DOI

SUSTAINABLE RURAL INFRASTRUCTURE AND WATERSHED MANAGEMENT SECTOR PROJECT

MARKET ASSESSMENT NAM PIENG 1 AND 2 REPRESENTATIVE SUBPROJECT

INACON

joint venture with

TETRA

sub consultants

BMEC ENGINEERING & CONSULTING

MIRA Consulting

MARKET ASSESSMENT - NAM PIENG 1 AND 2 REPRESENTATIVE SUBPROJECT

IN XAIGNABOULI PROVINCE, LAO PEOPLE'S DEMOCRATIC REPUBLIC

27 MARCH 2022

Sustainable Rural Infrastructure and Watershed Management Sector Project (ADB-funded SRIWMS – Loan No. 3817 - LAO)

Prepared by Dr. Kenneth E. Neils and Mr. Inphong Soommart

of the Loan Implementation Consultant – DOI (OP05-CS01)

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ABBREVIATIONS

CIF	Cost, Insurance, and Freight
DAFO	District Agriculture and Forestry Office
Ha	Hectare
HPN	Houaphan province
HVC	High Value Crop
K	Kip
Kg	Kilogram
LIC-DOI	Loan Implementation Consultant – Department of Irrigation
LIC-Province	Loan Implementation Consultant of a Project Province
LPB	Luang Prabang province
Mt	Metric Ton
PAFO	Provincial Agriculture and Forestry Office
PICSA	Partnerships for Irrigation and Commercialization of Smallholder Agriculture Project
RSP	Representative Subproject
SRIWSM	Sustainable Rural Infrastructure and Watershed Management Project
VTE	Vientiane
WUG	Water User Group
XBL	Xaignabouli province
XK	Xiengkhouang province

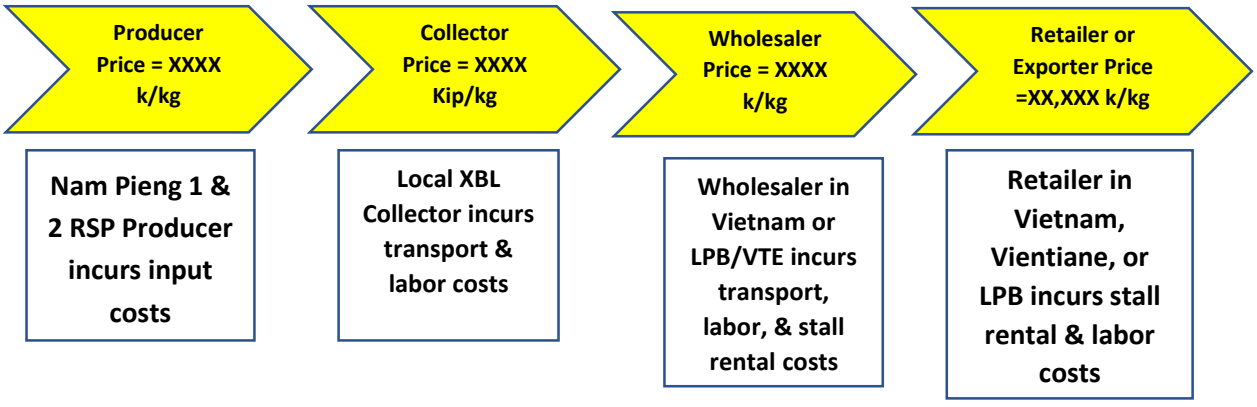
I. INTRODUCTION

The safe vegetables Nam Pieng 1 & 2 market assessment report is a deliverable under Output 1. The emphasis in the assessment was on collecting and analyzing high value agricultural product market information from markets at the local, provincial, national, and export levels. The focus was on assessing the current market for selected high value crops that could be produced and marketed by the producers of the Nam Pieng 1 & 2 Representative Subproject (RSP) in Xaignabouli Province (XBL). The market assessment includes priority, high value crops that can be produced during the dry season at the Nam Pieng 1 & 2 RSP and marketed with relatively high marketing margins at the different levels of the value chains.

To carry out this assessment, the LIC-DOI Agribusiness Specialist and Expert collected market information on potential high value crops that have been produced or could be produced in Luang Prabang Province and marketed profitably at various levels of the value chain. At the producer level, the Agribusiness Team visited and conducted workshops with the Nam Seng RSP and its producers, together with the PAFOs, DAFOs, and PICSA, in order to collect high value crop production preferences, cost of production, farmgate price, buyer linkages, and producer margins. The cost of collection of the local collectors and the destination for the collected agricultural crops were determined and the buyers, wholesalers or retailers at local, provincial, and national levels, were surveyed to collect prices and calculate margins at all levels. The market potential for exporting the products from these HVCs was determined based on historical global and regional export data and trends, recent export demand and supply information, Lao export information, and Lao competitiveness in the export market.

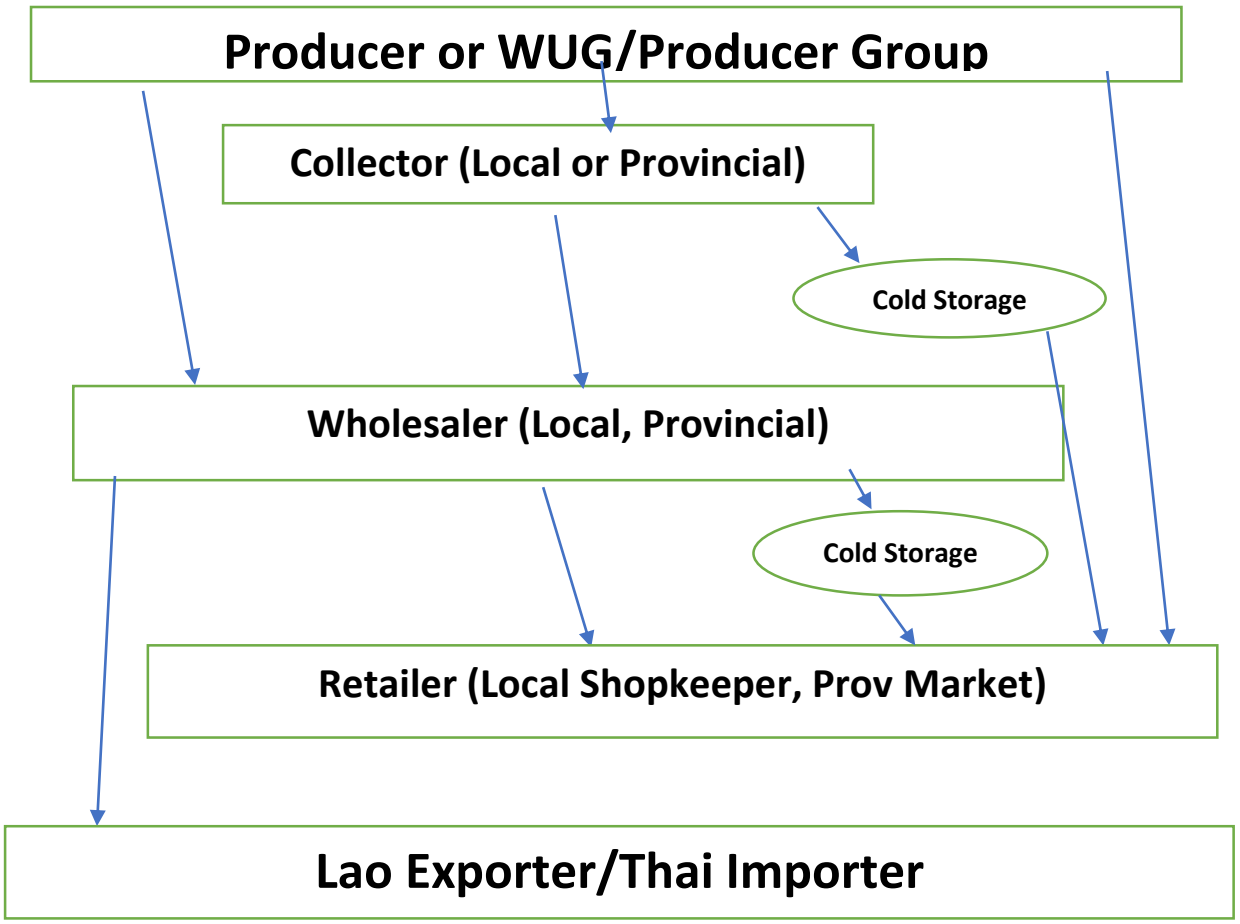
II. VALUE CHAIN DESCRIPTION

For the purposes of this market assessment, the value chains for the priority HVCs are described, initially, generically since there is little variation across HVCs. The general value chain for vegetables and herbs involves the producer at the Nam Pieng 1 & 2 RSP producing the crop during the dry season, selling at the farmgate to the local or provincial collector who owns or hires a large truck (up to 5-ton capacity) to transport the vegetables and herbs to the wholesaler or retailer in Luang Prabang, Vientiane, other provincial marketplaces, and to international markets.



The diagram above of the generic value chain does not cover the dynamics, that is, the linkages at the various levels in the value chains. The diagram that does this is the following marketing flow chart diagram.

Figure 2. Marketing Flow Chart



This diagram shows that the margins can vary depending on how agricultural products are marketed. If a producer group or collector transports a truckload of chili pepper plus other vegetables to a retailer in the Vientiane wet market or Luang Prabang wet market , that producer group or collector will receive a higher margin than if the sale was made to the wholesale market.

There are many margins along the value chain, including producer, collector, wholesaler, retailer, and exporter:

- Producer margin equals farmgate price minus cost of production.
- Collector margin equals price of product sold to wholesaler – cost of collection (transport, driver/labor)
- Wholesaler margin equals price of product sold to retailer – cost of wholesaling (transport, labor, rent on market stall)
- Retailer margin equals price of product sold to customer – cost of retailing (labor, rent on market stall)
- Exporter margin equals CIF price of product sold to importer – cost of exporting (transport, warehousing, handling, shipping)

For the priority crops, the various margins along with the costs and prices associated with each margin are given in the following table:

Table 1. Prices and Margins of the Recommended High Value Crops in the Value Chains

High Value Crop	Producer				Collector			Wholesaler			Retailer			Exporter		
	Yield	COP	PP	PM	COC	CP	CM	COW	WP	WM	COR	RP	RM	COE	EP	EM
	1000 Kg/HA	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG
Garlic	3.5	6.8	10	3.2	10.5	13	2.5	13.5	15	1.5	15.1	20	4.86	25.7	29	3.3
Green Soybean	3.5	1.486	9	7.514	9.178	9.5	0.323	-	-	-	10.395	12	1.605	-	-	-
	Farmer rents land to e.g., Hailin Co @ 4,180,000 Kip/ha; provides 15 days of labor @70,000 Kip/day			0.279	7.5	15	7.5							??	?? (Consumer Price)	??
Peanuts	3.5	1.49	3.5	2	4.04	5	0.96	5.54	10	4.46	10.1	15	9.86	5.3	18.135	2.835
Chili Pepper	0.98	5.26	10	4.62	10.18	11	0.82	11.54	12	0.46	10.14	16	4.86	17.3	27.4	10.66
Black Sesame	1	3.482	9	5.518	9.89	10.5	0.61	-	-	-	10.645	15	4.355	11.904	17.96	6.056
Leafy Vegs – Cabbage	1.59	2.15	6	3.85	6.18	6.5	0.32	7.04	8	0.96	6.65	10	3.35	-	-	-
Herbs – Cilantro	1.5	2.08	6	3.92	6.18	6.5	0.32	7.04	8	0.96	6.64	13	6.36	-	-	-
Maize	6	0.938	1.8	0.863	0.4	2.3	0.5	-	-	-	-	-	-	0.721	3.358	.337
Forage Crops – Napier Grass	25	1228	??	0.047		-	-	-	-	-	-	-	-	-	-	-

From this point on in this Market Assessment, each of the priority HVCs are described separately. The HVCs are garlic, green soybeans, peanuts, chili pepper, black sesame, leafy vegetables, herbs, maize, and forage crops.

