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The Philippines in the Mango Global Value Chain

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Acronyms

APEDA	Agricultural and Processed Food Products Export Development Authority, India
APEM	Peruvian Association of Mango Producers and Exporters
APHIS	Animal and Plant Health Inspection Service
BAS	Bureau of Agricultural Statistics
BRC	British Retail Consortium
CBI	Center for the Promotion of Imports from Developing Countries
CISH	Central Institute for Subtropical Horticulture, India
CNPO	National Council for Organic Production, Mexico
CONASPROMANGO	Comité Nacional Sistema Producto Mango, Mexico
DA	Department of Agriculture
DOST	Department of Science and Technology
DTI	Department of Trade and Industry
EMEX	Empacadoras de Mango de Exportación, Mexico
ETI	The Ethical Trading Initiative
EU	European Union
FAO	Food and Agriculture Organization, United Nations
FDA	Food and Drug Administration
FDI	Foreign Direct Investment
FPA	Fertilizer and Pesticide Authority
GAP	Good Agricultural Practices
HACCP	Hazard Analysis and Critical Control Points
HWT	Hot Water Treatment
ICAR	Indian Council of Agricultural Research, India
IFS	International Food Standards
IPP	Investment Priorities Plan
IQF	Individual Quick Frozen
ITC	International Trade Center
KBDS	Kenya Business Development Services Project
MAGAP	Ministry of Agriculture, Livestock, Aquaculture and Fisheries
NAFTA	North American Free Trade Agreement
NCCD	National Center for Cold Chain Development, India
NSF	The Public Health and Safety Organization
PCARRD	Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development
PSA	Philippine Statistics Authority
PUC	Pontificia Catholic University of Chile
SAGARPA	Secretary of Agriculture, Livestock, Rural Development, Fishery and Food, Mexico
SEDEX	Supplier Ethical Data Exchange
SIEX	Sierra Exportadora, Peru
SPS	Sanitary and Phytosanitary Standards
UNCTAD	United Nations Conference on Trade and Development
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
USITC	United States International Trade Commission

Executive Summary

This report uses the Duke CGGC Global Value Chain (GVC) framework to examine the role of the Philippines in the global mango industry and identify opportunities for the country to upgrade. The globalization of mango production and consumption is a relatively new phenomenon that is experiencing rapid growth. Over the past ten years, trade in mango products has tripled; in 2005 the total exports were just US\$696 million, while in 2015 it had increased to almost US\$2.1 billion (UNComtrade, 2016).¹ Mango products include fresh mango and processed ones such as dried, frozen, puree and juice. The mango export market is quite concentrated and dominated by developing countries located in the Tropics. The Philippines holds a relatively significant position in the mango GVC, and in 2015, the country ranked seventh amongst exporters of fresh and dried mango, with US\$91 million in exports and a 4% share of the global market (UNComtrade, 2016). Participation in the GVC is based primarily on the export of processed mango—85% of the country’s processed mango is destined for the export market. The mango industry plays an important role in the Philippines’ economy, providing a source of livelihood to about 2.5 million farmers (PCARRD-DOST, 2011). However, despite climatic advantages, fresh mango exports have declined considerably in recent years due to failure to meet strict SPS requirements in key markets.

The Mango Industry Global Value Chain

Mango trees grow in frost-free, warm tropical and subtropical climates, primarily in Asia, Latin America and Africa. The leading mango producing countries are India (42%), China (10%), Thailand (7%), Indonesia (5%), and Mexico (4%) (FAO, 2016). Although mango is the fifth most cultivated fruit in the world, most of the production is still locally consumed and trade is relatively limited. However, over the past 10 years, trade in mango products has tripled; in 2005 the total exports were just US\$696 million, while in 2015 it had increased to almost US\$2.1 billion (UNComtrade, 2016). With increased availability, mango prices in the global market have generally declined, though prices fluctuate mainly depending on variety, size, origin and season (USAID, 2013). Developed countries are including fresh and processed mango in their diets. Mango can be found in juices, ice cream, cereals and pastries among many other food products. Key characteristics of the mango GVC include:

- **Global demand for mangos is increasing.** Demand for mangoes is growing, often due to the nutritional characteristics and properties of the fruit. There is particularly high demand for “ready-to-eat” mangos in individual containers, as well as processed mangos, including dried and pureed mango.
- **Few countries have been able to penetrate the global market.** Many countries located in the tropics have mango production. However, few of them have been able to sustain and consolidate their participation in the GVC.

¹ This figure does not include mango juice, puree and frozen, since these products are mixed with other processed fruit products in the global trade statistics.

Producing countries face many constraints that limit their participation in the global industry, including a failure to meet GAP and SPS requirements for major global markets, and the lack of logistical and commercial infrastructure to support the requirements of large buyers.

- **Trade in fresh mangos is more regional in scope, while dried mango trade is more globally oriented.** All fresh mango imported into the US is sourced in Latin America, with approximately 50%—some US\$220 million— from Mexico. In 2015, Japan also sourced a significant share of its fresh mango imports from Asian producers, including Thailand, Taiwan, and the Philippines. Dried mango trade, however, is not bound by geographic location with shifts in supplier occurring as countries upgrade their capabilities.
- **The global mango sector operates as a buyer-driven value chain.** Large supermarkets are the leading actors in the key export markets for the sale of fresh mango (National Mango Board, 2015). During the past 20 years, they have continuously consolidated, gaining more power over the suppliers. Today, these lead firms exert significant influence over the entire chain and dictate how fresh produce is cultivated, harvested, transported, processed and stored.
- **Mango producers and processors face a complex system of standards.** Standards, established at the national, regional, and international level, are increasingly prevalent as consumers seek greater knowledge of how their food is produced. Standards can be public or privately led with focuses on a diverse array of health and safety concerns.

The Philippines in the Mango Global Value Chain

The Philippines holds a relatively significant position in the mango GVC. The country has been an important player in the global market since the 1980, with exports taking off in the 1990s. By 2015, the Philippines ranked seventh in exports of fresh and dried mango, with US\$91 million in fresh and dried mango exports for a 4% share of the global market (UNComtrade, 2016). It accounts for an average of 10% of world fresh and dried mango exports (FAO, 2016). Leading processors have been steadily gaining access to regional and global markets—major export destinations in 2015 were the US (24%), Hong Kong (17%), Republic of Korea (13%) and Japan (12%) (UNComtrade, 2016).

The Philippines is primarily present in the production and processing stages of the chain. Fresh mango exports are limited given poor performance in cold chain management, packaging, and pre-export SPS treatments, which prevent exporters from complying with standards required by key markets.

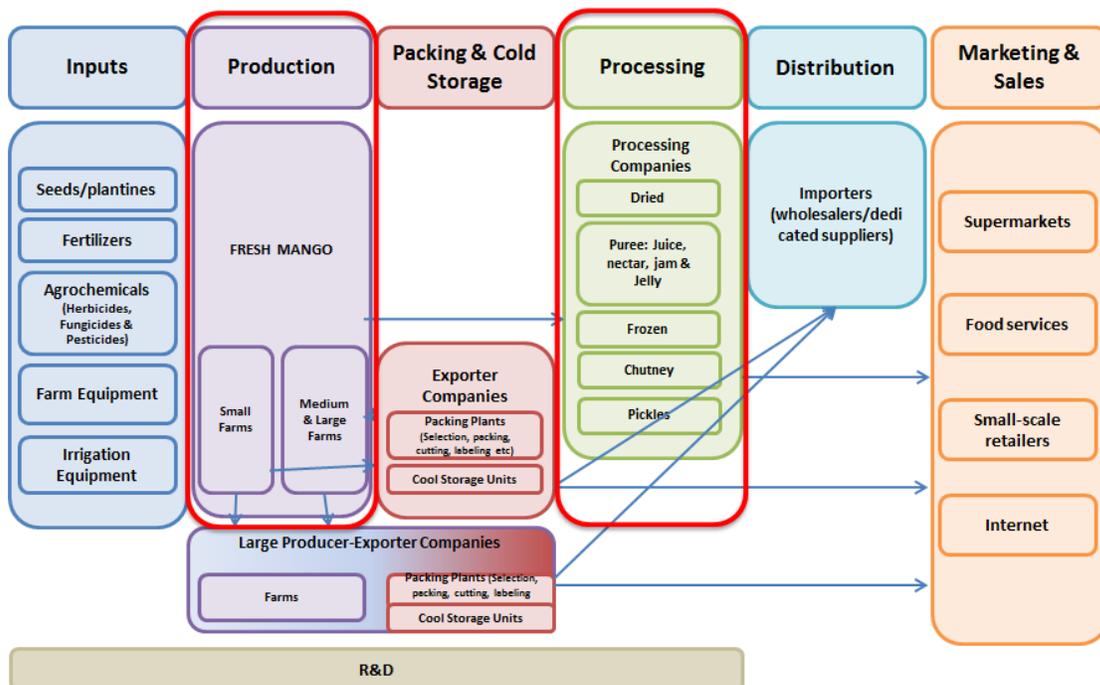
Mango production in the Philippines is often small-scale. In 2015, the average farm size of mango producers was only 1.34 ha. As a result, participation in fresh mango export is often tied to yield more than farm size. Lower yielding farms frequently sell to the local

market and to processors. Production occurs throughout the nation, with the largest production in Luzon followed by Mindanao and Visayas.

