
Australasian Agribusiness Perspectives

2018, Volume 21, Paper 7

ISSN: 1442-6951

The Philippines Fresh Papaya Export Value Chain

Yun Si Grace Chua

Postgraduate student, Centre for Global Food and Resources, University of Adelaide

Abstract

Value chain analysis tools were used to assess the performance, identify the constraints and provide intervention suggestions for the further development of the fresh papaya export industry in the Philippines. Efficiency, flexibility, responsiveness and food quality were the four main categories used to evaluate the performance of the chain. The inconsistent quality of Philippines papaya, poor sanitary and phytosanitary processes and inefficient strategic alignment along the chain were identified as the major barriers to profitable exports of Philippines papaya. With assistance from chain support agencies, local farmers should be able to be educated about Good Agriculture Practices, good sanitary and phytosanitary management, and the importance of strong relationships along the chain, and to be equipped with better technologies for harvesting. In addition, R&D programs should be developed on improved Integrated Pest Management and Integrated Crop Management and on disease and pest resistance papaya varieties. These interventions should allow farmers to produce fruit of the appropriate quality standards that enhance the future progression and opportunities available for fresh papayas in the Philippines.

Key words: value chain analysis; strategic integration; Philippines; fresh papaya; export

Introduction

Agriculture plays an important role in the Philippines even though the country is moving towards industrialisation. Employment in the agriculture sector comprised some 29 per cent of the total employment in 2015 (The World Bank Group, 2015). Furthermore, the agriculture sector contributed around 10 per cent of GDP in 2015 (Republic of Philippines NEDA, 2015). Hence, there are still a large number of citizens who live in rural areas and can only earn an income through agricultural activities (Advameg Incorporated, 2017).

The Philippines mainly exports its surplus agricultural products to the United States, Japan, Europe and ASEAN countries (Advameg Incorporated, 2017). The agricultural sector produced exports valued at \$US 5,280 million, approximately 9.2 per cent of the total export value of \$US 57,406 million in 2016 (Philippine Statistics Authority, 2016).

The main agricultural products grown in the Philippines are rice, corn, coconut, sugarcane, bananas, pineapple, coffee, mangoes, tobacco, and abaca. Its major export agricultural products consist of fruits and vegetables while imported agricultural products include different types of flour, soya bean, oilcake, pellets of fish and whey (Advameg Incorporated, 2017).

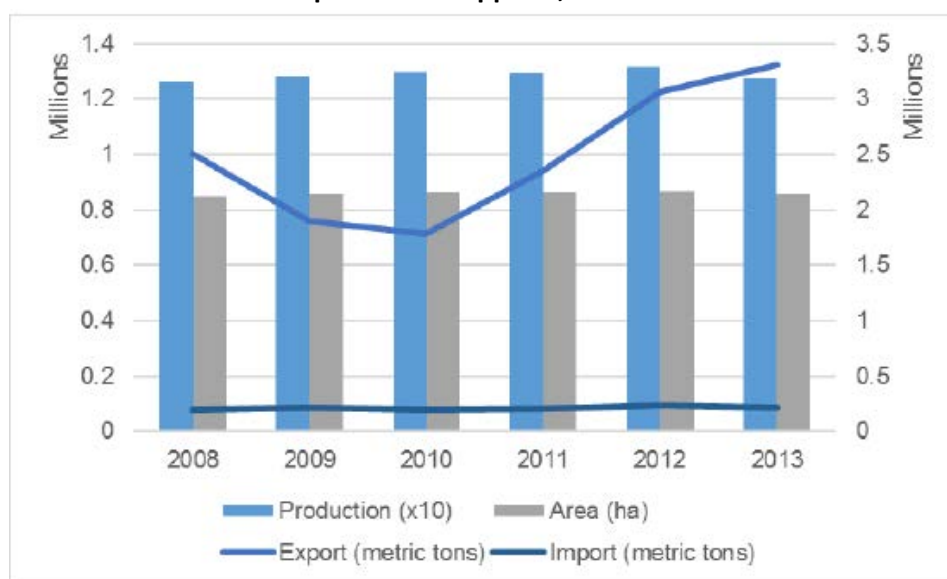
Papaya is an important fruit grown in and exported from the Philippines. There is an increasing trend in demand for papaya internationally and it was ranked in the top five most traded tropical fruits in 2014 (Valenciafruits, 2012). Despite the positive trend in papaya exports, it has a low export ratio with less than 3 per cent of global papaya production traded internationally (Evans, et al., 2015). Papaya's share of the total value of agricultural crop and agricultural output in the Philippines increased at an average of 2 per cent from 1998 to 2008 (Jose Ulysses J. Lustria, 2009).

With total papaya production more than enough to meet the domestic demand, papaya has the potential of becoming an important fruit export like banana and pineapple. All that is needed are appropriate measures to be implemented to access more of the excess supply for international markets. Hence, the Philippines fresh papaya value chain is used as a case study to analyse and identify the constraints to further improvement on the performance in export activities.

Fruit Sector Analysis in the Philippines

The majority of fresh fruits in the Philippines are consumed domestically despite having a few cash crops that are exported in huge volumes (Oxford Business Group, 2017). The Philippines is a major producer of banana, pineapple, mango, papaya and calamondin (Rodeo, 2016).

Figure 1. Total production (metric tons), area planted (ha) and trends in trade volume of fruit crops in the Philippines, 2008-2013



Source: (Rodeo, 2016)

As shown in Figure 1, there has been relatively stable area planted to fruit crops but an increase in total production volume from 2008 to 2012. However, in 2013, there was a drop in both total production volume and area planted to fruit crops due to the impacts of severe weather (Rodeo, 2016).