3. TARGETED HIGH VALUE CROPS

3.1 GARLIC

3.1.1 Demand and Supply

Demand - Global consumption of garlic was 26.5 million metric tons (mt) in 2016, including,

- fresh and cold-stored garlic (89.2% of total)
- dried garlic (10.1% of total)
- other – frozen, pickled, etc. (0.7%)

From 2004 to 2018, China's position as a global leader in garlic production gradually trended upward. China commands an 80% share of the global garlic exports, with the bigger clove garlic with lesser number of cloves the global preference. At present, Indonesia, Vietnam and the USA are the largest export destinations, with Southeast Asia, Brazil, the Middle East and Europe also serving as important markets.

National demand - In 2019 Lao (Laos) sold 322 metric tons of garlic (Ref: Selina Wamucii). In 2019 alone, the demand for Lao (Laos) garlic (herbs and spices category) increased by 2.8 percent compared to the year 2018. Between 2017 and 2019, garlic's exports grew by 71 percent bringing the country US$ 498,000, US$ 736,000, US$800,000 for the years 2017, 2018, and 2019, respectively. In 2020, there were no exports of garlic. Lao garlic exports are classified as garlic, fresh or chilled (HS code 070320).

Supply - From 2004 to 2018, China's position as a global leader in garlic production gradually trended upward. In 2018, global production of garlic was 28,494,130 mt, with China producing 22,273,802 (more than 78%). India 1,721,000 mt, Bangladesh 461,970 mt, 331,741 mt, and Egypt 286,213 mt. Now, with its relatively stable export market, China is the most critical country in the international garlic supply chain, accounting for 80% of global garlic exports. The 5 biggest exporters of garlic are China, Spain, Argentina, Netherlands and Italy. Collectively, those 5 countries represent 90.8% of revenues earned for garlic sold on the international market during 2020. That percentage indicates a very concentrated cohort of garlic suppliers.

Regional Supply (Asian countries) - Asian countries sold over two-thirds (67.7%) of the world's exported garlic during 2020 with shipments valued at $2.1 billion. China was the largest supplier. Laos purchased 609 metric tons of garlic (from Vietnam or China) in 2019.

3.1.2 Margins

Producer Margin = Farmgate (producer) price – cost of production
The cost of production in Luang Prabang province averages about 6800 Kip/kg (including labor) with a yield of about 3500 kg per hectare during the dry season in irrigated areas. The farmgate price during the dry season averages about 10,000 Kip/kg, giving a gross margin of 3,200 Kip/kg. At a yield of 3500 kg, the gross margin is 11,200,000 Kip/ha or $957/ha. The farmers know local collectors (with a transport truck) who they contact by cell phone and sell their dried garlic to.

Table 2. Prices and Margins of the Garlic Value Chain

High Value Crop	Producer				Collector			Wholesaler			Retailer			Exporter		
	Yield	COP	PP	PM	COC	CP	CM	COW	WP	WM	COR	RP	RM	COE	EP	EM
	1000 Kg/HA	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG
Garlic	3.5	6.8	10	3.2	10.5	13	2.5	13.5	15	1.5	15.1	20	4.86	25.7	29	3.3

Garlic Margins	Margin (1000 kip/kg)
Producer Margin	3.2
Collect Margin	2.460
W/sale Margin	1.855
Retail Margin	4.855
Exporter Margin	3.300

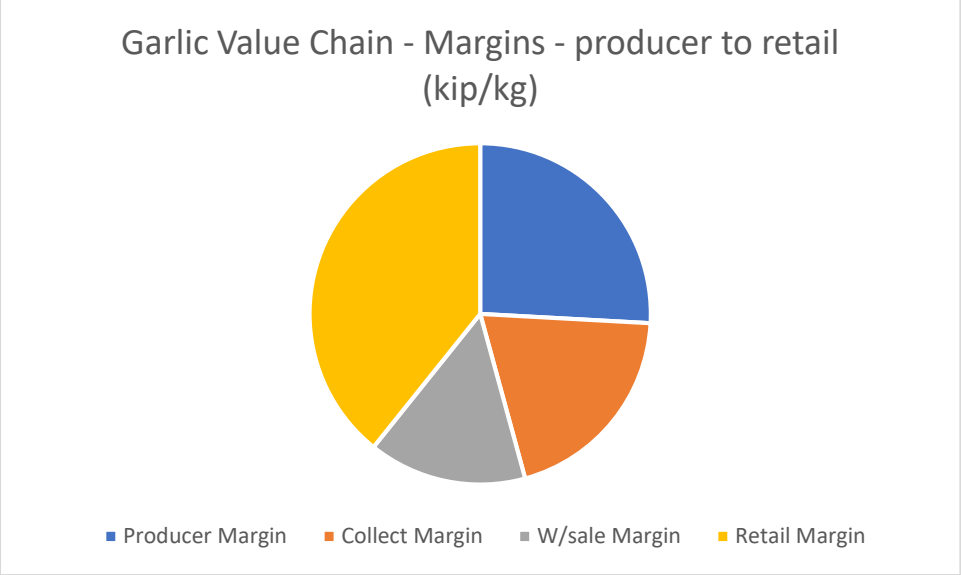


Figure 3. Comparative Margins of Producer to Retailer Levels of the Garlic Value Chain

Collector Margin = Collector price – producer price – cost of transport (includes labor)
In this margin estimation, it is assumed that a 5-ton capacity truck is hired (for 400,000 Kip/mt produce) by a local collector who transports the garlic to Vientiane markets after being contacted by wholesalers and retailers in Vientiane markets. The local collectors (as well as other provincial collectors) also transport the Luang Prabang garlic to other distant provincial markets, notably Luang Prabang. The collector typically arrives in the early morning (4-5 am) to the Vientiane wholesale market and other city markets where the wholesalers/retailers are met. The collector margin for relatively large volumes of garlic delivered to the Vientiane market is about the same or lower than the margin obtained when selling small quantities of garlic to local retail shops, where demand is limited.

Wholesaler Margin = Wholesale price – collector price – cost of market stall rent – cost of labor
Based on market information from the wholesalers/retailers at the Lao-Aussie wet market, the Non Kho New Market, the Vientiane Capital Market, and the TTL International Agriculture Products Wholesale Market in Vientiane, the wholesalers/retailers make their orders to the collectors in Luang Prabang province (and other provinces) and the collectors deliver the garlic (and other produce) to the market place where they meet the wholesalers/retailers. The costs incurred by the wholesalers includes the rent (about 2 million Kip per year) on the market stall and the cost of labor for handling and selling the garlic. Twelve kg bags of garlic are sold at the wholesale price and 1 kg loose or tied bundles of garlic are sold at the retail price.

Retailer Margin = Retail price – wholesale price – cost of transport – cost of market stall rent – cost of labor
As discussed above, many wholesaler/retailers in Vientiane marketplaces sell their garlic at a lower (wholesale) price for larger volumes while maintaining a higher retail price for direct consumers.

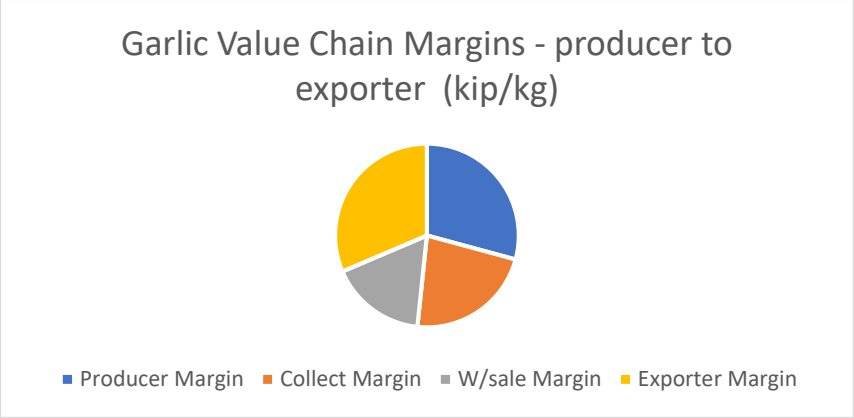


Figure 4. Comparative Margins of Producer to Exporter Levels of the Garlic Value Chain

Exporter Margin = Export price – wholesale price – cost of shipping – cost of transport, warehousing, and packing

Some of the high value crops, such as, garlic, have a history, in some cases relatively short,of being exported by Lao exporters. The pre-shipping costs (about $300/40 foot container) include the cost of transporting from the wholesale marketplace in Vientiane to a bonded warehouse, the cost of warehousing for up to a week, the cost of packing and handling. The cost of freight forwarding[1] to Thailand is relatively expensive because the amount of cargo transported from Thailand to Lao PDR is nine times greater than that transported from Lao PDR to Thailand[2]. In some cases, the trucks return to Laos empty. Empirical information from the exporting of dry goods to Thailand in 2015 included the scenario whereby the cost of two containers (totaling 40-feet) transported to Bangkok Thailand was $1700.

3.1.3 Seasonality, Product Quality, Value Added, and Competition

Seasonality - Garlic prices are influenced by the seasons, with minimal producer prices (5-10,000 Kip/kg) during and just after the harvest months, that is, starting in mid-February and carrying through to May, followed by a steep increase in the price of garlic (up to 40,000 Kip/kg) starting in late May when garlic is planted in the wet season, peaking in June, and dropping back to moderate prices (about 15,000 Kip/kg) by August and September then a gradual increase in price (to 20,000 Kip/kg) in October and November (when garlic is planted during the dry season) continuing through January and part of February

Value Added – Various garlic value-added products are processed and marketed widely in Laos, including pickled garlic. Dried garlic represents a sizeable percentage (~10%) of world trade and could be a profitable product for export.

Competition – The principal competition for the Lao multi-clove type of garlic is the large white multi-clove garlic imported from China. The large Chinese garlic sells at the wholesale and retail levels for about the same price per kg as the Lao garlic. However, Lao consumers prefer the Lao garlic because of its better taste. This competitive feature (good taste) of the Lao garlic makes the Lao garlic competitive on both the domestic and the international market.

[1] Includes cross-border costs (bridge toll, a temporary import charge on vehicles into Lao PDR, and immigration fees for crossing a border) charged at a border gate

[2] Ref: Logistics Costs in Lao People's Democratic Republic Development Studies Center, Institute of Developing Economies, Japan External Trade Organization

3.2 GREEN SOYBEANS

3.2.1 Demand and Supply

Demand - The majority of the green (vegetable) soybean "edamame" produced globally is exported to Japan. Though there is significant export demand for frozen and fresh green soybean in China and Japan, Lao exporters would need to invest in cold storage and refrigerated reefers in order to reach the Chinese market. In 2015, Taiwan exported 36,117 metric tons worth US$76.61 million, with 87.5 percent of the exports going to Japan. Taiwanese frozen green soybeans accounted for 44.3 percent of the Japanese market in 2015, making it the biggest exporter to the country for the eighth consecutive year, followed by Thailand and China. The average price of Taiwan's green soybeans exported to Japan was 271 Japanese yen (US$2.43) per kilogram, higher than China's 218 yen. Lao exporters cannot reach Japan with frozen green soybeans due to a transport infrastructure constraint.

Supply – Vegetable soybean is a type of soybean from which the immature pod is harvested and used as a fresh or frozen vegetable. As of 2014, vegetable soybean was grown on more than 300,000 hectares globally, with an annual production of 1.8 million mt, with China accounting for more than 90% of the production. Other countries producing vegetable soybean include Japan, Taiwan, Thailand, Indonesia, and Vietnam.