The Philippines has the most significant footprint in the processing segment. In 2014, processed mango exports climbed to US\$91 million. Dried mango represented the largest share among all processed products (77%), followed by juice (9%), airtight (8%), and puree (7%) (PSA, 2007-2014). In this segment, fruit quality is less of an issue, and destination markets do not require the strong SPS requirements that are mandatory for fresh exports.

In the Philippines mango sector, local buyers hold considerable power over producers. This is most evident among large processors (buyers) who, due to their economies of scale, dictate the characteristics and price they will pay for the fruit (Field Research, 2016). In general, large companies export their production directly and maintain direct relationships with customers, including supermarkets and food service companies. In 2014, there were approximately 66 companies exporting processed mango, including dried, puree, airtight, and juice. Nearly 70% of those firms are small and medium sized, exporting less than US\$500,000. The companies with exports above that threshold (19) accounted for 20% of the processed mango exporters and 95% of total processed mango exports in 2014 in terms of value (PSA, 2007-2014). Dried mango processors are mostly based in Cebu; processors of other mango products operate in and around metro Manila and metro Cebu (Briones et al., 2013). Three large firms lead the industry: Profood, M'Lhuillier Food Products, and FPD Food International.

Figure E- 1. Philippines Participation in the Mango GVC



Source: Authors.

The Philippines most pronounced strength in the mango GVC is its ability to support the cultivation of “Carabao,” a high-quality variety grown in the nation. It is also supported by an active and robust domestic processing industry. The most prominent include the following:

- **Superior quality variety:** The ‘Carabao’ variety is considered to be one of the finest and sweetest variety in the world. The thin ‘Carabao’ variety was listed as the sweetest fruit in the world by the 1995 edition of the Guinness Book of World Records and is one of the leading commercial varieties worldwide (Castillo-Israel et al., 2015).
- **Ideal climate conditions:** The Philippines possesses the ideal climate for mango growing (Luzon, in particular). It has a relatively cool dry season with high heat accumulation during the flowering and fruit development period. This advantage is substantial, since mango production is highly susceptible to climatic condition. Extended wet seasons and exposure to moisture, for example, can encourage fungal diseases that cause severe production losses.
- **Strong drive among domestic processors:** Lead processing firms have been in the mango industry for an extended period, advancing productivity increases and accomplishing new programs and initiatives through strong lobby activities. Some large processors have attempted to implement strategies to support the growers’ production process, promote GAP adoption and provide required technical assistance and capacity building for achieving sustained production of export grade mangos.

In order to capitalize on the advantages in the Philippines, the industry will need to address several constraints at the farm level. It also needs to address issues of post-harvest and certifications. Finally, coordination among value chain actors is essential to strengthen the competitiveness of the industry. A summary of the challenges includes the following factors:

- **Lack of scale economies at the production level:** The dependence on small-scale, non-commercial production fails to create the scale economies required to supply processors with sufficient raw material to deliver to their clients abroad. Global buyers tend to favor suppliers that can consistently and reliably deliver on time, price and quality. Repeated failure to do so generally results in exclusion from their supply chains.
- **Lack of modern production and harvesting techniques:** Due to limited knowledge on available technologies, little formal training/education and lack of financing, farmers continue to produce mango with outdated agricultural techniques and poor management. From 2010 to 2014, the farmgate price of ‘Carabao’ mango increased by roughly 8%, while the cash cost of inputs (e.g. fertilizers, flower inducers) increased by 23%, thereby significantly deteriorating the profitability of mango production (BAS, 2010; PSA, 2015). Even in large-scale and technically

sophisticated agribusiness firms, technology use is far below that of competitor countries such as Mexico and Peru (Briones et al., 2013).

- **Poor Post-Harvest Management and SPS Control:** Compounding the effect of poor production practices is the lack of capacity to comply with quality and SPS standards due to shortcomings in the cold chain system, poor SPS management and lack of packing skills (Field Research, 2016). Cold chain management is almost non-existent or deficient across the agricultural sector. Given the geographic distribution of production across the country, this essentially excludes farmers in distant locations from participating in the export-sector. Freshly harvested fragile produce is exposed to sunlight and inadequate road and transportation infrastructure en route to export packhouses and processors, which are located in major cities (Hambloch, 2015). Furthermore, there are few exporters with VHT and HWT facilities required for fresh mango entry into the Japanese and Korean markets (Briones et al., 2013; Hambloch, 2015). Finally, the equipment for handling and packaging are greatly inadequate and graders have no formal training on sorting or proper handling. As a result of this, post-harvest fruit damage and rejection rates climb up to 50% (Field Research, 2016).
- **Lack of coordination between industry stakeholders and high levels of bureaucracy:** The public sector is characterized by multiple government agencies offering similar services. The Department of Agriculture (DA) and the Department of Trade and Industry (DTI) have both issued separated roadmaps and planning documents for the mango industry. The implementation of these national strategies is uneven due to the autonomy of local governments to select which recommended initiatives to undertake. In addition, high costs of bureaucracy are often mentioned as constraints for accessing information, training and financial resources (Field Research, 2016).

Table E- 1. The Philippines and the Mango GVC: Upgrading Trajectories

Time Frame	Upgrading Trajectory	Key Benefits	Philippines Challenges
Short Term	Product and Process Upgrading: Improve yields and production	<ul style="list-style-type: none"> • Access to economies of scale and lower costs or production • Expand production and improve productivity • Reduce intermediaries cost and increase producers' income • Increase exports to stringent, yet more profitable markets. • Cope with the environmental change 	<ul style="list-style-type: none"> • Small-scale farmers struggle to obtain the right inputs and apply banned inputs • Lack of modern production techniques • Lack handling and packing skills • Poor post-harvest control, cold chain management, and traceability • Lack of compliance with SPS regulations & quality global standards. • Absence of coordination amongst farmers • Lack of coordination regarding industry policy • Fragmented R&D activities, lacking continuity • Limited funds to invest in R&D efforts • Lack of qualified human capital with specialized knowledge on the mango industry
Short Term	Product Upgrading: Creating a better product	<ul style="list-style-type: none"> • Higher returns per product • Increase export volume and value of fresh and processed mango • Access to profitable niche markets in developed countries (new markets supplied) • Ensure environmental sustainability (water contamination and soil erosion), improving long-term productivity 	<ul style="list-style-type: none"> • Long-term overreliance on agrochemicals • Over-spraying and application of banned chemicals by contractors with short-term interest in orchards productivity
Short to Medium Term	Functional Upgrading: Packing, Cold Storage, SPS Controls	<ul style="list-style-type: none"> • Market access for fresh mango to developed high value countries • Increase export volume and value of fresh exports to stringent markets 	<ul style="list-style-type: none"> • Large distances between farms and pack-houses, processors and distribution hubs • Shortcomings in the cold chain system • Poor SPS management • VHT and HWT facilities are mostly located in Davao and Metro Manila

Source: Authors

I. Introduction

The globalization of mango production and consumption is a relatively new phenomenon that is experiencing rapid growth. Over the past ten years, trade in mango products has tripled—in 2005 the total exports were just US\$696 million, while in 2015 it had increased to almost US\$2 billion (UNComtrade, 2016).² Mango products include fresh mango and processed ones such as dried, frozen, puree and juice. The mango export market is quite concentrated and dominated by developing countries located in the tropics.