Fruit exports had an average growth rate of 8 per cent from 2.5 million metric tons in 2008 to 3.3 million metric tons in 2013 although there is a dip in fruit exports in 2009 and 2010. Fresh fruits exports are one of the key contributors to the Philippines economy. In 2013, fresh banana ranked first in total volume exported at a quantity of 2.88 million metric tons, 87 per cent of total export volume. Second ranking was pineapple at a quantity of 0.41 million metric tons, 12.5 per cent of total export volume, followed by mango and papaya, each at 0.15 per cent of the total export volume. Other fruits contributed the remaining small share of the total export volume (Rodeo, 2016).

Fruit imports are mainly apple, mandarin, orange and grapes. From 2008 to 2013, fruit imports increased at an average of almost 4 per cent annually. This implies that the Philippines has a positive trade balance for fruit products (Rodeo, 2016).

Therefore, with an increasing trend of exporting fruit produce to international markets, analysing and improving on the Philippines fresh papaya value chain presents a positive opportunity to excel in this sector.

Market Analysis for Papaya

Papaya (*Carica papaya*) is a tropical fruit that belongs to the Caricaceae family. It originated in Mexico and Central America. It is a tree-like plant that can grow up to 10 metres in height. The leaves are green, large and divided in seven lobes. The papaya plant develops white flowers with five petals. The flowers can be male, female or bisexual. The type of flower depends on the variety and environmental temperature (SoftSchools.com, 2017). The fruit is cylindrically long, pear shaped or round, orange to orange-red, sweet and juicy when ripe. A large number of black seeds are located in the middle of the fruit. The several varieties grown in the Philippines are Solo, Cavite Special, Sinta, Red Lady Papaya and Known You No. 1 (Pinoy Bisnes Ideas, 2015).

Papaya can be used for many purposes. Ripe papaya is eaten fresh, incorporated into desserts, made into juice and processed as jelly, marmalade, candies and crystallized fruits. Green and unripe papaya can be served as a vegetable stew, in salad or pickled. Flowers and young leaves may also be eaten. Papain extracted from green mature fruits has industrial uses in the beer industry, as a meat tenderiser, for certain drug preparations, silk degumming and softening wool. Seeds may be used to expel intestinal worms and to induce abortion (Rivera, 2005).

Production of papaya

Table 1. Top 10 papaya producing countries (in tonnes), 2014

Top 10 Papaya Producing Countries, 2014		
Rank	Country	Production in tonnes, 2014
1	India	5,639,300
2	Brazil	1,603,351
3	Nigeria	850,000
4	Indonesia	840,121
5	Mexico	836,370
6	Dominican Republic	704,786
7	Democratic Republic of the Congo	220,483
8	Philippines	172,628
9	Venezuela (Bolivarian Republic of)	165,102
10	Thailand	157,571

Source: (Maps of World, 2017)

Table 1 depicts the top ten papaya producing countries in 2014. India is ranked first, producing 5,639,300 tonnes. This volume is approximately five times more than the second highest papaya producer, Brazil. The Philippines is the eighth major papaya producer in the world, contributing

172,628 tonnes, approximately 1.35 per cent of the world total papaya production (Maps of World, 2017).

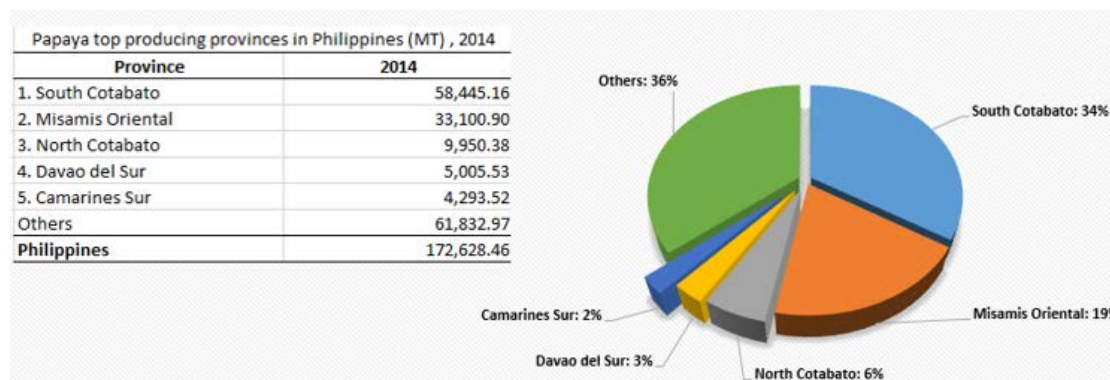
Table 2. Yield of papaya by top producing countries (Hg/Ha), 2014

	Country	Yield in Hg/Ha, 2014
1	Dominican Republic	2,633,731
2	Indonesia	895,242
3	Mexico	575,497
4	Brazil	500,562
5	India	422,863
6	Thailand	364,748
7	Philippines	218,020
8	Venezuela (Bolivarian Republic of)	190,561
9	Democratic Republic of the Congo	169,047
10	Nigeria	90,234

Source: (FAO, 2014)

From Table 2, Philippines is ranked seventh internationally in the yield of papaya, at a quantity of 218,020 hectogram per hectare in 2014. The Philippines therefore has a productivity advantage compared to some of the other top ten high production countries, and some agencies have suggested that the Philippines should specialise in producing papaya (FAO, 2014).

Figure 2. Papaya top producing provinces in Philippines (MT), 2014



Source: (Philippine Statistics Authority, 2014)

Solo papaya is the major variety produced in Philippines. In 2014, South Cotabato province produced 34 per cent of national papaya production and Misamis Oriental province was the next major producer, contributing 19 per cent of national papaya production. The other major papaya producing provinces, North Cotabato, Davao de Sur and Camarines Sur, produced at much lower levels: 6 per cent, 3 per cent and 2 per cent respectively of national papaya production (Philippine Statistics Authority, 2014).

From Figures 3 and 4, the area harvested, volume of production and yield was 9,459 hectares, 146,628 tonnes and 155,014 hectogram per hectare respectively in 2005, while in 2014, the area harvested, volume production and area harvested was 7,918 hectares, 172,628 tonnes and 218,020 hectogram per hectare respectively (FAO, 2017). Thus, there has been a gradual decrease in area harvested of papaya, yet significant growth in papaya production and yield. This implies a successful intensification paradigm. This has brought positive value to the industry and the opportunity to improve on the export.