3.2.2 Margins

Producer Margin –
* Producer Price if farmer produces and owns the green soybeans = 9000 kip/kg – 1.486 Kip/kg = 7.514 Kip/kg. However, there is limited domestic demand for green soybeans.
** Producer Price if Hailin Co. owns green soybeans that are produced. Laos farmers in Xaignabouli and Luang Prabang provinces rent their farmland to and produce green soybeans for various Chinese companies including the Hailin Fresh Soybean Development Company, LTD, a Chinese owned company that collects the green soybean from the farmers and exports green soybeans to the China market. In 2017 and 2018 the company managed to rent 184 ha in Xaignabouli, however, more recently the Company intended to rent farmland in Nan district in Luang Prabang. However, the COVID problem prevented the export of the soybeans to China and interrupted production. The green soybean production is again being done in 2022 by farmers on the RSPs in both Xaignabouli and Luang Prabang provinces. The current rent the farmers are paid by the Hailin Co. is 4,180,000 Kip/hectare ($357/ha). The farmers are also paid 70,000 Kip/day for 15 days of work in growing the crop.

Table 3. Prices and Margins of the Green Soybeans Value Chain

High Value Crop	Producer				Collector			Wholesaler			Retailer			Exporter		
	Yield	COP	PP	PM	COC	CP	CM	COW	WP	WM	COR	RP	RM	COE	EP	EM
	1000 Kg/HA	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG
Green Soybeans – Farmer owns production*	3.5	1.486	9	7.514	9.178	9.5	0.323	-	-	-	10.395	12	1.605	-	-	-
Green Soybeans – Chinese Hailin Co. owns production**	Farmer rents land @ 4,180,000 Kip/ha; provides 15 days of labor @70,000 Kip/day			4.180	7.5	15	7.5	-	-	-	-	-	-	?? In China	?? In China	?? In China

Green Soybean (Farmer owed) Margin	Margin (1000 kip/kg)
Producer Margin	7.514
Collect Margin	0.323
Retailer Margin	1.605

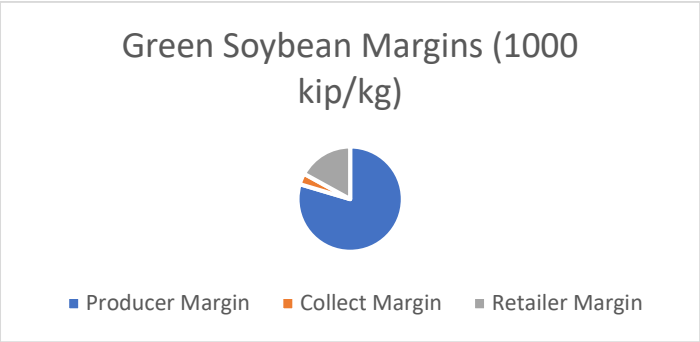


Figure 5. Comparative Margins of Producer to Retailer Levels of the Green Soybean Value Chain

Collector Margin = *Local Collector sells green soybeans to retailer in VTE/LPB at a price of 9500 Kip/kg – 9178 kip/kg = 322 Kip/kg
**Company as Collector transports green soybeans to China Agent who sells to consumers at about 15,000 Kip/kg) – (total costs of rent, production inputs, labor, cold storage, etc./total yield (kg/hectare)

Margin = 15,000 Kip/kg – (60,000,000/8000 mt soybeans) = 7500 Kip/kg

Retailer Margin =

Retailer Price = 12,000 Kip/kg

Retailer Margin = 12,000 Kip/kg – 9500 Kip/kg – 0.895 Kip/kg = 1.605 Kip/kg

3.2.3 Seasonality, Product Quality, Competition, etc.

Seasonality - The agroecological features of the Louangphabang and Xaignabouli provinces provide the company with the opportunity to sell on the China green soybean market before the Chinese main season harvest occurs.

3.3 PEANUTS

3.3.1 Demand and Supply

Demand – In 2020, the 5 countries that consume the most peanuts are China, India, Nigeria, USA, and Indonesia. The 5 top importing countries of peanuts were China, Netherlands, Indonesia, Germany and Russia who imported (in total value) 51.4% of total imports.

Country	Consumption (ml mt)
China	17.371
India	5.628
Nigeria	3.000
USA	2.314
Indonesia	1.311
Vietnam	0.670
Brazil	0.330

Overall spending on imported peanuts expanded by 170.6% over the 5-year period starting in 2016 and increased by 23.6% year over year since 2019. Below are the 20 best buying markets as measured by the highest dollar value worth of peanuts imported during 2020, for any peanuts regardless of whether shelled or not.

1. China: US$835.6 million (20.3% of total imported peanuts)
2. Netherlands: $537.1 million (13.1%)
3. Indonesia: $336.9 million (8.2%)
4. Germany: $213.6 million (5.2%)
5. Russia: $189.6 million (4.6%)
6. United Kingdom: $177.2 million (4.3%)
7. Vietnam: $151.1 million (3.7%)
8. Canada: $147.9 million (3.6%)
9. Mexico: $143.5 million (3.5%)
10. Poland: $98.2 million (2.4%)
11. Italy: $85.7 million (2.1%)
12. Spain: $75.3 million (1.8%)
13. Algeria: $68.7 million (1.7%)
14. Thailand: $68.1 million (1.7%)
15. Malaysia: $67.9 million (1.7%)
16. France: $65.7 million (1.6%)
17. Australia: $41.4 million (1%)
18. Belgium: $40.3 million (1%)
19. South Africa: $39.7 million (1%)
20. Ukraine: $39 million (0.9%)

By value, the listed 20 countries bought 83.2% of globally imported peanuts in 2020. Among the top importers, the fastest-growing peanuts importers since 2019 were: mainland China (up 159.8%), United Kingdom (up 42.7%), Australia (up 37.5%) and Vietnam (up 35.6%). Those countries that posted declines in their imports of peanuts were led by: Mexico (down -5.9%), Indonesia (down -3.5%), South Africa (down -3.4%), Russia (down -3%) and Italy (down -1.5%).

The following countries paid the lowest average unit prices for imported in-shell peanuts in 2020.

1. Burkina Faso: US$11 per ton (down -86.4% from 2019)
2. Mali: $37 per ton (down -50%)
3. Guinea: $85 per ton (down -3.4%)
4. Honduras: $91 per ton (2019 data unavailable)
5. Niger: $123 per ton (up 41.4%)
6. Kenya: $143 per ton (down -89.9%)
7. Timor-Leste: $158 per ton (2019 data unavailable)
8. Liberia: $191 per ton (2019 data unavailable)
9. Ghana: $212 per ton (up 34.2%)
10. Botswana: $267 per ton (down -85.2%)
11. Burundi: $346 per ton (2019 data unavailable)
12. Philippines: $364 per ton (up 58.3%)
13. Zambia: $411 per ton (up 927.5%)
14. Laos: $450 per ton (2019 data unavailable)
15. South Africa: $508 per ton (down -29%)
16. China: $569/ton

There were 5 double-digit reductions in average unit price paid per ton for in-shell peanuts from 2019 to 2020 namely low-cost importers Kenya (down -89.9%), Burkina Faso (down -86.4%), Botswana (down -85.2%), Mali (down -50%) and South Africa (down -29%).

The following countries paid the highest average unit prices for imported in-shell peanuts (change from 2019)

1. Mozambique: US$14,000 per ton (2019 data unavailable)
2. Nigeria: $9,000 per ton (2019 data unavailable)

3. New Zealand: $4,857 per ton (up 42.9% from 2019)
4. Ireland: $4,333 per ton (down -3.7%)
5. Maldives: $4,300 per ton (up 97.8%)
6. Bahamas: $4,143 per ton (up 42%)
7. Somalia: $4,000 per ton (2019 data unavailable)
8. Malawi: $3,803 per ton (down -18.3%)
9. Norway: $3,167 per ton (up 14.7%)
10. Gibraltar: $3,000 per ton (up 9.1%)
11. United States: $2,667 per ton (2019 data unavailable)
12. Switzerland: $2,654 per ton (up 7.8%)
13. Seychelles: $2,400 per ton (down -52%)
14. Slovenia: $2,306 per ton (down -16.3%)
15. Moldova: $2,250 per ton (up 58.7%)

The 5 double-digit accelerations in terms of higher average unit prices paid in 2020 compared to 2019 were experienced by importers in Maldives (up 97.8%), Moldova (up 58.7%), New Zealand (up 42.9%), Bahamas (up 42%) and Norway (up 14.7%).

Peanut consumption in Laos is large (per capita consumption = ??), with current production in Laos far below the quantity demanded. The main export market is Thailand, with some traders (from Lao Nam) selling directly to Pakse and Vientiane. The Lao Nyam Agricultural Products Trader Association reported that, in 2015, their members' dry peanut trade volume was 2,000 tons; the price offered to farmers was 12,000 Kip to 13,000 Kip per Kg of nuts (husked/milled) (approx. 1.5 USD/kg) with the conditions of moisture being less than 14%. The harvested peanut must be sun-dried to reduce the moisture content.

Peanuts from Luang Prabang province are marketed locally, in major wet markets in Vientiane and Luang Prabang provinces, and in export markets, namely, Thailand. Peanuts with shell are sold as washed or unwashed, shelled with skin or without skin. Value addition (3 times the peanut price) to peanuts includes producing snacks with sugar cane.

Supply - World Production: 50,606,000 MT (Updated 03/2022). The global supply of peanuts has grown by 20% in the past 10 years. The top 5 producing countries of peanuts were China, India, Nigeria, USA, and Sudan who produced 69.6% of the total. In 2020, exports of peanuts were worth a total US$3.93 billion. The top 5 exporting countries of peanuts were Argentina, India, USA, Brazil and Sudan who sold 71.4% of the total peanuts exported.

Country	%	Production (ml mt)	Export % (ml mt)
China	36%	(18.2 ml mt)	7%
India	13%	(6.8 ml mt)	29%
Nigeria	9%	(4.8 ml mt)	
USA	6%	(2.9 ml mt)	18%
Sudan	5%	(2.5 ml mt)	?%

Below are the top 20 countries that exported the highest dollar value worth of peanuts during 2020, regardless of whether the shipped peanuts were in-shell or shelled. Among the top exporters, the fastest-growing peanuts exporters since 2019 were: Myanmar also called Burma (up 312.2%), Sudan (up 147.7%), Argentina (up 98.7%) and South Africa (up 71.2%). Four countries posted declines in their exported peanuts sales namely: mainland China (down -22.3%), Madagascar (down -18.6%), Belgium (down -15%) and Nicaragua (down -7.4%). (Hyperlink: https://www.worldstopexports.com/top-peanuts-exports-imports-by-country-plus-average-prices/)

1. Argentina: US$860.4 million (21.9% of total exported peanuts)
2. India: $749.3 million (19.1%)
3. United States: $573.4 million (14.6%)
4. Brazil: $318.9 million (8.1%)
5. Sudan: $304.6 million (7.7%)
6. Netherlands: $234.6 million (6%)
7. China: $204.9 million (5.2%)
8. Senegal: $197.6 million (5%)
9. Nicaragua: $89.7 million (2.3%)
10. Vietnam: $65.9 million (1.7%)
11. Malawi: $39.6 million (1%)
12. Germany: $31.5 million (0.8%)
13. Belgium: $25.7 million (0.7%)
14. Israel: $23.2 million (0.6%)
15. South Africa: $16.8 million (0.4%)
16. Uzbekistan: $16.5 million (0.4%)
17. United Arab Emirates: $9.5 million (0.2%)
18. Myanmar: $8.6 million (0.2%)
19. Madagascar: $8.27 million (0.2%)
20. Turkey: $6.28 million (0.2%)

By value, the listed 20 countries shipped 96.3% of globally exported peanuts in 2020.