The Philippines is one of the leading global exporters of mango. The country has established itself as a leading producer and exporter of processed mangos, particularly in the dried mango category, where it has been able to distinguish its production from competitors based on its local variety of mango. In 2015, the nation was ranked seventh among exporters of fresh and dried mango, with US\$91 million in exports and a 4% share of the global market (UNComtrade, 2016). Participation in the GVC is based on the export of processed mango; 85% of which is destined to the export market. Despite climatic advantages, fresh mango exports have declined considerably in recent years. Locally, mango is the third most important fruit both in terms of quantity and value of production after bananas and pineapples. Thus, the mango industry plays an important role in the economy of the country, providing a source of livelihood to about 2.5 million farmers (PCARRD-DOST, 2011).

While it has been a strong player in the industry for some time, a series of constraints undermine the Philippines' potential to upgrade its position. One of the main problems limiting export performance of fresh mangoes is the failure to meet strict Sanitary and Phytosanitary (SPS) requirements in key markets. Agricultural challenges have affected productivity in recent year, compromising the processed mango industry—yields pale in comparison with competitors, and erratic annual production is often attributed to environmental factors, pest and diseases, and high costs of inputs (PCARRD-DOST, 2011). However, the industry also suffers from inadequate technological development to cope with environmental risk, the lack of irrigation equipment, inadequate fertilizer management and equipment, and abuse of pesticide use. In addition, good agricultural practices (GAP) are rarely implemented, and formal training for farmers is mostly absent (Briones et al., 2013; Buguis, 2014; Hambloch, 2015). Lastly, insufficient financial resources and infrastructure have also been highlighted as significant challenges (Field Research, 2016).

In recent years, other significant exporters have emerged in the industry, including Mexico, Peru, Brazil, India and Thailand. These countries—Mexico and Peru, in particular—have placed considerable focus on improving farming techniques. Many of their farms are certified and followed GAPs. As a result, both countries have increased their mango exports. Meanwhile, other countries have invested in Research and Development (R&D). India is a prominent example—the government has created an R&D center to deal with major problems confronting the industry such as low productivity and expanding seasonality.

These countries offer important lessons to the Philippines. Specifically, the country should focus on modernizing production so that it can export not only fresh mango, but also supply local processors that are working below capacity due to the shortage of raw materials. To continue to be global

² This figure does not include mango juice, puree and frozen, since these products are mixed with other processed fruit products in the global trade statistics.

leader, the Philippines needs to create a broad forum among value chain actors, especially between mango farmers and mango processors. A common strategy will provide the basis to expand the processed mango exports and penetrate with fresh mango in more demanding global markets.

This paper uses the global value chain (GVC) framework to understand how the global mango industry is changing, assess the Philippines current position in the GVC, and identify opportunities to upgrade with the goal of promoting economic development, particularly in rural areas. It first provides an overview of the mango value chain to present a clear understanding of the scope of the industry, how markets are structured and how changing distribution of demand and supply can alter structural dynamics. It then analyzes the Philippines' current position, examining both the advantages and the challenges for domestic industry development. After providing comparative case studies on Mexico and India's experiences in the mango GVC, it concludes by outlining potential upgrading strategies. Policy recommendations to enable those upgrading trajectories conclude the report.

2. The Mango Global Value Chain

2.1 The Global Mango Industry

Trade in mango is relatively new. The fruit is sold in fresh and processed forms such as dried, frozen, puree and juice. Mango trees grow in frost-free, warm tropical and subtropical climates, primarily in Asia, Latin America and Africa. The leading mango producing countries are India (42%), China (10%), Thailand (7%), Indonesia (5%), and Mexico (4%) (FAO, 2016). Although mango is the fifth most cultivated fruit in the world, most if the production is still locally consumed and trade is relatively limited. There are more than one thousand varieties, and each country produces a different set of mango (Normand et al., 2015; UNCTAD, 2016) and the most important commercial varieties differ significantly according to the region. While globally traded mango types vary according to the country, the most popular varieties are: Tommy Atkins, Kent and Alphonso. Table 1 presents the most important commercial varieties for the main exporter countries in Asia and Latin America.

Table I. Top Commercial Mango Varieties of Leading Exporter Countries

Country	Top Varieties Produced
Thailand	Brahman, Okrong
Mexico	Tommy Atkins, Haden, Manila, Kent, Keitt, Manzanillo Nuñez, Ataulfo, Irwin, and Diplomatico
Brazil	Tommy Atkins, Haden, Palmer, Keitt and Brazilian varieties (e.g. Espada, Bourbon, Ubá, Rosa, Coité, Mamão, Coquinho)
Peru	Kent, Haden, Tommy Atkins
India	Alphonso, Banganpalli, Chausa, Langra, Totapuri, Benishan, and Kesar.
Philippines	Carabao
Pakistan	Sindhri, Anwar Rataul, Fajri, S.S.-I, Dashehari
Vietnam	Xoai Tuong, Keow Savoey, Falam, Nam Klangwan

Source: Authors based on data from (APEDA, 2016a; Chakrabarti, 2011; Litz, 2009; Mehdi et al., 2016; Pinto et al., 2004; Tirlapur et al., 2014)

While the globalization of mango production and consumption is a relatively new phenomenon, it is experiencing rapid growth. Over the past ten years, trade in mango products has tripled; in 2005 the total exports were just US\$696 million, while in 2015 it had increased to almost US\$2 billion (UNComtrade, 2016). With increased availability, mango prices in the global market have generally declined, though prices fluctuate mainly depending on variety, size, origin and season (USAID, 2013). Developed countries are including fresh and processed mango in their diets. Mango can be found in juices, ice cream, cereals and pastries among many other food products.

Some of trends that are shaping this global industry are the increased demand due to nutritional benefits, strict SPS requirements limiting the participation of some producing countries in global trade and climate change affecting the production of mango. Below these industry trends are explained.

(1) Global demand for mangos is increasing due to its nutritional characteristics and properties. Fresh mango demand has increased in the last decade due to its nutritional value. In particular, there is a high demand for “ready-to-eat” mangos in individual containers, as well as mango puree in combination with other juices (CBI, 2015). This is also true for processed mangos, especially dried and pureed mango in the snacking segment, as well as incorporation of mango products into chocolate bars or energy biscuits. Processed mango is presented as an alternative to sugared snacks and is an increasingly used ingredient in home cooking (e.g. healthy-exotic cuisine) (CBI, 2014b). With exposure to mangos starting with baby foods, the next generation will likely be more familiar, moving mangos from the “specialty fruit” role to a mainstream staple (National Mango Board, 2015).

(2) Few countries have been able to penetrate the global market. Many countries located in the Tropics have mango production. However, few of them have been able to sustain and consolidate their participation in the GVC. Producing countries face many constraints that limit their participation in the global industry, including a failure to meet GAP and SPS requirements in major global markets such as the European Union (EU) and the United States (US). In addition, with limited experience in the global fruit trade, they lack logistical and commercial infrastructure to support the requirements of large buyers (UNCTAD, 2016). Exceptions include Mexico and Peru which have leveraged industry knowledge from other fruit exports to improve their positions within the chain. Mexico, in particular, has experienced tremendous growth over the past five years doubling its exports and becoming the largest exporter of fresh and dried mango in the world