Figure 3.. Production (tonnes) and area harvested (Ha) of papayas in Philippines, 2005-2014

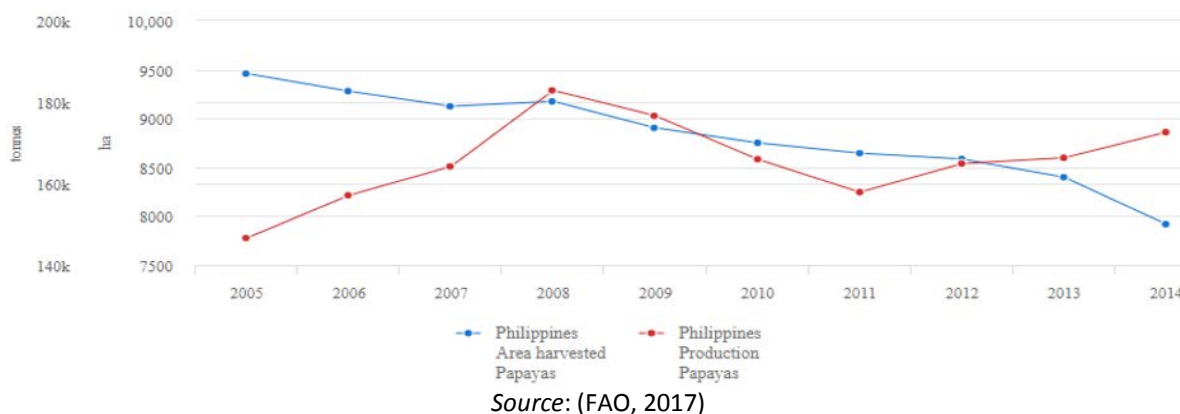


Figure 4. Yield (Hg/Ha) of papayas in Philippines, 2005-2014

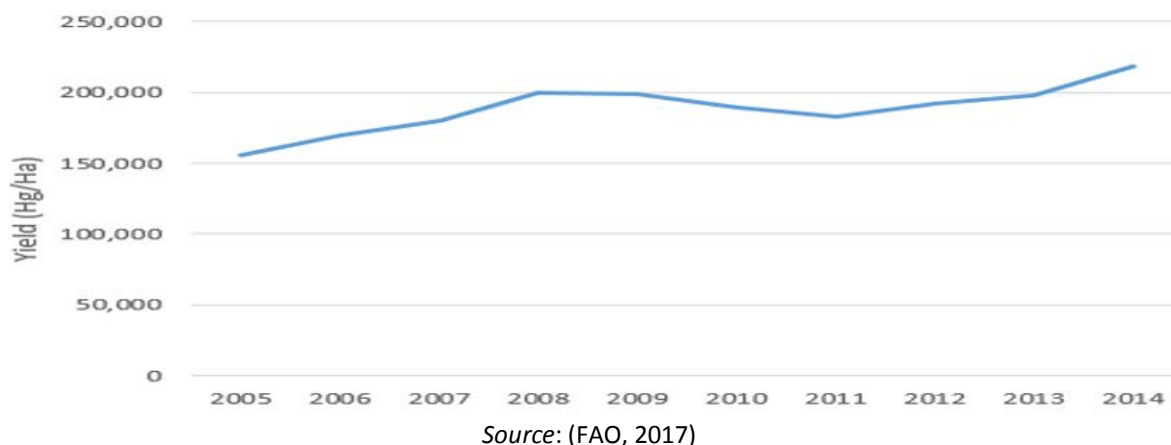


Figure 5. Philippines papaya gross production value (constant 2004-2006 million USD), 2004-2013

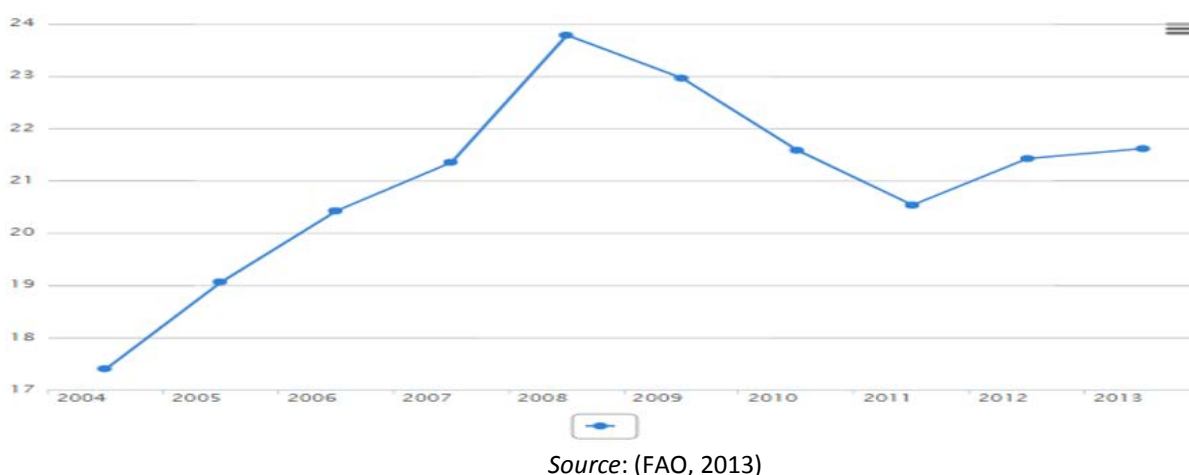


Figure 5 depicts the favourable potential in the value of production. There was significant growth in the value of production from \$US 19.06 million in 2005 to \$US 23.77 million in 2008, but then a substantial decrease in the value of production between 2008 and 2011. Since then the papaya industry in the Philippines has recovered and reached a value of \$US 21.65 million in 2013 (FAO, 2013). More recent data puts the value at \$US 22.43 million in 2014 (FAO, 2014).