The production area of peanuts in Laos was
2013-14 on 6720 ha
2014-15 on 5694 ha
2015-16 on 6497 ha

3.3.2 Margins

Table 4. Prices and Margins of the Peanut Value Chain

High Value Crop	Producer				Collector			Wholesaler			Retailer			Exporter		
	Yield	COP	PP	PM	COC	CP	CM	COW	WP	WM	COR	RP	RM	COE	EP	EM
	1000 Kg/HA	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG
Peanuts	3.5	1.49	3.5	2	4.04	5	0.96	5.54	10	4.46	10.1	15	9.86	10.721	18.135	7.414

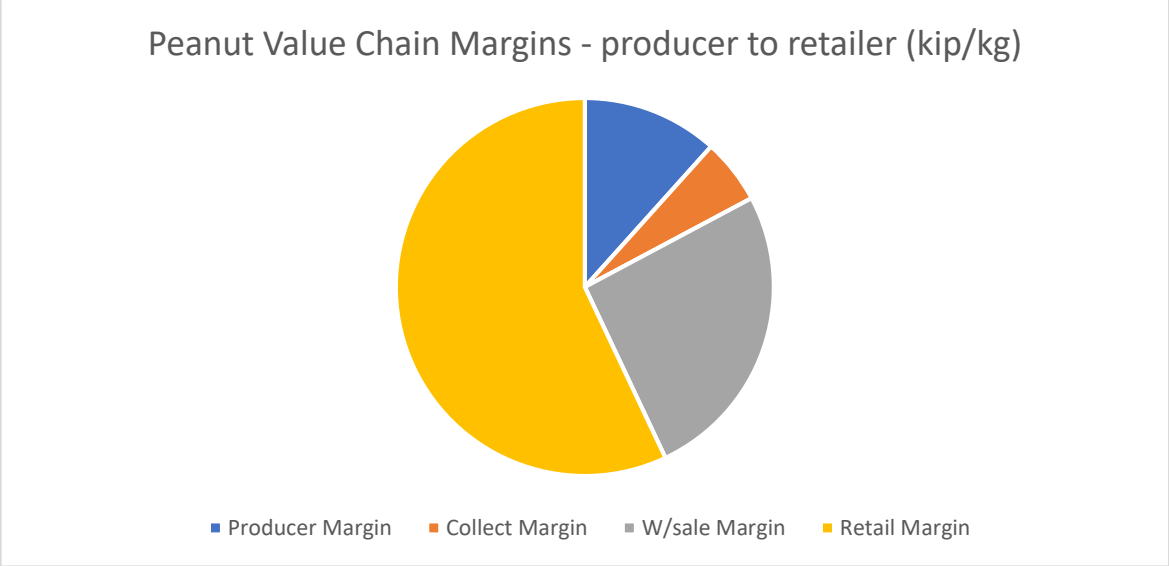


Figure 6. Comparative Margins of Producer to Retailer Levels of the Peanut Value Chain

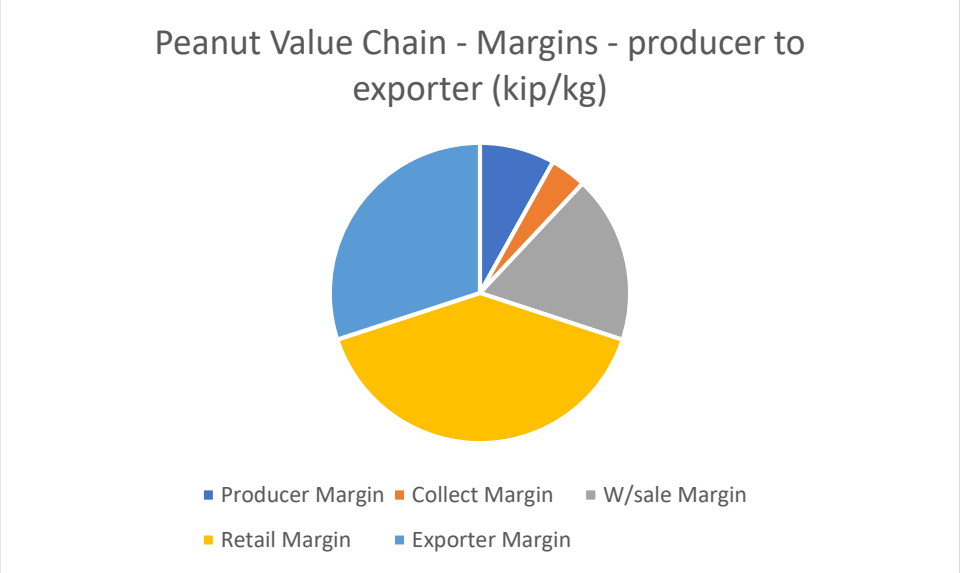


Figure 7. Comparative Margins of Producer to Exporter Levels of the Peanut Value Chain

Peanut Margins	**Margin (1000 kip/kg)**
Producer Margin	2
Collect Margin	0.960
W/sale Margin	4.460
Retail Margin	9.860
Exporter Margin	7.414

Producer Margin

COP Kip 1490/kg; farmgate price $1.11/kg; Yield = 3500 kg; income = 9000 Kip/kg * 166 kg/ha; margin 2014 Kip/kg ($479/ha)

Peanuts are typically cultivated in small areas and have a high labor requirements, making the crop suitable for poorer households with limited land. Mechanical tools to reduce such are reportedly available in Thailand and could be introduced on a trial basis. Due to peanut capacity to fix nitrogen, peanuts require less nitrogen-containing fertilizer and improve soil fertility, making them valuable in crop rotations,

Price = Kip 3500/kg; margin = Kip 2000/kg

Collector Margin

Price = Kip 5000/kg; margin = Kip 960/kg

Wholesaler Margin

Price (unshelled, unwashed) = Kip 6000/kg ($0.52/kg); margin = Kip 455/kg

The wholesale price in Lao kip is LAK 5102 per kg. The average wholesale price US$ 510/mt in Pakse and Vientiane (Ref: Selina Wamuchii, March 2022).

Price (shelled, with skin) = Kip 19,000/kg; margin = Kip 12,965/kg

Retailer Margin

Price (shelled, unwashed) = Kip 10000/kg; margin = Kip 4855/kg ($0.42/kg)

Price (unshelled, with skin) = Kip 30000/kg, margin = Kip 2855/kg ($0.25/kg)

Exporter Margin

Price (unshelled) cfr Rotterdam $1550/mt

The average unit price paid by global importers of peanuts still in-shell was $907 per ton in 2020. That dollar amount reflects a -18.5% decrease from the average tonnage rate of $1,113 during 2019. In June 2016, the average import price of Lao peanuts in Thailand was Baht 27/kg ($0.77/kg) as compared to peanuts from China (Baht 50/kg, $1.42/kg), Vietnam (Baht 33/kg, $0.94/kg), Myanmar (Baht 50/kg, $1.42/kg).

Argentina shelled peanuts https://www.indexmundi.com/commodities/?commodity=peanuts

Table 5. Monthly Average Prices of Argentine Shelled Peanuts in 2021-22

Month	Price	Change
Aug 2021	1,443.18	-
Sep 2021	1,476.14	2.28%
Oct 2021	1,539.29	4.28%
Nov 2021	1,552.27	0.84%
Dec 2021	1,475.00	-4.98%
Jan 2022	1,479.55	0.31%

.

Total export value, price, and quantity of exported peanuts from Laos were

2015 2000 mt to Torkhek Songmek Lao-Thai border
2016 US$ 14.788 ml (US0.77/kg) = 19,205 mt
2017 US$ 3.577 ml (US$1.46/kg) = 2450 mt
2018 US$ 5.234 ml (US$1.34/kg) = 3906 mt
2019 US$ 7.559 ml (US$0.51/kg) = 14,822 mt

Laos exports of raw peanuts to Thailand was US$7.33 Million (@0.51/kg) during 2019, according to the United Nations COMTRADE database on international trade.

3.3.3 Seasonality, Product Quality, and Value Added

Peanuts are planted as a rotation crop in place of rice, after the rice is harvested. The legume nourishes and aerates the soil and fixes the nitrogen. The shells make great compost.

Low prices paid for Lao peanuts is a result of the peanuts being of mixed varieties and grades, and poor post-harvest treatment. There is considerable potential to increase the market value of Lao peanut production through improving these factors. If all traders promoted the use of a standard variety of peanut and volumes were able to be secured then additional price margins are likely to be gained from their Thai buyers.

Whole peanuts can be dry roasted, boiled, baked or eaten raw as a snack food. Peanuts are also ingredients to make peanut oil, peanut butter and peanut flour. See Sae Lao Project on peanut butter. https://www.saelaoproject.com/environment/rice-peanut-farming/

Farmers can mill their well dried peanut at villages which have milling facilities or can have them milled free of charge by traders at their warehouses.

Peanut sales are made at the Lao-Thailand border crossing with Thai traders who then bulk up supply before sending truck loads to the main Thai markets. This approach depresses the price that Lao traders are able to attain. A more in-depth value chain study needs to explore the nature of these Thai traders and identify opportunities for Lao traders to trade directly to the main Thai markets.

Little-known industrial uses for peanuts encompass paint, varnish, lubricating oil, leather dressings, furniture polish, insecticides, soap and cosmetics. Peanut shells go into making plastics, wallboard, abrasives, rayon cellulose used for paper, mucilage and fuel.

3.4 CHILI PEPPERS

3.4.1 Demand and Supply

Demand – The global chili pepper consumption peaked at $4.2B (about 780,000 mt) in 2017, and then declined to $4.1B (752,000 mt) in 2018. The countries with the highest volume of pepper consumption in 2018 were Viet Nam (166,000 mt (valued at $904 ml)), India (86,000 mt (valued at $506 ml)) and the U.S.A. (68,000 mt (valued at $374 ml)), with a combined 41% share of global consumption, followed by another 33% by Bulgaria, Indonesia, China, Singapore, Malaysia, Sri Lanka, Germany, the United Arab Emirates and the UK. The countries with the highest levels of pepper per capita consumption in 2018 were Bulgaria (7.641 kg per capita), Singapore (5.288 kg per capita) and Viet Nam (1.724 kg per capita). Market performance is forecasted to decelerate, expanding with an anticipated compounded annual growth rate of +1.2% for the seven-year period from 2018 to 2025, which is projected to bring the market volume to 840K mt by the end of 2025.

Global imports totaled 414,000 mt (valued at $2.1 billion) in 2018, picking up by 8.6% against the previous year. The total import volume increased at an average annual rate of +2.9% over the period from 2007 to 2018; the trend pattern remained relatively stable, with somewhat noticeable fluctuations being observed in certain years. the major importing countries of chili peppers were the USA (75,000 mt, valued at $391 million), distantly followed by Viet Nam (35,000 mt), Germany (32,000 mt) and India (31,000 mt), together creating 42% of total imports. The following importers - the United Arab Emirates (16,000 mt), the UK (13,000 mt), France (11,000 mt), the Netherlands (11,000 mt), Spain (10,000 mt), Japan (9,500 mt), Pakistan (8,200 mt) and Russia (8,000 mt) - together made up 21% of total imports. From 2007-2018, Viet Nam was the fastest growing pepper importer in the world, with a compounded annual growth rate of +21.5% (Ref: Global News Wire – Research and Markets, World Pepper Market 2020: Historic Review of 2007-2018 with Projections to 2025). Over the period under review, global pepper imports attained their maximum in 2018 and are likely to see steady growth in the near future.

In Laos, the demand for chilis in the major markets in Laos is primarily for fresh red or dried red chili peppers, with much being imported from Vietnam.