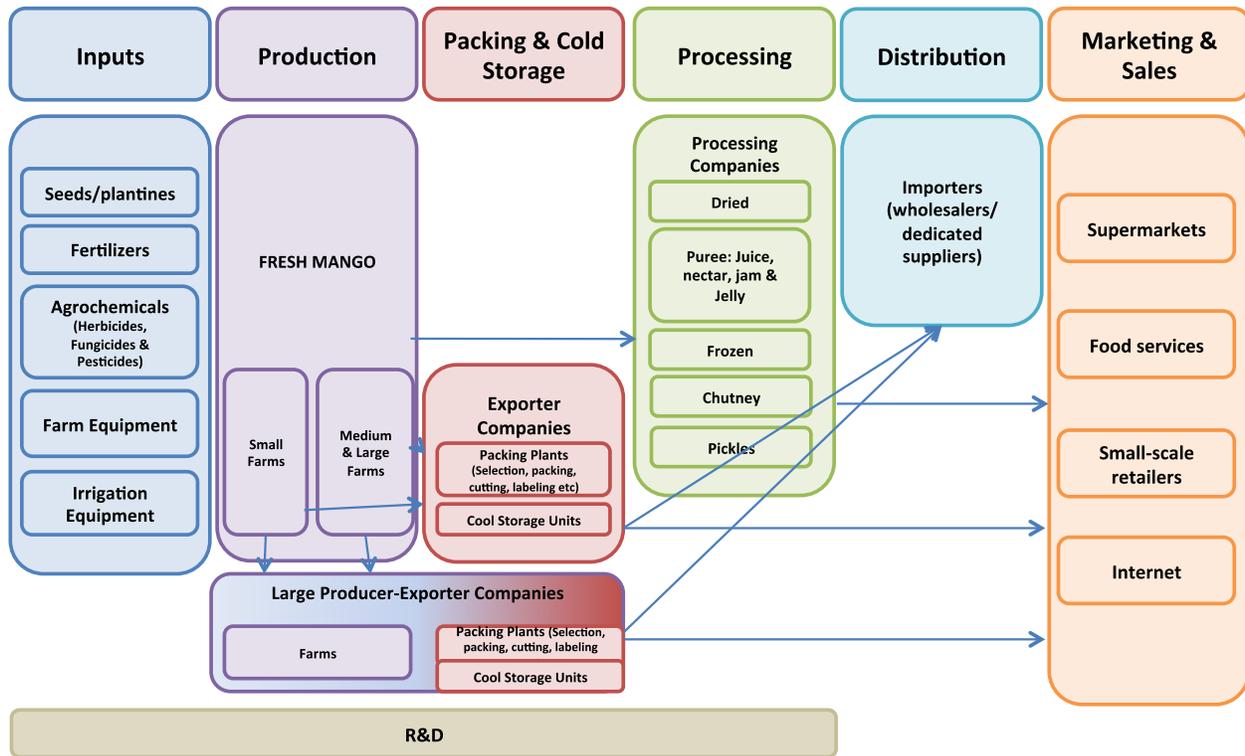
(UNComtrade, 2016). The country has managed to not only export fresh and processed mango to its neighbor, the US, but also to other far-off locations such as Europe and Japan (UNComtrade, 2016).

(3) The climate change phenomenon is not favorable to mango production. The general trends of climate change in the Tropics and Subtropics, including higher temperatures, lower rainfall and higher frequency of natural disasters are expected to affect mango production. Even though mango is adapted to stressful environments and has physiological mechanisms to cope with them, further adaptation will be necessary, including displacement of cultivation areas where climate will be more suitable; this will require research (Normand et al., 2015). Specific orchard management techniques will also be required (e.g. improvement of irrigation techniques to increase water efficiency, management of tree canopy and flowering).

2.2 Mapping the Mango Global Value Chain

As with many major fruits, the mango global value chain can be divided into five main segments: Production, Packaging & Cold Storage, Processing, Distribution and Marketing and Sales. Figure 1 illustrates these main stages. Fresh mango net higher prices but they are more difficult to handle, only premium quality is suitable for export, they must meet a number of strict standards and require constant cold chain management to arrive in perfect condition to the sales point. On the other hand, processed mango allows for the use of second category produce, increasing consumption rates, longer shelf life, and income smoothing throughout the year, not only during harvesting seasons. These segments are discussed in further detail below.

Figure 1. Mango Global Value Chain



Source: Authors

Production: Mango trees are perennial; they begin to produce fruits four years after planting, reaching full maturity between 10-15 years. These can be productive for up to 40 years using good management techniques, including fertilizer and irrigation use. However, mango trees are extremely susceptible to pests and diseases such as mango hopper, mealy-bug and powdery mildew among others (Asia Farming, 2017). Hence, they require regular spraying with pesticides, and spraying is generally carried out four to six times a year (FDS Kenya, 2015). As a result, pest management is one of the highest costs in the mango cultivation and can make mango production a risky activity for producers without access to resources to undertake spraying. Unlike many other commercial fruits, production of mango for exports has not yet consolidated and continues to be undertaken by a range of small, medium and large farms. Small farmers are usually grouped in cooperatives to achieve economies of scale or they are linked to a contractor that usually provides technical assistance and financial support. Medium and large farms that use modern agricultural techniques are usually common in Mexico, Peru, Brazil, India and Thailand.

Packing and Cold Storage for Fresh Mangos: This segment of the chain involves the preparation of fresh mango for shipping and sale. A perishable product, the shelf life of harvested mangos is short (2-3 weeks) compared to other products such as apples (2 to 7 months), grapes (1 to 5 months) or plums (2 to 5 weeks) (CCNI, 2016). In addition, temperature controlled systems must be employed immediately after harvest until the product reaches its final destination. During this stage, fresh mangos are washed, sized and undergo a Hot Water Treatment (HWT) to control fruit flies. Mangos are then graded and packed in boxes of approximately four kilograms (Asia Farming, 2017). They are placed in a single layer—around 8-15—in the box with holes for air ventilation (Asia Farming, 2017). Packing is typically undertaken by export firms with large

packhouses that aggregate the production from numerous different producers, and most likely also export a range of other tropical fruits. These exporters may also have some degree of production. Exporters may sell mangos to regional distributors or can sell directly to large retail stores.

Processing: This stage of the chain consists primarily of manufacturing activities, converting fresh mango into a range of processed products. The most popular processed mango products are:

- **Dried.** Fresh mangos are peeled, sliced and mixed with sugar. Then, the mango slices are laid in a tray and dehydrated. Dehydration is typically done by osmotic concentration in which the water is removed from the mango.
- **Purée.** Mangos are processed into purée for re-manufacturing into products such as nectar, juice, concentrate, jam and jelly. Mango puree may be made from the whole mango by specialized processors, but also by factories producing dried mango that use the mango leftover on the pit to produce the purée.
- **IQF.** Individual Quick Frozen (IQF) is a technology that allows each piece of fruit to be frozen separately avoiding large chunks of frozen product. The shelf life of IQF mango is up to 24 months. This form of mango is later used in smoothies, salads and confectionaries (OctoFrost, 2016).

Activities in this stage of the chain undertaken by a different set of firms than those involved in production and, while inherently linked to on-farm cycles due to the need for raw materials to maximize installed capacity, this is characterized by lower risk than agricultural production. In addition, this stage further differs in terms of factor intensity compared to cultivation; in the cultivation of mangos, labor is a key component, while in the processing stage of the chain, capital is the main component needed to acquire the necessary equipment and infrastructure.

Energy provision is also an important inhibitor for any potential entry into the downstream processing stages of the value chain, regardless of whether output is oriented to the local or foreign market. Electricity prices are amongst the highest in Asia (Enerdata, 2014). This is partly due to a lack of investment in new technologies, including enhancements in the grid network (EIU, 2015; Enerdata, 2014; Field Research, 2016). Total installed capacity in 2014 reached 17,944 MW (DOE, 2015). Committed investments, however, to date for 2015-2019 would ramp up an additional 5,200 MW (DTI et al., 2014), increasing capacity by almost 30%. The government estimates that it needs to add around 1,000 MW of new capacity every year to avert a repeat of the energy crisis in 2013 (Enerdata, 2014). Electricity demand in the Philippines is projected to grow at 5.7% per year on average between 2015 and 2020 and 4.6% annually over the next 20 years (EIU, 2015; IEA, 2013).

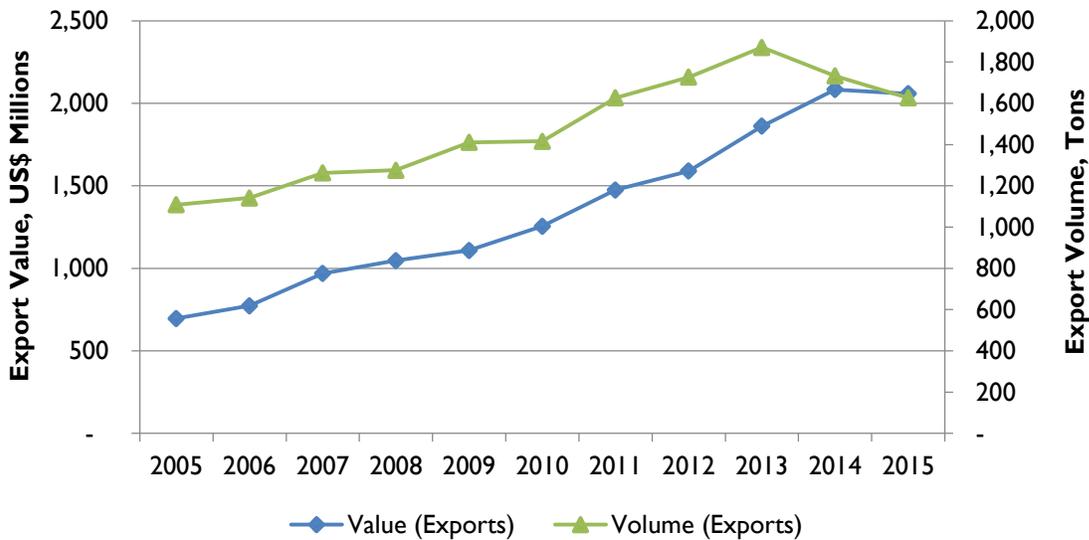
Distribution. The distribution segment of the value chain incorporates all activities corresponding to the reception of the mangos in the end market and delivery to sales outlets. Many exporters sell directly to end clients, but in other cases, brokers or intermediaries may be used in destination country. There is a growing tendency today to focus on direct buying and eliminating intermediaries. However, this requires production and shipping of consistent quality fruit, as there are usually limited mechanisms – particularly for fresh mango exports - for redirecting the shipments rejected by the client to less demanding markets. Brokers tend to be used more often by smaller producers or those that are new to the GVC, serving to aggregate supply and minimize transaction costs for final buyers. In the case of processed mango this is similar in which the exporter sells directly to large food retailers or food manufacturers. Exporters may also sell their products through distributors.