Export of papaya

Table 3. Global papaya exports, 2004-2013

Global Papaya Exports, 2004 - 2013		
Year	Tonnes	Value ['000 US\$]
2004	285,334	203,580
2005	263,300	185,649
2006	276,299	181,723
2007	287,515	187,015
2008	242,985	183,206
2009	277,311	194,086
2010	268,254	188,105
2011	270,532	192,865
2012	278,098	212,270
2013	300,741	229,664

Source: (FAO, 2017)

Table 4. Top 10 papaya exporting countries, 2013

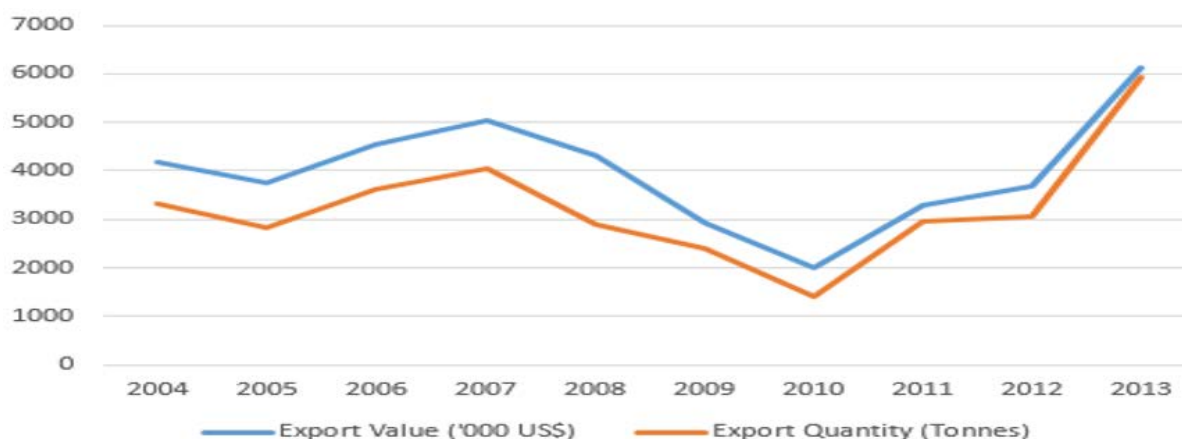
Top 10 Papaya Exporting Countries, 2013		
Rank	Country	Exporting Quantity in tonnes
1	Mexico	115,054
2	Guatemala	32,133
3	Brazil	28,561
4	Belize	25,634
5	Malaysia	24,469
6	United States of America	15,060
7	India	11,410
8	China	7,354
9	China, mainland	7,127
10	Philippines	5,925

Source: (FAO, 2017)

In Table 3, there is an upward trend in the global papaya exports from 285,334 tonnes, valued at \$US 203,580,000 in 2004 to 300,741 tonnes, valued at \$US 229,664,000 in 2013 (FAO, 2017). Table 4 depicts the top ten papaya exporting countries in 2013. Mexico exports the highest papaya quantity at 115,054 tonnes. The Philippines is ranked tenth, exporting 5,925 tonnes (FAO, 2017). Hence, there is still room for improvement of the expansion in the Philippines papaya industry to up keep other major papaya exporting countries.

There was an increase in papaya exports from the Philippines from a quantity of 3,324 tonnes, valued at \$US 4,182,000 in 2004 to 5,925 tonnes valued at \$US 6,132,000 in 2013 (FAO, 2017) (Figure 6).

Figure 6. Philippines papaya exports, 2004- 2013



Source: (FAO, 2017)

Import of papaya

Table 5. Top 15 papaya importing countries, 2013

Top 15 Papaya Importing Countries, 2013		
Rank	Country	Importing Quantity in Tonnes
1	United States of America	155,078
2	Singapore	22,657
3	Canada	17,464
4	El Salvador	12,279
5	Netherlands	7,680
6	United Arab Emirates	6,890
7	Germany	6,768
8	Portugal	5,601
9	Spain	5,485
10	United Kingdom	5,264
11	China	4,441
12	China, Hong Kong SAR	3,329
13	Japan	2,752
14	Saudi Arabia	2,009
15	Italy	1,924

Source: (FAO, 2017)

Table 5 depicts the top fifteen papaya importing countries in 2013 (FAO, 2017). Ranking first is the United States of America, importing a quantity of 155,078 tonnes, followed by Singapore, importing a quantity of 22,657 tonnes. The major importing countries for Philippines papaya are Japan, Singapore, New Zealand, South Korea and Taiwan (Jose Ulysses J. Lustria, 2009). There may be opportunities for Philippines papaya exporters to penetrate and capture new markets in the major papaya importing countries, such as in North America and Europe, to expand its market base.

Domestic supply and demand of papaya

The total production of papaya makes up the gross supply, which is available for exports, feeds and waste, and food consumption (Table 6). There is no import of papaya from 2005 to 2014. The production of papaya has increased from 146,628 metric tons in 2005 to 172,628 metric tons in 2014. Total production is ample to meet domestic demand (Jose Ulysses J. Lustria, 2009).

The Philippines Fresh Papaya Value Chain Map

Figure 7 depicts the current papaya value chain map in the Philippines. The stakeholders that are involved in this chain include the producer or smallholder farmer, assembler or collector, assembler

Table 6. Supply and utilisation of papaya in Philippines (in MT), 2005-2014 (UT- Utilisation, SU- Supply Utilisation)

	SU Production	SU Imports	SU Gross Supply	UT Exports	UT Seeds	UT Feeds and Waste	UT Processing	UT Total Net Food Disposable	UT Per Capita kg/yr	UT Per Capita gm/day
Papaya										
2005	146,628	0	146,628	2,842	0	8,627	0	135,159	1.59	4.36
2006	157,120	0	157,120	3,620	0	9,210	0	144,290	1.66	4.55
2007	164,234	0	164,234	4,060	0	9,610	0	150,564	1.70	4.66
2008	182,907	0	182,907	2,878	0	10,802	0	169,227	1.87	5.12
2009	176,656	0	176,656	2,305	0	10,461	0	163,890	1.80	4.93
2010	165,981	0	165,981	1,391	0	9,875	0	154,715	1.66	4.55
2011	157,907	0	157,907	2,951	0	9,297	0	145,659	1.54	4.22
2012	164,913	0	164,913	3,065	0	9,711	0	152,137	1.58	4.33
2013	166,336	0	166,336	5,925	0	9,625	0	150,786	1.54	4.22
2014	172,628	0	172,628	5,108	0	10,051	0	157,469	1.58	4.33

Source: (Philippine Statistics Authority, 2017)

distributor or farmer-cooperator, exporter, importer, wholesaler-retailer and importing country's domestic consumer.