Supply - Around 34.5 million ton of green chilies and around 3.9 million ton of dried chilies were produced worldwide in the year of 2016. China was the world's largest producer of green chili, providing half of the global total. Global pepper harvested area peaked at 622,000 hectares in 2007. Based on 2018 figures, pepper production increased by +55.4% against 2012 indices. The pace of growth was the most pronounced in 2016 with an increase of 11% against the previous year. Global

production reached 758 mt (produced on 570,000 hectares) in 2018 and is likely to continue its growth. The general positive trend in terms of pepper output was largely conditioned by a tangible increase of the harvested area and a resilient expansion in yield figures. The countries with the largest volume of pepper production in 2018 were Viet Nam (273K mt), ~36% of the total, Indonesia (88K mt), 12%, and Brazil (80K mt), 11%. Global average pepper yield amounted to 1.3 mt per hectare in 2018. In general, the yield increased from 2007 to 2018 at an average annual rate of +4.0%.

Global exports in 2016 and in 2018 totaled 398,000 mt and 392,000 mt (valued at about $2 billion, and about 52% of the total world pepper produced in 2018), respectively. The largest 3 exporting countries (exporting 64% of the total) were Viet Nam which exported 142,000 mt (valued at $743 million), Brazil (73,000 mt, valued at $243 million), and Indonesia (36,000 mt, valued at $200 million). Other exporting countries included India (17,000 mt), Germany (16,000 mt), Sri Lanka (15,000 mt), Malaysia (12,000 mt), Mexico (8,400 mt), the Netherlands (7,500 mt), France (6,800 mt) and the U.S.A. (6,800 mt).

India, the world's biggest exporter of red chilis, shipped out 578,800 mt in 2021, up nearly 8% from a year ago. (Ref: https://economictimes.indiatimes.com/news/economy/foreign-trade/red-chili-pepper-prices-surge-on-crop-damage-in-top-exporter-india/articleshow/90047378.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst)

3.4.2 Margins

Table 6. Prices and Margins of the Chili Pepper Value Chain

High Value Crop	Producer				Collector			Wholesaler			Retailer			Exporter		
	Yield	COP	PP	PM	COC	CP	CM	COW	WP	WM	COR	RP	RM	COE	EP	EM
	1000 Kg/HA	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG
Chili Pepper	0.98	5.26	10	4.62	10.18	11	0.82	11.54	12	0.46	10.14	16	4.86	17.3	27.4	10.66

Chili Pepper Margin	Margin (1000 kip/kg)
Producer Margin	4.623
Collect Margin	0.823
W/sale Margin	0.455
Retail Margin	4.855
Export Margin	10.657

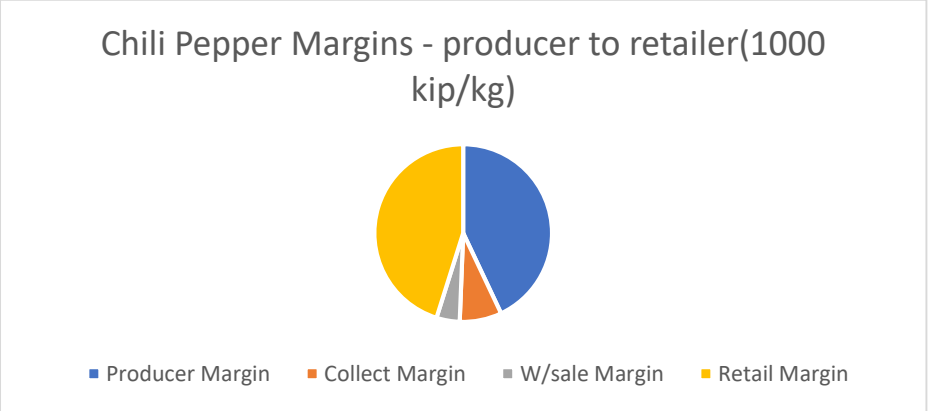


Figure 8. Comparative Margins of Producer to Retailer Levels of the Chili Pepper Value Chain

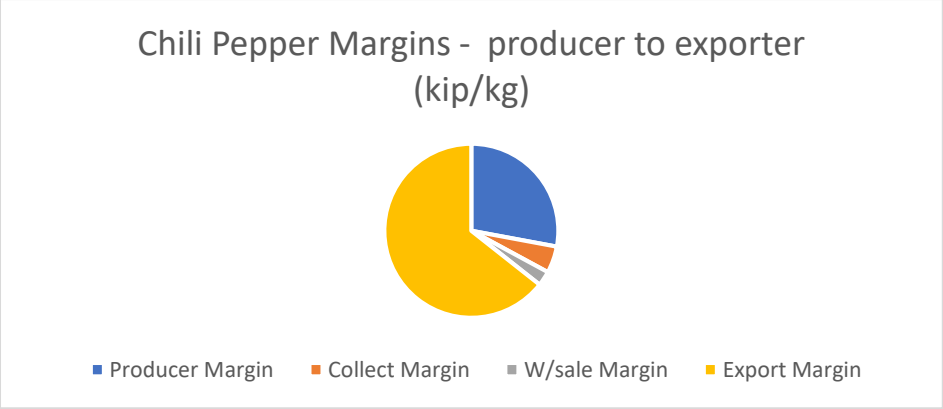


Figure 9. Comparative Margins of Producer to Exporter Levels of the Chili Pepper Value Chain

Farmgate Margin

Price: Kip 10,000/kg

Producer Margin: 4623 Kip/kg ($385/hectare)

Collector Margin

Price: Kip 11,000/kg

Collector Margin: Kip 820/kg

Wholesaler Margin

Price: Kip 12,000/kg

Wholesaler Margin: Kip 460/kg

Retailer Margin

Price: Kip 16,000/kg (Note: Lao Red chili pepper with stem: Kip 16,000/kg (Ref: Mrs. Koong: Lady retailer mobile # 55334100 - Non Kha New Market on 5 March 2022)

Retailer Margin: Kip 4860/kg

Exporter Margin

Price: Kip 27,400/kg

Exporter Margin: 10,660/kg

As of March 7, 2022, the prices of red chilli peppers were surging as output in top exporter India were set to drop by a fifth from a year ago, hit by an invasive pest attack and damage from unseasonal rain in key southern producing states. Lower production has boosted prices by 80% in four months to a

record high and prices are likely to stay high through the year, forcing overseas buyers to shell out more at a time when the prices of fuel and other food ingredients are also soaring.

Bangladesh, China, Indonesia, Malaysia, Nepal, Sri Lanka, Thailand and the United States accounted for the bulk of India's exports of $1.3 billion in 2021. Wholesale prices in India's biggest spot market of Guntur have risen to 180,000 rupees ($2,340) per mt from about 100,000 rupees in November (2021). In 2018, the average chili export price amounted to $5,214 per mt, going down by -14.2% against the previous year. The global export price peaked at $8,660 per mt in 2015; however, from 2016 to 2018, export prices remained at a lower figure. Prices varied noticeably by the country of origin; the country with the highest price was the Netherlands ($8,605 per mt), while Mexico ($2,602 per mt) was among the lowest. In general, the pepper import price, however, continues to indicate noticeable growth. Prices varied noticeably by the country of destination; the country with the highest price was the United Arab Emirates ($8,027 per mt), while Viet Nam ($2,485 per mt) was among the lowest. From 2007 to 2018, the most notable rate of growth in terms of prices was attained by the United Arab Emirates, while the other global leaders experienced more modest paces of growth (Ref: Global News Wire). https://economictimes.indiatimes.com/news/economy/foreign-trade/red-chilli-pepper-prices-surge-on-crop-damage-in-top-exporter-india/articleshow/90047378.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst

3.4.3 Seasonality, Product Quality, Value Added, and Competition

Seasonality - Lao red chili peppers are more expensive (Kip 20,000/kg) during the wet season (June – Dec).

Product Quality - Red chili peppers are the preferred color of chili peppers by Lao and international consumers. The same size of chili that is green sells for a discount compared to red chili peppers. Part of the problem with selling Laos chili peppers is that there is typically a significant percentage of green colored peepers being sold.

Value Added - Dried red chilli pepper can be stored for up to one year, but best consumed before 6 months

Competition - In the dry season, Thai and Vietnamese red chili are the most significant competitors for Laos red chili in the main markets of Vientiane. The dried red chili pepper from Vietnam was selling at the VTE Capital market for Kip 45,000/kg on 5 March 2022, while the Laos fresh chili pepper was selling for Kip 10,000/kg. The Laso chili pepper retailer stated that Laos dried red chili is preferred by the Laos consumer but also is much more expensive (Kip 100,000/kg).

Part of the difference between the Lao and the Thai (and Vietnamese) red chili is the extent or % of red chilis being sold. In the case of Thai chilis on 5 March in the TTL Wholesale market, the small green/red mixed chili pepper price was 28,000 Kip/kg, the large green/red chili pepper was 30,000 Kip/kg; and the large mostly red chili peppers' price was 37,000 Kip/kg.

3.5 BLACK SESAME

3.5.1 Demand and Supply

Demand

About 70% of the world's sesame seed, that is, mostly white sesame seed, is used to produce oil and meal. Black sesame is a high-value ingredient (in the confectionary industry) that is in demand in many developed countries, including Japan. In the international market, it is priced significantly higher than white sesame and the other colored sesame seeds. Among the various countries that export black sesame, Myanmar is able to export over 2000 mt of black sesame to Japan each year. Laos has not exported black sesame, however, the quantity of black sesame demanded in the international market continues to grow.

Supply

The world sesame production is about 5,532,000 metric tons.[3] Asia and Africa produce nearly 97% of the world's supply of sesame. In 2018, 6,016,000 mt were grown worldwide on 11,743,000 ha with an average yield of 512 kg/ha. Average sesame yield is found to be highest in China (1223 kg/ha) followed by Nigeria (729 kg/ha) and Tanzania (720 kg/ha), and Myanmar (525 kg/ha on 12.78 % of the world's production area).

Myanmar is one of the top ten sesame producing countries and ranks the third largest in cultivated area and the second largest in production. In Myanmar, sesame is grown by small and medium farmers and they harvest sesame manually, which is a highly labor-intensive operation. Sesame is an economically important crop not only for producing edible oil but also for domestic and international markets. It is also an essential component for Myanmar cultural ceremonies and traditional food. Sesame thrives well in a harsh environment and requires limited fertilizer, water, and litter without the need for the use of pesticides due to high levels of natural tolerance for diseases and insects. The supply of sesame is affected by postharvest practices. Postharvest loss is the loss of grain between the moments of harvest and consumption that occurs at all stages of postharvest handling: processing, transportation, storage, packaging, and marketing. The major determinant sources of sesame postharvest losses were farm size, total sesame grain produced, weather conditions, distance when piles are transported, stacking days, the distance of the sesame farm, and mode of grain transportation [19]. High production and postharvest losses are also challenges [20]. The serious loss in quantity and quality that occur in oilseeds is mainly due to the adoption of improper postharvest technologies. This leads to the incidence of damaged, discolored, shriveled, and malodorous kernels in the product.