Marketing and Sales: This stage involves the point of sale to the final consumer. Marketing and sales activities are performed by several different actors depending on the geographic end-market. These include supermarkets, food services and small-scale retail outlets. Supermarkets increasingly represent the most important market channel, accounting for the largest share of the fruits and vegetable sales in key markets. In the EU and the US, they represent around 75-80% of all retail food purchases (Reardon et al., 2007). Important retailers include Wal-Mart, Tesco, Carrefour and Costco amongst others. Processed mango such as dried and juices are also marketed in supermarkets and food stores.

2.3 Global Trade in the Mango Global Value Chain

Over the past ten years, trade of mangos has increased significantly in both volume and geographic scope. Demand has been buoyed by rapidly expanding consumption in the US, China and the Netherlands, while several Latin American countries have increased their exports in fresh and processed products. Mango is a popular product in tropical countries; however, globally, the market for this fruit has only really developed in the last decade (Figure 2). Since mango is a newly traded product, global statistics are not yet disaggregated to differentiate trade data between fresh and dried, or other processed forms of mango; juice, for example, is mixed with other tropical fruit juices. This makes it difficult to analyze the input-output trade flows in the industry. In order to develop a more nuanced understanding of the industry, this report thus uses a combination of aggregate data from UN Comtrade, and disaggregated country trade data from major importer countries to identify trends and specific type of products.

Figure 2. Global Exports Fresh and Dried Mango, by Value and Volume, 2005-2015



Source: UN Comtrade, HS 2002-080450, Based on All Exporters, Downloaded 12/28/2016

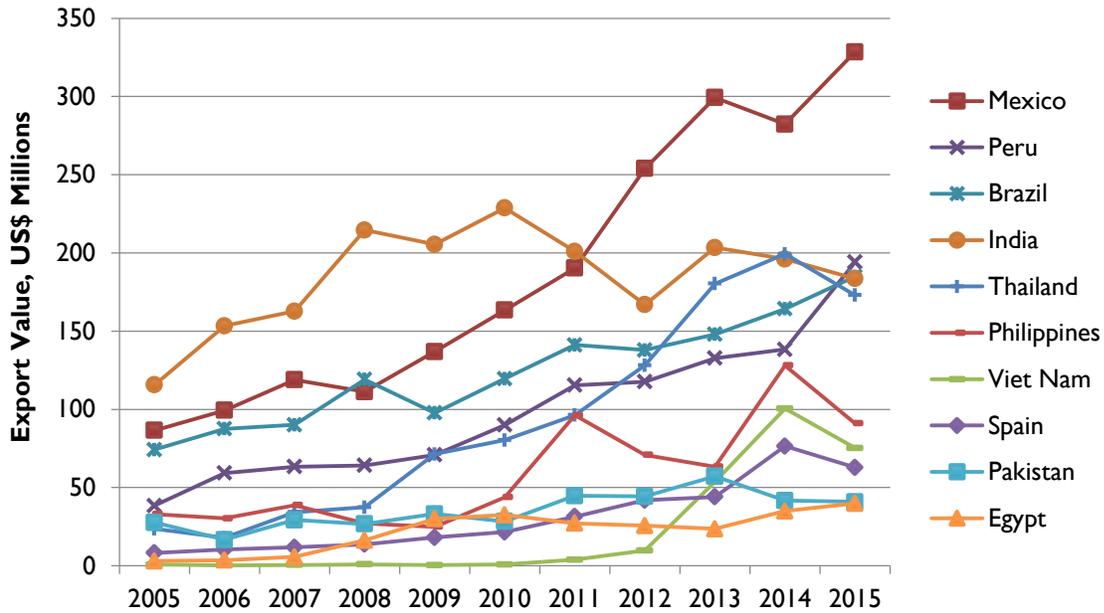
The mango export market is quite concentrated and dominated by developing country producers in the Tropics. Mexico has dominated international mango trade over the past four years with a 16% of market share. Other leading exporters are Peru, Brazil, India and Thailand, which together with Mexico accounted for 53% of global exports in 2015. In 2012, Mexico surpassed India, the world leader. India has lost ground because it has not been able to incorporate new technologies in production, and productivity has declined. In 2008, the country led global trade

with a 20% market share, but by 2015, this had declined to just 9% and the country had slipped to fourth place. Peru has also demonstrated a great performance in the last decade, exporting fruits and vegetables becoming one of the leading exporters of asparagus, grapes, avocados and mangos, among others (Fernandez-Stark et al., 2016).³ The Netherlands plays a role as a re-exporter in the industry due to its position as a key logistics hub in Europe (UNComtrade, 2016).

Regionally, Latin America leads exports, accounting for 34% and three of the top five exporters Mexico, Peru and Brazil. Asia has shown a mixed performance; of the region's three relevant exporters over the past decade, India's competitiveness has declined; the Philippines has demonstrated inconsistent exports, some years high while the next year exports drops drastically. Only Thailand has become an important player in the mango trade, growing exports from just 3% in 2005 of global share to 8% in 2015.

³ Peru has benefitted from the knowledge of large Chilean fruit exporters who have invested heavily in the country (Fernandez-Stark et al., 2016).

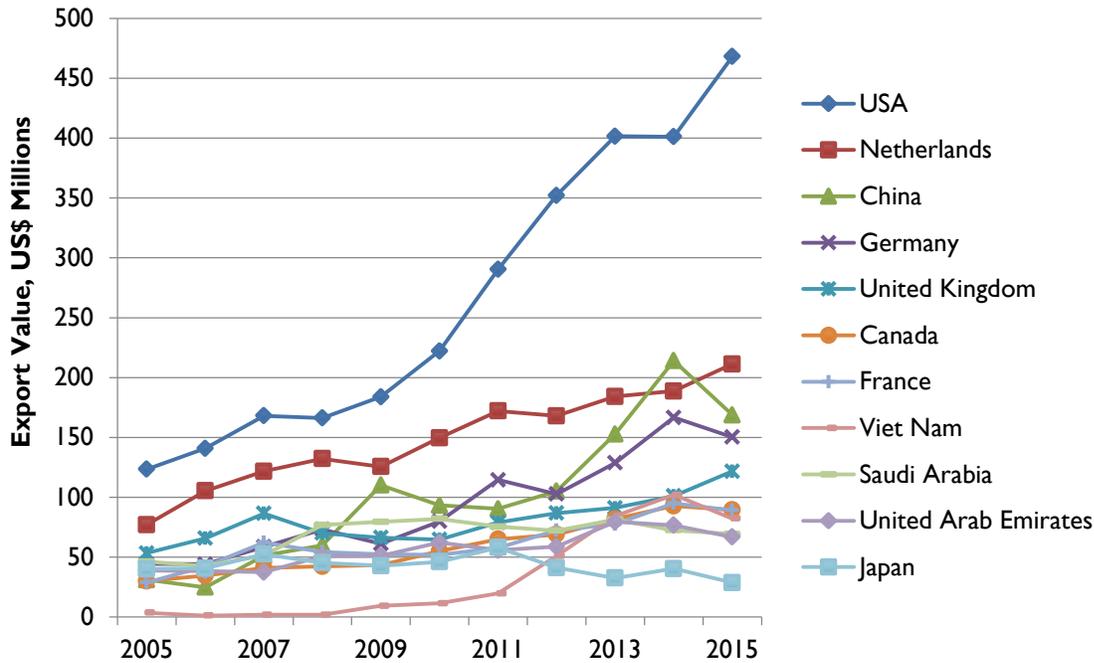
Figure 3. Leading Exporters of Fresh and Dried Mango, By Value 2005-2015



Source: UN Comtrade, HS 2002-080450, Based on All Exporters, Downloaded 12/28/2016

Mango importers are mainly developed countries, with the exception of China. The top five importers concentrate 54% of the global market. The US is the leading importer totaling US\$468 million in 2015 with a 23% of market share, and its growth has largely driven global growth over the past decade. Fresh mango accounts for the lion’s share of imports (80-85%), compared to dried mango with 15%-20% (US Trade Commission, 2016). Mango is particularly popular amongst the Hispanic population living in the US, as well as young (21 to 39) high income Americans (US\$100K+) (National Mango Board, 2015). Nonetheless, China’s imports have grown more than five-fold during the same period. The country imported just US\$31 million in 2005, increasing to US\$169 million by 2015. This is mainly due to the increase in disposable income of Chinese population and a growing demand for non-traditional fruits (EUSME Centre, 2015). Other top importers are located in Europe, including Netherlands, Germany, and United Kingdom (UK).