Producer: Smallholder farmers usually produce their own seeds or buy planting materials from local nurseries. Depending on the type of contract-growing arrangement, some contract companies produce their own seed stocks and supply planting materials to contract producers while some companies supply all the required inputs which producers complement with land, labour and management. In the Philippines, producers generally have poor knowledge of agriculture practices to produce good quality papaya and a lack of skills to operate modern technology to improve on production (Jose Ulysses J. Lustria, 2009).

Assembler: These collectors are in charge of collecting papayas from different smallholder farmers and delivering to the assembler-distributor. Assemblers also do direct delivery to the local market for sales.

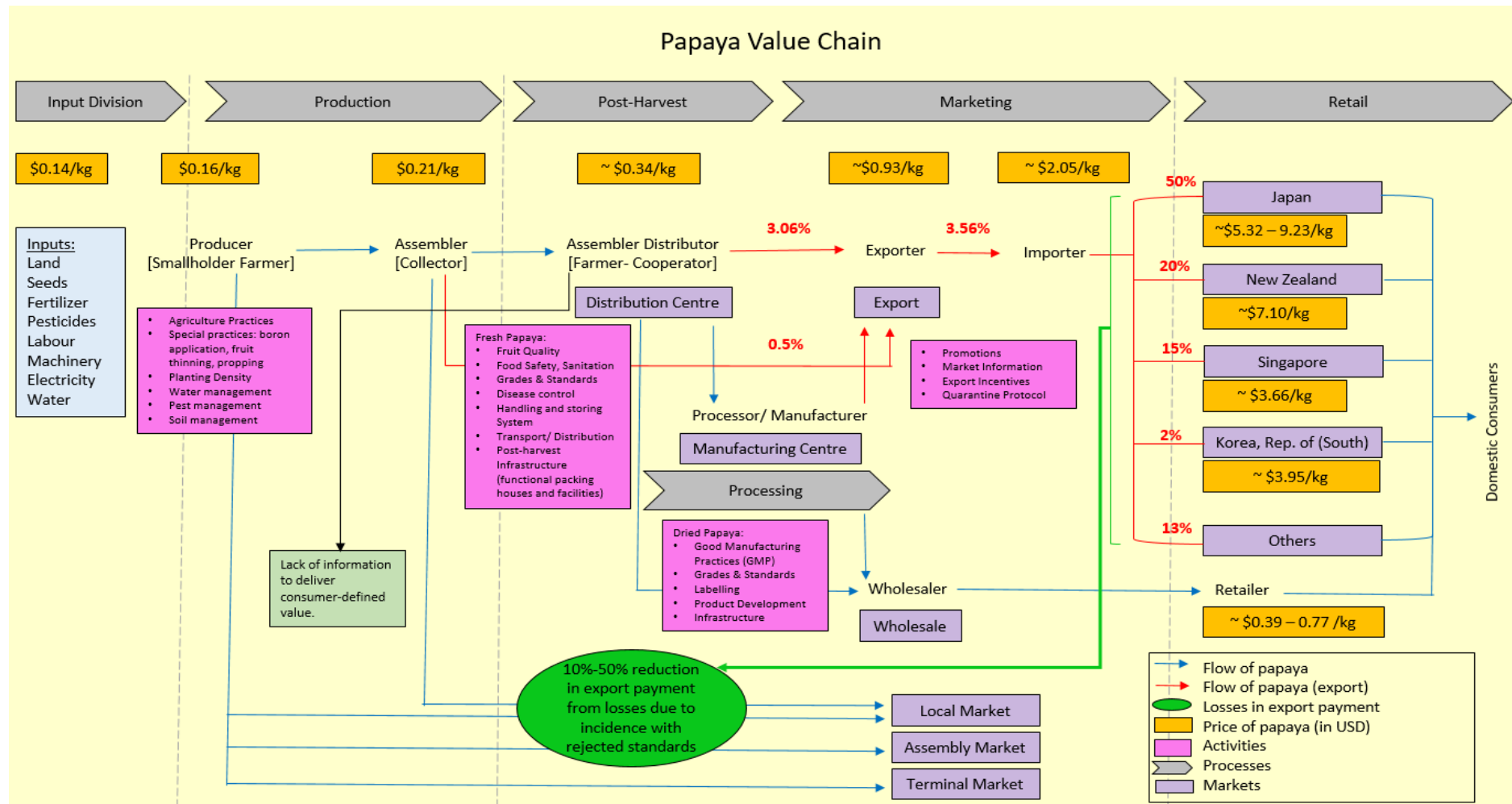
Assembler-Distributor: The assembler-distributor usually finances producers and traders in supply areas and has agents responsible for procurement. Post-harvest management is done at this stage. This includes transporting, handling, packaging, storing, distributing, conducting quarantine protocols for sanitary and phytosanitary measures, inspecting fruit quality, grades and standards. There is weak knowledge regarding good post-harvesting management and hence, there are huge losses incurred due to inappropriate standards of approved quality from retailer. A portion of the fresh papayas are distributed to manufacturing companies for processing into different papaya by-products.