[3] Sustainable Sesame (Sesamum indicum L.) Production through Improved Technology: An Overview of Production, Challenges, and Opportunities in Myanmar by Daisy Myint, Syed A. Gilani, Makoto Kawase, and Kazuo N. Watanabe,

3.5.2 Margins

Table 7. Prices and Margins of the Black Sesame Value Chain

High Value Crop	Producer				Collector			Wholesaler			Retailer			Exporter		
	Yield	COP	PP	PM	COC	CP	CM	COW	WP	WM	COR	RP	RM	COE	EP	EM
	1000 Kg/HA	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG
Black Sesame	1	3.482	9	5.518	9.89	10.5	0.61	-	-	-	10.645	15	4.355	11.904	17.96	6.056

Black Sesame Margins	Margin (1000 kip/kg)
Producer Margin	5.518
Collect Margin	0.610
Retailer Margin	4.355
Exporter Margin	6.056

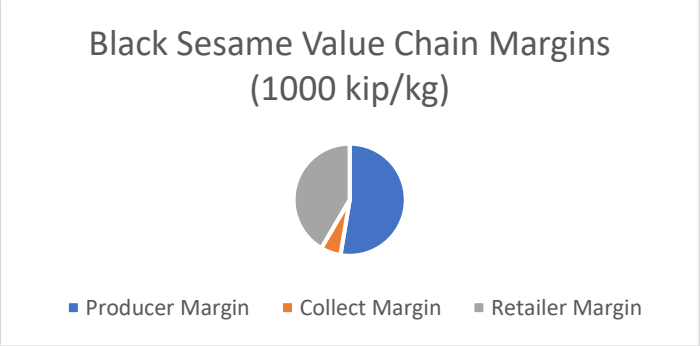


Figure 10. Comparative Margins of Producer to Retailer Levels of the Black Sesame Value Chain

Producer Margin

Producer Price: 9,000 Kip/kg

Producer Margin: 9,000 Kip/kg – 3,482Kip/kg = 5,518 Kip/kg ($472/ha)

Collector Margin

Collector Price: 10,500 Kip/kg

Collector Margin: 10,500 Kip/kg – 9,890 Kip/kg = 610 Kip/kg

Wholesaler Margin (not available)

Wholesale Price

Wholesale Margin

Retailer Margin

Retailer Price: 10,645 Kip/kg

Retailer Margin: 15,000 – 10,645 Kip/kg = 4,355 Kip/kg

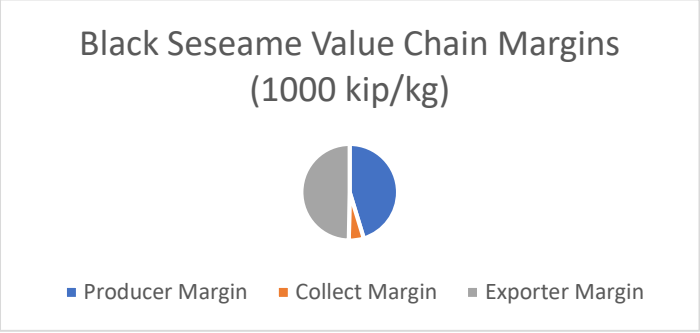


Figure 11. Comparative Margins of Producer to Exporter Levels of the Black Sesame Value Chain

Exporter Margin

Exporter Price: 17,960 Kip/kg

Exporter Margin: 17,960 Kip/kg – 11,904 = 6,506 Kip/kg

3.5.3 Seasonality, Product Quality, and Value Added

Seasonality

Regional black sesame prices tend to be highest in October-January and lowest in June-July.

Product Quality

Most of the farmers are still struggling to meet the high standards required by the foreign markets because of poor agronomic practices, and weather-related crop failures result in low yields and large pre- and postharvest losses. Development of high-yielding varieties with better quality and with non-shattering traits, and tolerance to biotic and abiotic stress should be encouraged to increase the sesame productivity.

Food safety issues are of particular importance for international trade for sesame seeds and its products. A common requirement for importing countries is that the crop is produced under Global GAP (Good Agricultural Practice) standards. Market standardizations, grades, and requirements depend on countries that used the end-products. As an example of an Asian country that has done well in exporting over 2000 mt of black sesame annually to Japan, Myanmar has standards and technical regulations, as well as SPS (Sanitary and Phytosanitary Measures) mainly based on an international standard such as food standards, which are adopted from CODEX. Standard specifications and GAP guidelines are used to inspect exported and imported agricultural products. Myanmar's sesame seeds have the specification for export, that is, seed purity (98%–99%), oil content (48%–51%), free fatty acid (2% Max), admixture (1%), other color mixed (2% Max), moisture (8% Max), clean, dry, and no mold.

Value Added

For the Laos black sesame value chain (VC) actors to export black sesame to Japan, the requirements are to meet the specifications that Myanmar exporters have been meeting for many years. Japan requires a clean, dry, no mold product and for Laos VC actors to be able to assure such a product, cleaning, grading, color sorting, and product traceability is required.

3.6 LEAFY VEGETABLES - CABBAGE

3.6.1 Demand and Supply

Demand - The global cabbage market revenue amounted to $39.4B in 2018, dropping by -3% against the previous year. This figure reflects the total revenues of producers and importers (excluding logistics costs, retail marketing costs, and retailers' margins). The market value increased at an average annual rate of +3.1% from 2007 to 2018; the trend pattern indicated some noticeable fluctuations being recorded throughout the analyzed period. The most prominent rate of growth was recorded in 2010 when the market value increased by 14% year-to-year. Global cabbage consumption peaked at $43.7B in 2016; however, from 2017 to 2018, consumption failed to regain its momentum. The country with the largest volume of cabbage consumption was China (33M mt), comprising approx. 45% of total consumption. Moreover, cabbage consumption in China exceeded the figures recorded by the world's second-largest consumer, India (9.2M mt), fourfold. The third position in this ranking was occupied by Russia (3.7M mt), with a 5.2% share. The countries with the highest levels of cabbage per capita consumption in 2018 were Romania (57 kg per person), South Korea (46 kg per person) and Ukraine (39 kg per person). Driven by increasing demand for cabbage worldwide, the market is expected to continue an upward consumption trend through 2025. Market performance is forecast to

retain its current trend pattern, expanding with an anticipated CAGR of +1.4% for the seven-year period from 2018 to 2025, which is projected to bring the market volume to 80M mt by the end of 2025.

In 2018, the global exports of cabbage and other brassicas totaled 2.5M mt, surging by 7.2% against the previous year. The total export volume increased at an average annual rate of +3.4% over the period from 2007 to 2018; however, the trend pattern indicated some noticeable fluctuations being recorded over the period under review. The most prominent rate of growth was recorded in 2011 when exports increased by 16% year-over-year. Over the period under review, global cabbage exports reached their maximum in 2018 and are likely to see steady growth in the near future. In value terms, cabbage exports amounted to $1.7B in 2018. Over the period under review, the total exports indicated a resilient expansion from 2007 to 2018: its value increased at an average annual rate of +3.4% over the last eleven years. Global cabbage exports attained their peak figure in 2018 and are expected to retain its growth in the near future. China was the largest exporter of cabbage and other brassicas in the world, with the volume of exports reaching 990K tonnes, which was near 39% of total exports in 2018. The U.S. (220K tonnes) ranks second in terms of the total exports with a 8.7% share, followed by the Netherlands (8.3%), Spain (6.2%) and Mexico (5.7%). Canada (85K tonnes), Poland (84K tonnes), Italy (72K tonnes), Germany (66K tonnes) and Macedonia (57K tonnes) followed a long way behind the leaders.[4] Exports from China increased at an average annual rate of +7.0% from 2007 to 2018. At the same time, Macedonia (+11.5%), Spain (+9.3%), Mexico (+6.1%), Canada (+5.6%) and the Netherlands (+3.1%) displayed positive paces of growth. Moreover, Macedonia emerged as the fastest growing exporter in the world, with a CAGR of +11.5% from 2007-2018. The U.S. and Italy experienced a relatively flat trend pattern. By contrast, Germany (-2.2%) and Poland (-3.7%) illustrated a downward trend over the same period. While the share of China (+21 p.p.), Spain (+3.9 p.p.), Mexico (+2.7 p.p.), the Netherlands (+2.4 p.p.), Macedonia (+1.6 p.p.) and Canada (+1.5 p.p.) increased significantly in terms of the global exports from 2007-2018, the share of Poland (-1.7 p.p.) displayed negative dynamics. The shares of the other countries remained relatively stable throughout the analyzed period. In value terms, the largest cabbage markets worldwide were China ($398M), the U.S. ($344M) and the Netherlands ($194M), with a combined 54% share of global exports. Spain, Mexico, Italy, Canada, Poland, Germany and Macedonia lagged somewhat behind, together accounting for a further 32%.

Cabbage is one of a number of leafy vegetables that is consumed regularly by Lao consumers.

Supply - In 2018, the amount of cabbage and other brassicas (a genus that includes cabbage, swede, rape, and mustard) produced worldwide stood at 73M mt, picking up by 1.7% against the previous year. The total output volume increased at an average annual rate of +1.4% over the period from 2007 to 2018; the trend pattern remained relatively stable, with only minor fluctuations being observed in certain years. The pace of growth was the most pronounced in 2011 with an increase of 6.8% against the previous year. Global cabbage production peaked in 2018 and is expected to retain its growth in the near future. The general positive trend in terms of cabbage output was largely conditioned by slight growth of the harvested area and a relatively flat trend pattern in yield figures. In value terms, cabbage production totaled $40.5B in 2018 estimated in export prices. In general, the total output indicated prominent growth from 2007 to 2018: its value increased at an average annual rate of +1.4% over the last eleven years. The trend pattern, however, indicated some noticeable fluctuations being recorded throughout the analyzed period. Based on 2018 figures, cabbage production decreased by -11% against 2016 indices. The pace of growth appeared the most rapid in 2010 when production volume increased by 26% year-to-year. Global cabbage production peaked at $45.5B in 2016;

[4] Transport Costs and Prices in Lao PDR Unlocking the Potential of an Idle Fleet (2018 World Bank pub)

however, from 2017 to 2018, production failed to regain its momentum. In 2018, approx. 2.5M ha of cabbage and other brassicas were harvested worldwide; therefore, remained relatively stable against the previous year. The harvested area increased at an average annual rate of +1.3% over the period from 2007 to 2018. In 2018, the global average cabbage yield totaled 29 mt per ha, approximately reflecting the previous year. Overall, the cabbage yield continues to indicate a relatively flat trend pattern.

In 2018, approximately 2.3M mt of cabbage and other brassicas were imported worldwide; dropping by -10.3% against the previous year. The total import volume increased at an average annual rate of +2.4% over the period from 2007 to 2018; however, the trend pattern indicated some noticeable fluctuations being recorded over the period under review. The pace of growth appeared the most rapid in 2015 with an increase of 24% y-o-y. Over the period under review, global cabbage imports reached their peak figure at 2.6M mt in 2016; however, from 2017 to 2018, imports stood at a somewhat lower figure. In value terms, cabbage imports totaled $1.5B in 2018. Overall, the total imports indicated a conspicuous increase from 2007 to 2018: its value increased at an average annual rate of +2.4% over the last eleven years. The trend pattern, however, indicated some noticeable fluctuations being recorded throughout the analyzed period. Based on 2018 figures, cabbage imports decreased by -12.2% against 2016 indices. The most prominent rate of growth was recorded in 2011 with an increase of 16% against the previous year. Global imports peaked at $1.7B in 2016; however, from 2017 to 2018, imports failed to regain their momentum. n 2018, China, Hong Kong SAR (546K tonnes), distantly followed by the U.S. (225K tonnes), Canada (189K tonnes), Malaysia (176K tonnes), Russia (113K tonnes), Germany (112K tonnes) and Thailand (105K tonnes) represented the main importers of cabbage and other brassicas, together mixing up 64% of total imports. Singapore (64K tonnes), Japan (60K tonnes), the Czech Republic (53K tonnes), France (50K tonnes) and the UK (42K tonnes) occupied a minor share of total imports. Imports into China, Hong Kong SAR increased at an average annual rate of +6.3% from 2007 to 2018. At the same time, Thailand (+32.5%), Malaysia (+9.8%), France (+2.5%), the U.S. (+2.2%), Canada (+2.0%) and the Czech Republic (+1.2%) displayed positive paces of growth. Moreover, Thailand emerged as the fastest growing importer in the world, with a CAGR of +32.5% from 2007-2018. Singapore experienced a relatively flat trend pattern. Among the main importing countries, Thailand experienced the highest rates of growth with regard to imports, over the last eleven-year period, while the other global leaders experienced more modest paces of growth. The average cabbage import price stood at $641 per tonne in 2018, approximately reflecting the previous year. Over the period from 2007 to 2018, it increased at an average annual rate of +1.1%. The growth pace was the most rapid in 2013 when the average import price increased by 18% year over year. Over the period under review, the average import prices for cabbage and other brassicas attained their maximum at $692 per tonne in 2014; however, from 2015 to 2018, import prices failed to regain their momentum. There were significant differences in the average prices amongst the major importing countries. In 2018, the country with the highest price was Canada ($1,597 per tonne), while Russia ($315 per tonne) was amongst the lowest.