Figure 4. Leading Importers of Fresh and Dried Mango, By Value 2005-2015

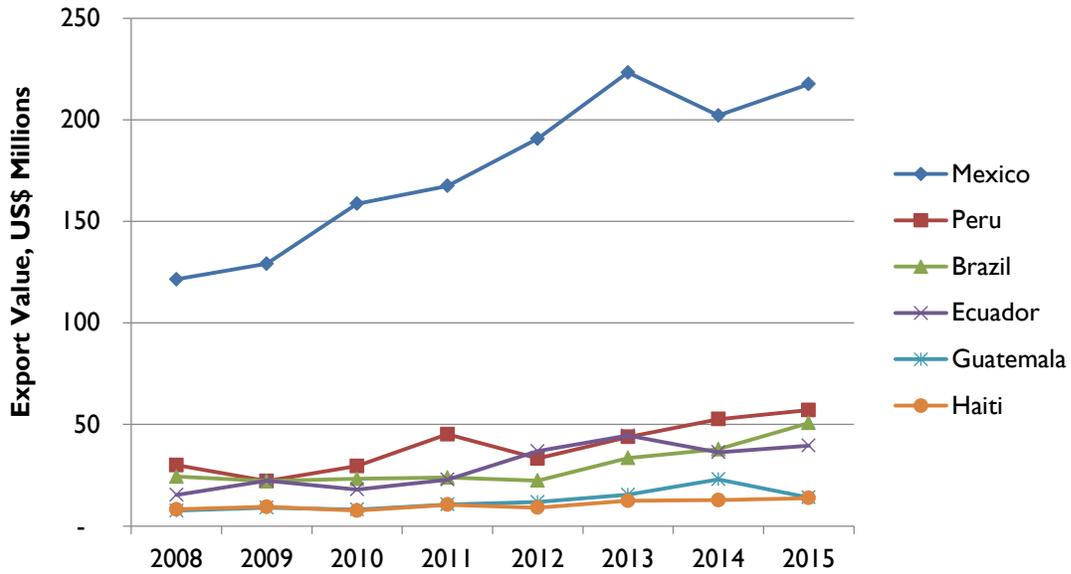


Source: UN Comtrade, HS 2002-080450, Based on All Exporters Downloaded 12/28/2016

Trade in fresh mangos is more regional in scope; likely owing to the short shelf life and the relatively high cost of shipping these fragile products. All fresh mango imported into the US is sourced in Latin America, with approximately 50%, some US\$220 million, from Mexico. Likewise, although a much smaller market with just US\$27 million in fresh mango imports in 2015, Japan also sourced an important share of its imports from Asian producers, including Thailand, Taiwan, and the Philippines. Japan, however, introduced particularly restrictive SPS requirements in 2011, which few producers in the region, and the Philippines, in particular, have been able to meet. Although all exporters to Japan have seen their export value decline, the most significant reduction has been from the Philippines, which saw exports decline from US\$16 million in 2005 to US\$2 million in 2015 (Trade Statistics of Japan, 2016). The leading EU markets, including the UK, Germany and France draw the bulk of their imports from Brazil, Peru, Spain and Cote D'Ivoire (UNComtrade, 2016).⁴

⁴ According to UN Comtrade (2016), the EU imported approximately 340,000 MT of mango (fresh and dried) in 2012; that same year, CBI reported 3,400 MT of dried mango was imported. Based on this, we assume that dried mango imports are approximately 1% of all fresh and dried mango imports that year.

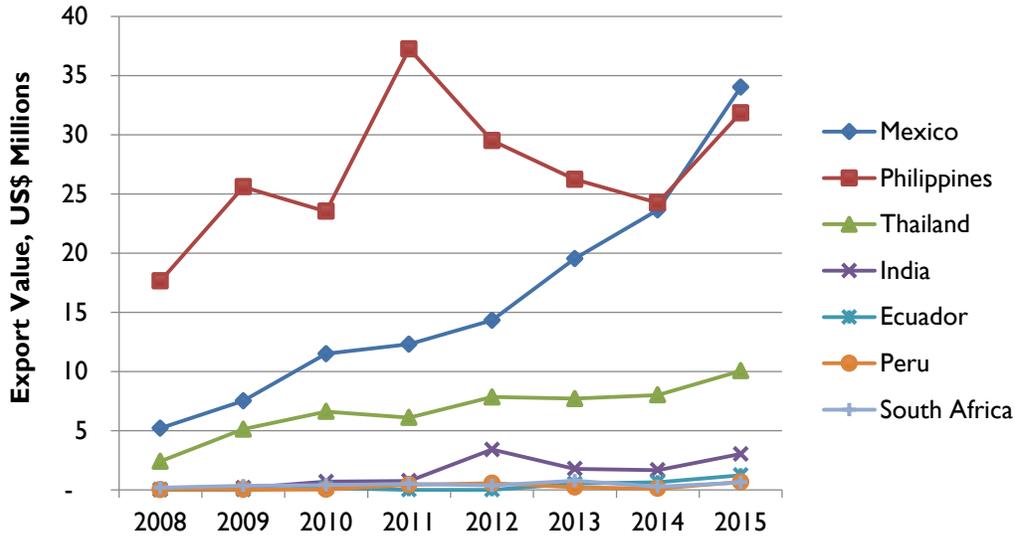
Figure 5. Leading Exporters of Fresh Mango to the United States, by Value, 2008-2015



Source: (USITC, 2016)

Dried mango trade, however, is considerably more global in scope. As with fresh mango, the US is a major importer, with US\$82 million in imports in 2015 (USITC, 2016). Again, Mexico is its most significant trade partner and the country has rapidly ramped up its US exports of dried mango from just US\$5 million in 2008 to seven times that (US\$34 million) in 2015, to meet the growing demand. In the process, Mexico has steadily captured market share from the Philippines, the long-time leading supplier of dried mango to the US, surpassing it in 2015. A key reason for this has been the fluctuating Philippine export quantities, attributed locally to variations in the supply of raw materials. Nonetheless, the two countries accounted for approximately 80% of US dried mango imports between 2010 and 2015 (USITC, 2016).

Figure 6. Leading Exporters of Dried Mango to United States, by Value 2008-2015



Source: (USITC, 2016)

European countries demand for **dried mango** is small and accounted for only 1% of all imported dried fruit. The major countries serving this market are Thailand, Philippines and South Africa (CBI, 2014b). The top exporters of dried mango to Japan are very similar countries: Philippines, Mexico, South Africa, Thailand and China. The exports of dried mango to Japan are small but increasing rapidly; in five years they tripled. In 2010, Japan imported just US\$165,448; by 2015 this had risen to US\$433,076. Mexico has been gaining market in this Asian market in recent years. In 2009, Mexico exported only US\$16,252 of dried mango to Japan and in 2015 this figure increased 8 times to reach US\$128,654. The other top countries exporting dried mango to Japan, led by the Philippines, shows a less constant performance.

2.4 Lead Firms and Governance

The global mango sector operates as a buyer-driven value chain. Large supermarkets are the leading actors in the key export markets for the sale of fresh mango (National Mango Board, 2015), with controlling market shares of up to 80% across the EU and in the US (Reardon et al., 2007; Reardon et al., 2012). These buyers seek enhanced cost competitiveness, consistency and product differentiation from their global supply chains. During the past 20 years, they have continuously consolidated, gaining more power over the suppliers. Today, these lead firms exert significant influence over the entire value chain and dictate how fresh produce is cultivated, harvested, transported, processed and stored. Table 2 lists the ten largest global food retailers, Wal-mart is the largest outlet, followed by Kroger and Costco (Supermarket News, 2013). This power dynamic is also true for final processed mango products such as dried and juice.