Exporter: Approximately 3.5 per cent of the total Philippines fresh papaya production goes to export. Exporters receive supply from the assembler-distributor and deliver it to the Importer. In addition, exporters are responsible for the expenses for hot water treatment (HWT), packaging, hauling and shipping.

Importer: Importers are responsible in receiving the fresh papaya goods and distributing it to wholesaler-retailer without inspecting and sorting out upon arrival (Maunahan, et al., 2015).

Wholesaler-Retailer: International wholesaler-retailers are the decision-makers to accept or reject the exported Philippines papayas. The percentage of reduction in export payment from rejected papaya due to standard issues can be 10 per cent to 50 per cent (Maunahan, et al., 2015). Hence, it is crucial for the upstream chain participants to deliver consumer-defined value.

Figure 7. Papaya value chain map in Philippines



Source: (Korea JoongAng Daily, 2016), (McGregor & McGregor, 2009), (City-Cost, 2016), (GlobalPrice.info, 2016), (Philippine Statistics Authority, 2017), (McGregor, et al., 2009), (Maunahan, et al., 2015), (Philippine Statistics Authority, 2003), (Jose Ulysses J. Lustria, 2009)

Importing approximately 50 per cent of the total exported Philippines papaya, Japan is the top Philippines papaya importer. New Zealand, Singapore, and South Korea follow with approximately 20 per cent, 15 per cent, and 2 per cent of the total exported Philippines papaya respectively.

Assessing the Performance of the Chain

A value chain strategy relies on a suitable strategic fit and strategic scope for the supply chain of a particular product, which aims to then maximise value in the supply chain (Chopra & Meindl, 2012). To assess the performance of the Philippines papaya value chain, four categories are evaluated: efficiency, responsiveness, flexibility and food quality (Lusine, et al., 2007).

Efficiency

Efficiency aims to maximise value added by the process and minimise the cost absorbed in inventories. A number of factors like production cost, profit, productivity and price are used to measure the efficiency of the value chain (Lusine, et al., 2007).

Production cost: From Table 7, the production cost of papaya in Philippines is approximately \$US 0.14 per kilogram whereas the production cost of papaya in other major producing countries such as India and Brazil is approximately \$US 0.05 per kilogram and \$US 0.04 per kilogram respectively. This implies that Philippines bear a much higher production cost as compared to its international competitors. Hence, there is still room for improvement to reduce production cost to keep pace with others.

Table 7. Production costs of major papaya exporters

Country	Production cost (USD \$/kg)	Year of Study	Reference
India	0.05/kg	2012	(Narendra, 2015)
Brazil	0.04/kg	2004	(da Silva, et al., 2004)
Philippines	0.14/kg	2012	(Philippine Statistics Authority, 2017)

Source: (Narendra, 2015), (da Silva, et al., 2004), (Philippine Statistics Authority, 2017)

Profit: Table 8 depicts an estimation of price breakdown and the share of profit margin of each stakeholder along the supply chain. The downstream participants take up a large share of the profit margin. This implies that the upstream participants have little information and bargaining power to negotiate.

Table 8. Profit margin of each stakeholder along the papaya supply chain

Stakeholder	Buying price/kg (USD)	Selling price/kg (USD)	Margin (USD)	Share of the retail price / Profit Margin (%)
Producer		0.16 ¹		2.73
Assembler	0.16	0.21	0.04	0.68
Assembler-Distributor	0.21	0.34	0.13	2.22
Exporter	0.34	0.93	0.59	10.07
Importer	0.93	~2.05 ³	1.12	19.11
Wholesaler-Retailer	1.71	~5.86	3.82	65.19

¹Price paid to producer or smallholder farmer.

²Cost of fruit only; exporter should also take on the expenses for hot water treatment, packaging materials, hauling and shipping.

³Including cost of fruit, freight and mark-up.

Source: (Maunahan, et al., 2015), (Philippine Statistics Authority, 2003)

Productivity: From Table 9, Philippines had yield 21.80 tonnes per hectare in 2014. The yield of papaya in Philippines has a productive and competitive edge among other higher production of papaya countries such as Dominican Republic and Nigeria. However, Philippines can still find ways to further progress its productivity such as increase area planted for more production activities to occur.

Table 9. Productivity of major papaya exporting countries, 2014

Country	Area (Ha)	Production (Tonnes)	Productivity (Tonnes/Ha)
India	133,360	5,639,300	42.29
Brazil	32,031	1,603,351	50.06
Nigeria	94,200	850,000	9.02
Indonesia	9,384	840,121	89.53
Mexico	14,533	836,370	57.55
Dominican Republic	2,676	704,786	263.37
Democratic Republic of the Congo	13,043	220,483	16.90
Philippines	7,918	172,628	21.80

Source: (FAO, 2017)

Price: The export volume and export value for Philippines papaya has increased from 2008 to 2013 as shown in Table 10. However, the unit value has gradually decreased during that time period. In 2013, the Philippines papaya's unit value was at \$US 1034 per tonne while other major papaya exporters such as Brazil and India papaya's unit value was at \$US 1463 per tonne and \$US 1565 per tonne respectively (FAO, 2017). This implies that Philippines pricing was mediocre in the international market.

Table 10. Philippines export volume, export value and unit value, 2008-2013

Year	Export Volume (Tonnes)	Export Value ('000 US\$)	Unit Value (US\$/Tonnes)
2013	5,925	6,132	1034
2012	3,065	3,696	1205
2011	2,945	3,300	1120
2010	1,391	1,990	1430
2009	2,396	2,918	1217
2008	2,878	4,298	1493

Source: (FAO, 2017)

Flexibility

Flexibility is the extent of responsiveness to changes in demand or supply and ability to handle external disruptions (Gilmore, 2010). This can be assessed by customer satisfaction, volume flexibility and the number of lost sales that is categorised under delivery flexibility (Lusine, et al., 2007).