3.6.2 Margins

Table 8. Prices and Margins of the Cabbage Value Chain

High Value Crop	Producer				Collector			Wholesaler			Retailer		
	Yield	COP	PP	PM	COC	CP	CM	COW	WP	WM	COR	RP	RM
	1000 Kg/HA	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG
Cabbage	1.59	2.15	6	3.85	6.18	6.5	0.32	7.04	8	0.96	6.65	10	3.35

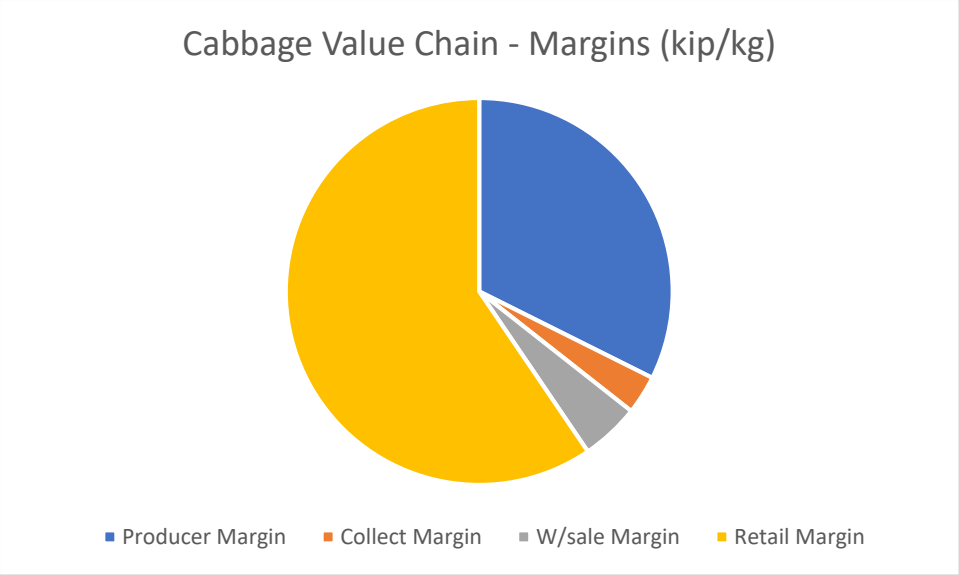


Figure 12. Comparative Margins of the Cabbage Value Chain

Cabbage Margin*	Margin (kip/kg)
Producer Margin	2.097
Collect Margin	0.210
W/sale Margin	0.318
Retail Margin	3.855

Producer Margin

Farmgate Price = 6000 Kip/kg – 2150 Kip/kg

Margin = 3850 Kip/kg ($329/ha)

Collector Margin

Price = 6500 Kip/kg

Margin = 320 Kip/kg

Wholesale Margin

Price = 8000 Kip/kg

Margin = 960 Kip/kg

Retail Margin

Price = 10,000 Kip/kg (VTE retail price at Vientiane Capital Organic market on 5 March 2022)

Margin = 3350 Kip/kg

Export Margin

The average global cabbage export price amounted to $682 per mt in 2018, coming down by -5.4% against the previous year. If the export price (cif by tandem truck to Bangkok) paid by the international buyer was the same ($682/mt) as in 2018, and the wholesale price in Laos (Vientiane wholesale market) of cabbage paid by the exporter was 6000 Kip/kg, the cost of reefer services (as per, e.g., the Thai Reefer Service Company) would need to be about 2000 Kip/kg (2 million Kip/mt or $4718/27600 mt tandem truck capacity) in order to breakeven. Further marketing margin survey work is needed here.

Intra-regional and intra-country transport costs - The average annual distance driven by Lao transport trucks is 55,000 kilometers. In comparison with other developing countries, Lao PDR is in the lower mid-range and is comparable to other developing, landlocked countries (i.e. Niger, Malawi, Ethiopia, Hungary, Czech Republic, etc.). The low annual mileage together with the high costs of capital and low profit margins prevent companies from investing in more expensive, yet more cost-efficient vehicles. This in turn increases variable operating costs and prevents them from competing with transport service providers from neighboring countries. This is exacerbated by the grim outlook for the transport industry. In recent years, declining transport demand together with new market entrants have led to significant overcapacity in the sector. As a result, many trucks remain idle for long periods of time.[5] Note that consolidation services (which are usually much higher than full truckload shipments). Transport prices vary greatly by the direction of transport (both in (1) and (2)). Lowest transport prices are observed on southern routes with an average of LAK 1,925 / LAK 622 per ton-km, followed by northern routes with an average of LAK 3,321 / LAK 869. The highest prices per ton/km are observed on central routes with an average of 5,057 / LAK 1,548. There are a number of explanations for this: The higher price of northern routes is likely due to the more mountainous topography and worse road condition (compared to southern routes)

3.6.3 Seasonality, Product Quality, and Added Value

Seasonality

The wet season is considered the highest price time of the year for fresh vegetables.

Product Quality

The shelf life of cabbage can be extended significantly if proper cold storage conditions are facilitated. However, the pre-feasibility of cold storage needs to be done.

Value added

Potential market premium price for organic cabbage in major Lao markets (Vientiane and Luang Prabang).

3.7 HERBS (Cilantro)

3.7.1 Demand and Supply

Demand - As the herbs are highly perishable, there is little/no opportunity for exporting from Laos. The markets demanding the herbs are limited to national, provincial, and local. The demand across these various markets is steady as these herbs are consumed on a daily basis

Supply – Cilantro leaves can be produced in 30 days, multi-cropping is very possible during the dry season. Coriander, the seeds from the cilantro plant, take about 90 days before being harvested.

[5] Transport Costs and Prices in Lao PDR Unlocking the Potential of an Idle Fleet (2018 World Bank pub)

3.7.2 Margins

Table 9. Prices and Margins of the Cilantro Value Chain

High Value Crop	Producer				Collector			Wholesaler			Retailer		
	Yield	COP	PP	PM	COC	CP	CM	COW	WP	WM	COR	RP	RM
	1000 Kg/HA	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG
Cilantro	1.5	2.08	6	3.92	6.18	6.5	0.32	7.04	8.33	1.288	8.478	13	4.522

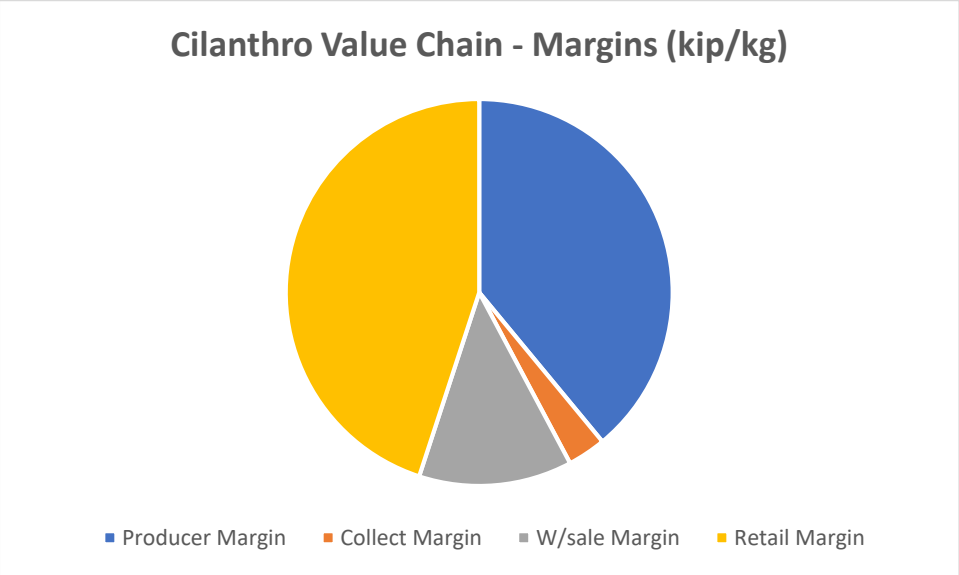


Figure 13. Comparative Margins of the Cilantro Value Chain

Producer Margin
Producer Price = 6000 Kip/kg (cilanthro bunches – 7 bundles per kg)
Producer Margin = 6000 Kip/kg – 2080 Kip/kg = 3920 Kip/kg (5,883,000 Kip/ha or $503/ha)

Collector Margin
Local Collector Price = 6500 Kip/kg
Local Collector Margin = 6500 Kip/kg - 6180 Kip/kg = 320 Kip/kg (sells to shopkeeper located within 10 kilometers from farm)

Wholesale Margin
Vientiane Wholesaler Price = 8000 Kip/kg
Wholesaler Margin = 8333 Kip/kg – 7040 Kip/kg (hires 5 mt truck to bring to Vientiane produce) = 1293 Kip/kg

Retailer Margin
Vientiane Retailer Price = 13,000 Kip/kg
Retailer Margin = 13000 Kip/kg – 8478 Kip/kg = 4522 Kip/kg

3.7.3 Seasonality and Product Quality

Cilanthro (and other herbs) are produced and available from Laos suppliers all year. During the wet season, the herbs can be multi-cropped under shade to protect from the extreme rainfall.

To maintain product quality and shelf life, cold storage is available at the Loa Aussie market in Vientiane. Cilanthro and dill can be stored for about 7 days in cold storage with very little deterioration. The herbs can also be frozen for a number of months or kept frozen in ice cubes with no deterioration.

3.8 MAIZE

3.8.1 DEMAND AND SUPPLY

Demand – Maize is an important component of animal feed fed to swine and poultry. The # head of swine and poultry has nearly doubled (as measured by head per capita) in Laos in the recent past 20 years from 1998-2018. In China, Vietnam, and Thailand the # head per capita has, generally, increased but at a much lesser rate over the same time period. The average increase in the # head of poultry per capita in the four countries was 78% versus 28% for # head of swine per capita during the 20 years. The demand for feed is directly proportionate to the # head (chicken and swine)/capita in each of the countries.

Table 10. Number of Head of Swine and Poultry in Various Asian Countries in 1998 and 2018

Country	Swine			Poultry		
	1998	2018	% Increase	1998	2018	% Increase
	# Head/Capita			# Head/Capita		
Laos	0.28	0.53	89	2.3	5.6	143
China	0.32	0.3	-6	2.3	3.7	61
Vietnam	0.23	0.3	30	1.7	3.2	88
Thailand	0.11	0.11	0	3.3	4	21
Average Increase			28			78

Laos produces more maize than it consumes, exporting surplus maize to neighboring countries, China, Thailand and Viet Nam. These neighboring countries are net importers of maize from abroad for supplying their animal feed industries. 72.3% of the maize used by Viet Nam's animal feed industry was imported, while in Thailand the need for imported maize in 2020 to supply feed demand was estimated at around 29-41 per cent of the total demand.