Table 2. Leading Ten Global Food Retailers, By Sales 2013

Supermarket	Country of Origin	Sales (US\$ billion)
Wal-Mart Stores	United States	466
Tesco	United Kingdom	119
Carrefour	France	116
Costco	United States	103
Kroger Co.	United States	98
Schwarz Group	Germany	98
Metro Group	Germany	86
Aldi	Germany	81
Target Corp.	United States	71
AEON	Japan	71

Source: (Supermarket News, 2013)

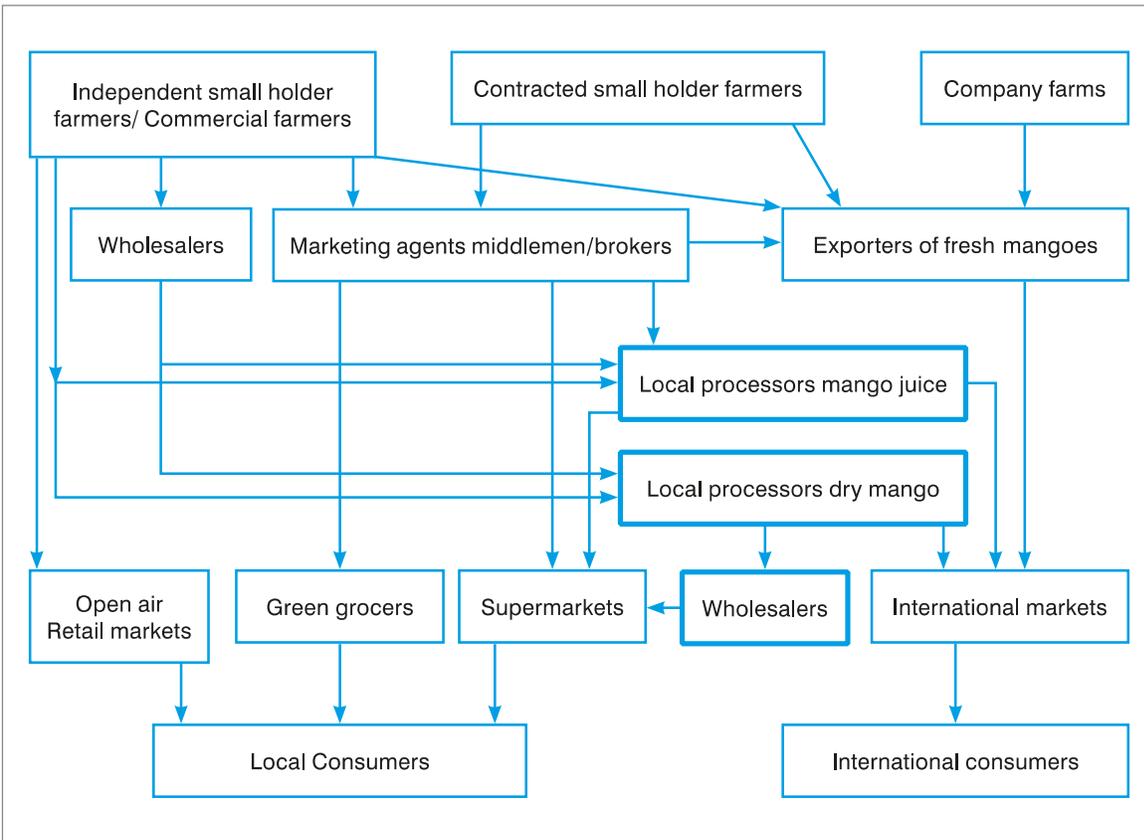
Note: Where necessary, currencies were converted using Oanda historical currency converter, using rates available December 31, 2013.

Supermarkets now wield considerable influence not only over how mangos are produced but, as a result of their control over access to market, they also have substantial bargaining power over how much producers are paid, how they are paid and when. Operations through brokers continue to be less controlling, reflecting the more traditional market structure and allowing for a greater variety of product quality and size. However, with such a large share of the market dominated by supermarkets, sales through brokers and other intermediaries are characterized by greater uncertainty. This power dynamic is also true for final processed mango products such as dried and juice.

The power dynamic for mango as inputs to remanufacturing final food products such as cereals, juices, ice creams and pastries among many others is very similar. Key global brands such as Coca-Cola, Unilever and Nestle hold great control in the value chain due to their size and global buying power. Mango producers of mango puree and other intermediate mango products need to follow the rules of these global brands in order to participate in the GVC.

On the supply side of the value chain, mango producers can be divided into four categories: a) independent smallholder farmers, b) contracted smallholder farmers, c) commercial farmers and d) large company farms (ITC, 2014) (See Figure 7). Since mango is a relatively new commercial product, which has been mainly cultivated for domestic consumption in producing countries, the majority of the supply continues to be generated by independent smallholders around the globe. These smallholder farmers may be organized in cooperatives or sell their production to intermediaries. Contracted farmers sell their mango production to exporters. They also buy mangos from the other three types of producers to augment their supply. Commercial farmers are mango growers that own large scale farms of more than 1,000 mango trees. Finally, large company farms are owned by exporters/processors in the sector that directly sell their products abroad. These large company operations are primarily present in Latin American countries such as Brazil, Mexico and Peru. These firms have introduced modern techniques for cultivation, harvesting and post-harvesting. These countries have professionalized their production and they have been able to cross their regional boundaries, exporting fresh mango to countries in Europe and Asia.

Figure 7. Type of Mango Producers and the Network with Final Consumers



Source: (ITC, 2014)

Small producers must follow the certifications and standards established by lead firms and governments in import markets. For a variety of reasons, including limited financial wherewithal to invest in costly certification of standards compliance, these producers are generally not well positioned to respond to these challenges and those unable to do so are often marginalized (Dolan & Humphrey, 2004; Fernandez-Stark et al., 2012; Lee et al., 2010b; Maertens & Swinnen, 2009). For example, Japan introduced a very strict standard for fresh mango in 2011 and many supplier countries who rely on smallholder production experienced rejection of their mangos. A number of countries that do not meet the standards to export fresh mango thus have shifted to exporting processed mango that only requires manufacturing food safety standards, and has no requirements with respect to traceability at the farm level (Field Research, 2016).

2.4.1 Standards and Certifications

Mango producers and processors face a complex system of multiple standards at national, regional and international levels. As seen in Table 3, this system includes both public and private standards. Most public standards focus primarily on preventing SPS problems. Private standards have emerged alongside a host of health and safety standards for fruits sector that have proliferated in developed nations over the past 15 years. The increase in safety standards is largely attributed to a greater public awareness of the potential health risks related to foodstuffs and the potentially high costs that

private firms face as a result of selling tainted products (Dolan & Humphrey, 2004; Gulati et al., 2006; Lee et al., 2012). Lead firms have developed specific codes to regulate the products they sell. For example, Carrefour, implemented the Filière Qualité, and the UK-based Tesco supermarket implemented its private standard, Nature's Choice.

Table 3. Prominent Standards in the Mango Industry

	Public		Private	
	Mandatory	Voluntary	Individual	Collective
National	<ul style="list-style-type: none"> • National legislation (pesticide use, labor regulations, sanitary inspections etc) • USDA Standards 	<ul style="list-style-type: none"> • HACCP • USDA National organic program 	<ul style="list-style-type: none"> • Nature's Choice (Tesco) • Field-to-Fork (M&S) • Terre et Saveur (Casino) • Conad Percorso Qualità (Italy) • Albert Heijn BV: AH Excellent (Netherlands) 	<ul style="list-style-type: none"> • British Retail Consortium (UK) • Assured Foods Standards (UK)
Regional	<ul style="list-style-type: none"> • EU Regulations 		<ul style="list-style-type: none"> • Filieres Qualite (Carrefour) 	<ul style="list-style-type: none"> • GlobalGAP⁵ • Dutch HACCP • Qualitat Sicherhiet (QS – Belgium, Holland, Austria) • International Food Standard (German, French, Italian)
International	<ul style="list-style-type: none"> • World Trade Organization SPS Agreement 	<ul style="list-style-type: none"> • ISO 9000 • ISO 22000 	<ul style="list-style-type: none"> • SQF 1000/2000/3000 (US) 	<ul style="list-style-type: none"> • GlobalGap • Global Food Safety Initiative • SA 8000 • IFOAM Standard

Sources: (Henson & Humphrey, 2009; Steve Jaffee & Masakure, 2005; Lee et al., 2010a, 2012)

⁵ GlobalGap is one of the most widely adopted standards. This standard was first developed in Europe in 1997 by an association of European fresh produce importers and retailers, and principally concerns pesticides and chemical use as well as the environmental impact of farming systems. US retailers began to adopt this standard for fresh produce in 2008 (GlobalGAP, 2008).