Customer satisfaction: Customer demand factors include age, time of year, quality and quarantine requirements (McGregor & McGregor, 2009). These factors have always been a struggle for the Philippines papaya industry. In the mid-1990s and 2000, a drop in Philippines papaya demand was due to the papaya ring spot virus which had infected Davao, southern island of Mindanao and Luzon while there was a temporary suspension of Japanese plant quarantine certification for Philippines papaya in 2002 (McGregor & McGregor, 2009). Importer-wholesalers and retailers prefer small-to-medium size and blemish-free papaya in green, unripen, more than yellow, ripened, where shelf-life can be preserve longer before reaching to the final consumer. Besides, having uniform size, approximately 8 to 10 pieces in each box is one of the desirable factors for the importer and wholesaler-retailer. However, recurring issues of irregular quality, uneven size, colour or ripening and maturity boxes became a barrier and caused customer dissatisfaction (Maunahan, et al., 2015).

Volume flexibility: Philippines papaya are certainly not volume flexible. For example, in the period between July to October 2013, Philippines papaya exports to Singapore reached as high as 500 boxes. Given orders of 200 boxes, the exporters were able to deliver the Philippines papaya to importers that were of satisfying conditions. However, when the importers increased demand, irregular quality, uneven size, colour or ripening and maturity became recurring issues. This resulted in reductions in export payments reaching as high as 50 per cent (Maunahan, et al., 2015).

The number of lost sales: As mentioned above, the ring spot virus outbreak shut down some markets. These concerns caused huge rejections of Philippines papaya and hence, facing high number of lost sales that could be potentially earned. Undersupply of Philippines papaya due to irregular qualities and standard requirements that does not meet customer satisfaction also leads to sales lost (Maunahan, et al., 2015). The issue of sales lost may lose customer confidence in Philippines papaya and hence arises as a potential of revenue for other major papaya exporters.

Responsiveness

Responsiveness is the degree to which the chain reacts and handles a spectrum of quantities demanded, lead times, a variety of products, service level, supply uncertainties and building innovative products (Chopra & Meindl, 2012). Hence, responsiveness can be evaluated through fill rate and response time in these circumstances.

Fill rate: Fill rate is the measure of degree of customer demand that is met through immediate stock availability, without backorders or lost sales (Vermorel, 2015). Stock availability and backorders can be fluctuating when the demand of Philippines papaya are seasonal. In New Zealand, demand for Philippines papaya is higher in winter months from May to August. This may cause low stock availability and faces back orders when the production rate is relatively constant throughout the year (McGregor, et al., 2009). Stock availability and backorders may also become an issue when huge amount of Philippines papayas are being rejected back to the exporters.

Response time: Due to the incomplete information flow along the supply chain, some chain participants, especially the producers, lack consumer insights. Besides, weak and poor strategic alignment is another issue along the supply chain (Maunahan, et al., 2015). With these conditions, the Philippines papaya value chain has longer response times as compared to other major papaya exporters. One example of the value chain that has failed to respond to importer requirement is that although the exporter had meet the increased demanded quantity, quality and standards do not reach the wholesaler-retailer requirements. This implies that there are weak linkages and incomplete information at the upstream chain participants who are the producers.

Food Quality

Food quality can be assessed through product and process quality. Each measure can be further evaluated into different components (Lusine , et al., 2007).

Product Quality

Product quality includes sensory evaluation, shelf-life, product sanitary and phytosanitary (SPS) and product reliability (Lusine , et al., 2007).

Sensory evaluation: The indicators of high quality fresh ripened papayas are the small to medium size, blemish-free papaya with yellow skin surface and reddish-orange flesh. Papaya has a sweet flavour

and buttery texture that is smooth and melts in your mouth. Philippines 'solo' papayas are very popular in the international markets due to its attributes (Pinoy Bisnes Ideas, 2015).

Shelf-life: For importers, product shelf-life is crucial as the papayas are stored for 1 to 2 days before distributing to wholesaler-retailers where it must last at least 3 days at the supermarket or retail shop (Maunahan, et al., 2015). Appropriate storing and packaging can extend the shelf-life before reaching to the final consumer. However, importer-wholesalers face recurring issues of irregular colour and maturity of Philippines papayas and hence incurred losses from the upstream chain participants.

Product sanitary and phytosanitary (SPS): Philippines fresh papaya requires a phytosanitary certificate and vapour heat treatment or water hot treatment in accessing export to Japan, Singapore, South Korea and New Zealand. Other markets such as Hong Kong and the Middle East only require phytosanitary certificate (Jose Ulysses J. Lustria, 2009). However, papaya ring spot virus, bacterial crown rot and mites might still appear in papayas. Thus, there are cases of temporary suspension of quarantines certification for Philippines papayas (McGregor & McGregor, 2009).

Product reliability: Philippines papaya has low product reliability especially when there is an outbreak of diseases and quarantine issues. An increase in demand for Philippines papaya also decreases the product reliability.

Process Quality

Process quality includes production and marketing subsystems (Lusine , et al., 2007).

Production subsystem: Improvement is needed in the production subsystem in order to reduce losses from rejected Philippines papayas due to quality and safety issues. Poor pest management brings up the possibility of disease occurrence and pest population. Hence, countries such as Japan, Singapore, South Korea and New Zealand, who are major importers of Philippines papaya, may suspend quarantine certification if requirements are not met up to standard (Maunahan, et al., 2015). Poor post-harvest such as inappropriate storing, handling and packing of papayas are also reasons for the rejection from wholesaler-retailer.

Marketing subsystem: Poor quality of Philippines papayas are the result of an inefficient and weak marketing subsystem. Weak linkages along the chain, particularly with producers, prevents them from obtaining marketing information about the optimum quality requirements desired by the wholesaler-retailer. The lack of compliance to international standards gives opportunities to its competitors who have more complete marketing information of the desired conditions by the wholesaler-retailer.