Table 11. Value of Maize Exports from Laos to Various Countries (2015-2018)Value of Maize Exports from Laos to	2015	2016	2017	2018
	Million USD			
China	28			
Thailand	11	11	4	7
Vietnam	13	17		

Supply - The importance of maize as a cash crop in the country came to prominence during the 2000's, as between 2002 and 2008 the yearly growth rate of maize production averaged 40.9 per cent, with a peak in 2005 of 83.1 per cent yearly growth and no year falling below 11 per cent growth. During this period, the amount of land dedicated to maize production also increased substantially, growing at an average rate of 27.4 per cent per year. In Luang Prabang province, hybrid maize expanded due to increasing demand from Thailand and Viet Nam, being introduced by Thai and Vietnamese buyers with support from local traders and district extension agents. Maize production in the country reached a peak of 1.55 million tons in 2016 and then fell to 1.19 and 0.77 million tons in 2017 and 2018, respectively. The yield of maize, after growing consistently from the second half of the 90's, has stayed relatively stable in 2012-2017 at an average of 5.83 tons per hectare and then falling in 2018 to 5.18 tons per hectare.

Combined, Xayaboury, Xiengkhouang, Houaphan, and Luang Prabang provinces in 2018 produced 55.6 per cent of all the maize produced in Lao People's Democratic Republic and accounted for 82.1 per cent of the total harvested area with maize.

Table 12. Maize Production Area, Total Production, and Yield in SRIWSM Project Provinces

Province	2018 – Production Area (ha)	2018 – Production (mt)	2018 - Yield (mt/ha)
Total	**148.2**	**768**	**6**
Xayabouly	**43.1**	**232.5**	**5.6**
Xiengkhouang	**20.7**	**105**	**5.9**
Houaphan	**9.6**	**56.2**	**5.6**
Luang Prabang	**8.7**	**33.1**	**6.3**

3.7.2 Margins

Table 13. Prices and Margins of the Maize Value Chain

High Value Crop	Producer				Collector			Wholesaler			Retailer			Exporter		
	Yield	COP	PP	PM	COC	CP	CM	COW	WP	WM	COR	RP	RM	COE	EP	EM
	1000 Kg/HA	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG	1000 K/KG
Maize	6	0.938	1.8	0.863	0.4	2.3	0.5	-	-	-	-	-	-	0.721	3.358	.337

Figure 14. Comparative Margins of Producer to Exporter Levels of the Maize Value Chain

Producer Margins

Producer Price – current price (as of March 2022) 1800 Kip/kg (in grain form)

Maize in cob form can be seen as an input, to be converted into dry maize in grain form, which is then exported or consumed by domestic users of maize. Farmers sell most frequently to small traders, known as "village collectors", who trade yearly volumes of maize of 1,000 tons or less. Additionally, 21 per cent of farmers sell to district traders from the same district either exclusively (15 per cent of farmers) or partially (6 per cent), while a small number of farmers sell to traders from another village. Village collectors act largely like aggregators, buying from farmers and selling (as agents) to larger traders. Farmers usually face few choices (in terms of number of potential buyers) selling their maize at the farmgate. 29 per cent of surveyed farmers reported having an agreement with a trader (mostly of an oral nature), with important differences among provinces. Median and mean prices of maize in grain were LAK 1,600 per kg and LAK 1,602 per kg respectively. There are many farmer characteristics associated with maize sales prices received by farmers, such as: Geographic factors, whether farmers are members of a producer group (i.e. a "cooperative"), whether farmers have dedicated storage facilities to store their maize, whether farmers store maize, and for how long, whether farmers receive inputs from traders, and the wealth of the farmer.

Producer Margin – 863 Kip/kg ($442/ha)

Collector Margin

Collector Price – 2300 Kip/kg

Collector Margin – In 2018, maize in grain form was bought for an average of LAK 1,635 per kg (median LAK 1,650 per kg), but there were differences among provinces. Traders who bought maize only in cob form, as expected, had significantly higher margins than those buying maize in grain form. Shelling often takes place at the "village collector" (small trader) level or other traders that buy maize directly from farmers.

Export Margins

Exporter Price – Reference prices are (i) United States (prices for no.2 yellow maize in United States Gulf ports) and (ii) Thai maize prices (source: Thai Feed Mill Association). Maize farmers in Laos are very vulnerable to the occurrence of negative shocks to the price of maize. Current price (18 March 2022) of #2 yellow maize in US ports is $7.4175/bushel (or $0.292/kg or 3358 Kip/kg)

Exporter Margin – 3358 Kip/kg (exporter price = current #2 yellow corn price) – 2300 Kip/kg (Collector price) – 721 kip/kg (exporter costs) = 337 Kip/kg

3.8.3 Seasonality, Product Quality, and Issues

Seasonality – The mean number of months that traders store maize was 3.6 months, while the median was 3 months.

Product Quality - Traders indicated that drying and sorting maize are necessary to improve the quality of maize, in line with the importance of reducing humidity and avoiding contamination by fungi or pests. The first quality check of maize is carried out by the trader (often, a "village collector") when he/she checks the maize that a farmer has for sale for moisture content and contamination (for example, by weevils). The price offered by traders to farmers for maize is conditional on its observed quality. The degree of humidity is an important determinant of the quality of maize sold and we would expect a priori that those farmers storing and selling dry maize fetch higher prices. Adequate storage can reduce the incidence of problems like insects, rodents and fungi damaging stored maize, and which can also negatively affect the sales price of maize. Furthermore, the capacity to store maize also tends to improve a farmer's bargaining position, as they can in principle decline an immediate sale opportunity in expectation of improved prices in the future.

Issues - existence of heterogenous regulatory requirements across different provinces. These include export fees charged in Xiengkhuang, Luang Prabang, and Xayaboury provinces, the registration requirements for exporters, different regimes for the import of seeds, among others. To our knowledge, there is no centralized repository of the existing regulatory information for the maize value chain in the country.

3.9 FORAGE CROPS

3.9.1 Demand and Supply

Demand

Animal fattening is clearly related to market access and meat demand. Rural areas of Laos have traditionally struggled to find markets for products because of low population density and poor transport links. However, Luang Prabang province has had a high commercial rate of cattle export to Thailand and China and more recently has experienced increasing commercial opportunities in places where smallholders are growing forage for cattle feeding. The farmers that farm the Nam Seng irrigation scheme area have about 1,200 heads of cattle, with an average of 5.8 head per household. Cattle are an important export and the main source of monetary income for most farmers in Xiengkhouang province. At present, the model of cattle raising is a traditional method, that is, free grazing on the paddy fields eating the rice straw over the dry season and keeping the cattle in a shelter during the wet season.

Increasing income, population and urbanization, as well as the export of beef and buffalos to neighboring countries, have all contributed to the short supply of beef in the domestic market. In 2016, about 15% (20,281 head) of the province's cattle were for domestic consumption, and approximately 6% (8,113 head) were for sale as live animals. MAF estimated that about 100,000 cattle were slaughtered annually. This is equal to 10,000 tons of beef (valued at about 70 million USD) annually consumed in Laos. As the demand for livestock and livestock products continues to increase on a per capita basis (from 8 kg/person/year in 2015 to 8.4 kg/person/year) in Laos, the derived demand for forage crops by cattle farmers, generally, in Laos, and the cattle fattening industry, specifically, increases. Markets, however, for forage crops produced in Xiengkhouang province are usually localized because of the weight and bulky physical characteristics of the forage crops. Ruzzi grass is a preferred forage crop during the wet season, while Napier grass and elephant grass, are examples of dry season forage crops. This market assessment relates the market potential for HVCs and livestock that are produced in the dry season. The Napier grass is the forage crop example that is described here. This assessment does not include the demand (domestic or international) and supply for fattened cattle nor the demand (domestic, international) for meat or other cattle products. For the cattle market assessment please contact the Cattle Specialist of the LIC-Xiengkhouang province.

Supply

Lao-native beef cattle are primarily *Bos indicus*, and most ruminant production in Laos is still dominated by small-scale or backyard producers that use traditional practices, resulting in low productivity. The cattle herd size in Laos has grown by an average of 5 percent per year from 1.52 million in 2010/11 to 1.81 million in 2014/15. In 2016, the Laos cattle population was 1.88 million head, with smallholder farmers representing 98% of production despite efforts by the Laos government to develop commercial-scale farms. There were 170 commercial cattle farms in 2016, with 56 percent in the Central region of Laos.

For Nam Seng farmers alone, the dry season production of forage crops will compete for irrigated cultivated land with other HVCs. Napier grass, mainly used to feed livestock in cut and carry feeding systems, has a relatively high level of total digestible nutrient content and crude protein of about 17%, thereby a relatively efficient forage crop for fattening livestock. Napier grass can be produced during the dry season with irrigation on the Nam Tong irrigation scheme at about 75 mt (wet weight)/ha (or about 12 mt (dry weight)/ha over six months, with monthly harvesting possible. It takes about 1 hectare of forage crop (Napier grass) to feed 2 cattle for 6 months (360 cow-days). Within the six months, the cattle increase their weight by

3.9.2 Prices and Margins

The producer margin for production of Napier grass is estimated by valuing the dry matter weight of the Napier grass fed to cattle over a given time period minus the costs of the production of the Napier grass over that same time period. It takes approximately 15 kg of dry matter of Napier grass fed to cattle to get 1 kg weight gain of the cattle. The producer prices of live cattle in Laos per mt for the years 2016, 2017, 2018 were US$ 2,700, US$ 2,748, US$ 3,012, respectively.

Producer Price: Not Available.
Producer Margin – In Thailand, the revenues of Napier grass farmers production year 2021 found that all size of Napier grass cultivation areas has the average income was $205.16/hectares, the average cost was $105/hectares and net profit (gross margin) was $100.16/hectare (see detail on the study in the paragraph below).

> "An example of producing and feeding Napier Grass to cattle in Thailand is referenced here. In Thailand, Napier grass is the newest economics crop of the farmers in Nong Wua So district, Udon Thani Province. returns of Napier grass farmers in Nong Wua So District Udon Thani Province and 3) to analyze problems and obstacles of Napier planting and find a solution to solve the problem by choosing to study in the farmers who are Napier planting in Nong Wua So district, Udon Thani Province. Sampling by using a specific method (Purposive Samplings) for 54 cases, the production results in 2021 were analyzed as follows from the study of the average cost per hectares of Napier grass farmers in Nong Wua So district, Udon Thani Province for the production year 2021 found that the average total cost all sizes of cultivated areas equal to $105/hectares which are divided into average variable cost was $97.4/ hectares and the average fixed cost was $7.63/hectares. when considering by the size of the cultivated area it was found that small planting areas (1-3 hectares) had average total costs of $126.53 /hectares, which consisted of average variable costs are equal to $116.76/hectares and the average fixed cost is $9.76/ hectares. The medium-sized planting area (3.1-5 hectares) has an average total cost of $93.97/hectares consisting of an average variable cost was $84.22 / hectares while the average fixed cost was $9.76/hectares. For large planting areas (more than 5 hectares) the average total cost is $83.23/hectares which consists of the average variable cost of $79.0 /hectares and the average fixed cost is $4.19/hectares. The revenues of Napier grass farmers production year 2021 from the study found that all size of Napier grass cultivation areas has the average income was $205.16/hectares, the average cost was $105/hectares and net profits was $100.16/hectares. When the researchers considering by the size of the cultivated area it was found that small planting areas (1-3 hectares) had an average income of $229.35/hectares, an average cost of $126.53/ hectares, and an average net profit of 102.82/hectares." (Ref: COSTS AND RETURNS OF NAPIER GRASS PRODUCTION IN NONG WUA SO DISTRICT, by Krisdakorn Wongwai, UDON THANI, THAILAND, September, 2021).