Identification of Major Constraints

Inconsistent quality of Philippines papaya

The inconsistent quality of Philippines papaya is always a recurring issue that contributes huge losses to the upstream chain participants. Factors that contribute to the inconsistent quality include non-uniform ripening, maturity, uneven sizes, pests and diseases, slow adoption of technologies, poor agriculture practices, inappropriate storing and handling, poor packaging, climate disturbances and mechanical damages (Jose Ulysses J. Lustria, 2009). Sorting and grading of Philippines papaya is not properly handled at the final check stage before packing for export. This creates a barrier to export successfully to importing countries (FAO-UN, et al., 2013). The ability to deliver consumer-defined value is crucial to satisfy the international retailers as they are the decision-maker to accept or reject the exported Philippines papayas (Maunahan, et al., 2015). In addition, the ability to shorten response

time and improve product reliability allows the chain to build long term relationships with the importer and international wholesaler- retailer. This ensures sustainable growth and future opportunities to expand the export sector of Philippines papaya industry.

Sanitary and phytosanitary barriers to trade

Sanitary and phytosanitary measures are important indicators for importing countries to evaluate the decision of accepting or rejecting the exported agri-products. Due to the weak production subsystem and poor post-harvest management, Philippines papaya often faces concerns regarding diseases and pests which are unsafe for human health and consumption. Post-harvest treatment process such as the Vapor Heat Treatment (VHT) or Hot Water Treatment (HWT) and obtaining Phytosanitary Certificate (PC) are not properly done due to the lenient quarantine quality check in the Philippines (Jose Ulysses J. Lustria, 2009). Common insect pests such as mites, scale insects, fruit fly and aphids are threats that cause rotting and damage to the plant and fruit. This may lead to the development of certain diseases. Diseases that occur in papaya include damping-off, bacterial crown rot, papaya ring spot virus, phytophthora rot and brown spot (Yebes, 2015). This prevents access to importing countries and, in addition, reduction of export payment for these rejected goods and temporary suspension of quarantine certification create significant disadvantages for the upstream chain participants.

Inefficient strategic alignment along the chain

The inefficient strategic alignment along the chain is because of the weak linkages, particularly with the producers. The lack of information flow upstream, prevents them having awareness of the importing country standards. Repetitive reduction in exporting payments due to quality issues infers that the producers often receive lesser profits than they expected. This situation discourages them to better manage their production subsystem and post-harvest subsystem (Maunahan, et al., 2015).

Suggested Interventions

Table 11 shows a list of interventions that may improve the efficiency and performance of Philippines papaya value chain in the input supply, farm production, post-harvest and marketing stages. It also includes its immediate beneficiaries.

Government agencies such as the Department of Trade and Industry (DTI) and the Department of Agriculture (DA) have the capability of having commercial and agricultural attaches assigned abroad. Their assistance could greatly help to expand and develop export market opportunities for Philippines papayas. Besides, Local Government Units (LGU) could assist in imparting their knowledge to local producers on Good Agriculture Practices (GAP) and the importance of producing papayas that are safe for consumption. The Food Development Centre (FDA) and the Department of Science and Technology (DOST) could assist by ensuring the constant flow of required quality and standards set by importing countries (Jose Ulysses J. Lustria, 2009).

Investors from overseas countries such as Australia also provide assistance for fruits and vegetables R&D. A recent program provided a grant of \$AU 84 million from Australia for fruit R&D in Philippines to further improve on productivity and integrated crop management in the fruit sector (Philstar Global, 2008).

Table 11. Suggested Interventions

Stage	Interventions	Beneficiaries
Input Supply	<ul style="list-style-type: none"> • Provide farmer training on seedling production and improved production technologies. • Under the assistance of Local Government Units (LGU), operate model nurseries to meet seedling standards of every province that produces papaya. 	Producer
Farm Production	<ul style="list-style-type: none"> • Conduct farmer training on Good Agriculture Practice (GAP) and the various diseases in papaya. • Impose strict quarantine requirements and inspections to prevent spread of diseases such as Papaya Ring Spot Virus (PRSV). • Conduct R&D on bio-pesticides and biocontrol agent against bacterial crown rot and mites in papaya. • Conduct R&D on PRSV-resistance papaya varieties. • Conduct R&D and related programs to enhance Integrated Pest Management and Integrated Crop Management technologies. • Remove papaya growing areas that are infected by PRSV. • Conduct R&D and related programs to have more efficient fertilization and irrigation technologies. 	Producer
Post-harvest	<ul style="list-style-type: none"> • Promote and conduct intensive training on post-harvest handling, storing and packaging technologies. • Training and capacity building. • Strengthen linkages along the chain by regular updating and compliance to importing country standards. • Promote a strong emphasis on sorting and grading of papaya to ensure its quality. • Increase Food Development Centre (FDC) testing services to beyond Manila. This can be done by informing Department of Science and Technology (DOST) testing laboratories to follow the codex guidelines for the assessment of the capability of food testing laboratories. • Impose strict inspection on the Vapor Heat Treatment procedure to ensure the right quality for export. 	Producer/ Assembler/ Assembler-Distributor
Marketing	<ul style="list-style-type: none"> • Obtain market information about the import market requirements regarding fruit quality, desired packaging, SPS measures and trade regulations. • Obtain knowledge of the international price to stay competitive at all times. • Promote awareness of other major papaya exporters and their strengths. • Expand sales to new markets such as USA and UAE. This is potentially feasible as there is a bilateral relation between Philippines and UAE while Philippines is the third largest trading partner with the USA. 	Exporter/ Importer/ Wholesaler-Retailer

Conclusion

This analysis of the Philippines fresh papaya value chain has concluded that there is positive potential to expand in the export sector. There is an increasing trend in exporting of papayas which implies the increasing demand for it internationally. Hence, the development and growth in the papaya industry, particularly in the export sector, enables further economic progression that is beneficial for the nation. An assessment on the performance of the chain was done to identify major constraints such as the low fruit quality, poor sanitary and phytosanitary measures and weak linkages along the chain. Interventions were recommended to improve on the efficiency and competitiveness of the value chain. Lastly, it has to be noted that assistance and investment from government agents are crucial for these interventions to be realised for the further progress of the papaya industry in the Philippines.

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