Public standards

Public phytosanitary standards have become increasingly strict as countries strive to protect their own agricultural production from disease and their citizen's health in the face of increased global movement of products. In general, public standards are much stricter in developed countries such as the US, Europe and Japan than developing and emerging economy markets such as Russia and China.

For the US market, the phytosanitary controls and measures for fresh mango are managed by the APHIS-USDA (US Department of Agriculture's Animal and Plant Health Inspection Service), and the controls for processed mango by the FDA (Food and Drug Administration). APHIS determines which fresh fruits and vegetables exports by country are authorized to enter the US, and establishes the requirements for their importation. Given that mango is prone to insect infestations, these are fairly restrictive (UNCTAD, 2016). In order to guarantee the elimination of fruit flies, fresh mango suppliers of the US must submit their fruits to a certified hydrothermal treatment inspected directly by a USDA agent or an official representative (UNCTAD, 2016). If a source fails to meet the requirements in terms of pest management, APHIS determines the suspension of imports from that country (UNCTAD, 2016).

For the European markets, the European Commission has also imposed phytosanitary requirements in order to prevent the introduction and spread of organisms that could be harmful to plants and plant products within the EU, as well as legal requirements designed to guarantee consumer safety and preventing the entering of substances that are dangerous to health (CBI, 2014a). The former focus on hygiene, traceability and maximum residue levels (MRLs) for certain contaminants and pesticides that might be present in mangos (CBI, 2014a).⁶ If mangos (fresh and dried) do not meet these requirements they are simply not allowed into the EU market, and the provider (or the trade partner) runs the risk of fines up to 70,000 euros (CBI, 2014a).

For the Japanese and Korean markets, fresh mangos must undergo a process called Vapor Heat Treatment (VHT) to remove fruit flies (Pasadilla & Liao, 2006). In Japan, new stringent regulations were implemented after 2006, when the Ministry of Health, Labor and Welfare (MHLW) introduced a list system, prohibiting the distribution of food containing agricultural chemicals above certain level of Maximum Residue Limits (MRLs).

For organic mango, the most internationally recognized certification is the USDA National Organic Program (NOP), which is responsible for developing the rules and regulations for production, handling, labeling, and enforcement of all organic products. USDA Organic certification confirms that a farm or handling facility—whether within the United States or abroad—complies with USDA organic regulations. In order to capture the environmental gains of organic production and enter high value niche markets, mango farmers have begun certifying their organic production. Mexico, Peru, and Brazil show a high number of producers certified in USDA Organic; however, other countries are lagging behind including Ecuador, Thailand, Pakistan, Guatemala, and India. Philippines has only one mango producer certified (USDA, 2016b) (See Table 4).

⁶ Buyers in several member states (e.g. the UK, Germany, the Netherlands and Austria) use MRLs that are stricter than those specified in EU legislation (CBI, 2014a).

Table 4. USDA Organic Mango Producers in Leading Export Countries, 2016

Country	Number of Mango Producers Certified USDA Organic
Mexico	144
Peru	131
Brazil	46
Ecuador	19
Thailand	5
Egypt	2
Pakistan	2
Philippines	1
Guatemala	0
India	0

Source:(USDA, 2016b)

Processed mango is regulated under the Hazard Analysis and Critical Control Point (HACCP) system developed by the US Food and Drug Administration (FDA). This has been widely adopted by both major organizations and the World Health Organization and the Food and Agriculture Organization (FAO) importer countries alike (Pasadilla & Liao, 2006). HACCP is a management system in which food safety is addressed through the analysis and control of biological, chemical, and physical hazards from raw material production, procurement and handling, to manufacturing, distribution and consumption of the finished product (FDA, 2016).

The ISO standards related to processed products, drawn up by the International Organization for Standardization, comprise two main series: ISO 9000 Quality Management System and ISO 14000 Environmental Management System. They ensure that processes are run properly and are validated by approved specialist independent bodies, which conduct regular audits (UNCTAD, 2016).

Private standards

Private standards are not only concerned with phytosanitary aspects, but also with product quality and size, and establish requirements that differentiate their products according to environmental, social, and environmental factors of production (FAO, 2006; TESCO, 2005). Private standards are characterized by a lack of harmonization, both in requirements and enforcement mechanisms across countries, which has added significant cost to compliance.

The private standard that has the most impact, by far, is GlobalGAP, which emerged in the late 1990s as the European public grew concerned that government regulations were not strict enough to ensure food safety (Steven Jaffee et al., 2011; Singh, 2013). Some US supermarkets, such as Walmart, Giant, and Food Lion, require GlobalGAP, specifically, while many more required it indirectly (GlobalGAP, 2015). Mango farmers thus have begun certifying their production in order to enter these high value markets. Peru, Mexico, Brazil, India and Egypt shows a high number of producers certified in GlobalGAP; however, other countries are lagging behind including Ecuador, Thailand, Pakistan, and Guatemala. Philippines has no mango producer certified (GlobalGAP, 2017) (See Table 5).

Table 5. GlobalGAP Certified Mango Producers in Leading Export Countries, 2016

Country	Number of Mango Producers Certified GlobalGAP
Peru	380
Mexico	80
Brazil	80

India	60
Egypt	60
Ecuador	24
Thailand	17
Pakistan	5
Guatemala	4
Philippines	0

Source: GlobalGAP (2017)

The control of lead firms over the chain has been achieved through the introduction of these private standards and codes of conduct that govern both the characteristics of the product, as noted above, and the social and environmental conditions of cultivation and post-harvest handling. For example, French supermarket, Carrefour, implemented the *Filière Qualité*, which does not allow post-harvest chemical treatments to preserve freshness (FAO, 2006).⁷ UK-based Tesco implemented its private standard, Nature's Choice, for European producers in 1993, and expanded it globally in 2004 (Cox, 2007). Nature's Choice focuses on environmental impact of fruit production, including integrated pest management, minimal chemical use, encourages water and energy efficiency and recycling. Tesco accepts Assured Produce—a similar certification carried by multiple European supermarkets—as an equivalent to Nature's Choice (FAO, 2006). The private standards best known globally are – as mentioned before—GlobalGAP, BRC and IFS (UNCTAD, 2016). In the European market, standards such as SEDEX and ETI are also important (USAID, 2011) (See Appendix I). In the case of processed food, lead firms require good manufacturing practices established by public standards such as HACCP, ISO 9000, and ISO 22000.

3. The Philippines and the Mango Global Value Chain

The Philippines holds a relatively significant position in the mango GVC. It ranked seventh in 2015 among exporters of fresh and dried mango, with US\$91 million in exports and a 4% share of the global market (UNComtrade, 2016). Participation in the GVC is based primarily on the export of processed mango, 85% of which is destined to the export market. Despite climatic advantages, fresh mango exports have declined considerably in recent years, primarily as a result of failure to meet strict SPS requirements in key markets. Locally, mango is the third most important fruit both in terms of quantity and value of production after bananas and pineapples. The mango industry plays an important role in the economy of the country, providing a source of livelihood to about 2.5 million farmers (PCARRD-DOST, 2011).

Low yields that pale in comparison with competitors result in erratic production and export trends. The shortages are often attributed to environmental factors, pest and diseases, and high costs of inputs (PCARRD-DOST, 2011). However, the industry suffers from inadequate technological development to cope with environmental risk, lack of irrigation equipment, inadequate fertilizer management and equipment, and abuse of pesticide use. In addition, GAPs are scarcely implemented, and formal training for farmers are mostly absent (Briones et al., 2013; Buguis, 2014; Hambloch, 2015). Finally, insufficient financial resources and substandard infrastructure have also been cited as constraints for heavily increasing production and exports (Field Research, 2016).

This section analyzes the Philippines' participation in the mango GVC by first using trade and firm-level data to examine current products and exports. It then outlines the industry organization and

⁷ *Filière Qualité*: a system that is based on five core principles: taste and authenticity, long-term sustainable partnerships along the supply chain, fair price, constant product quality, and environmental sustainability.

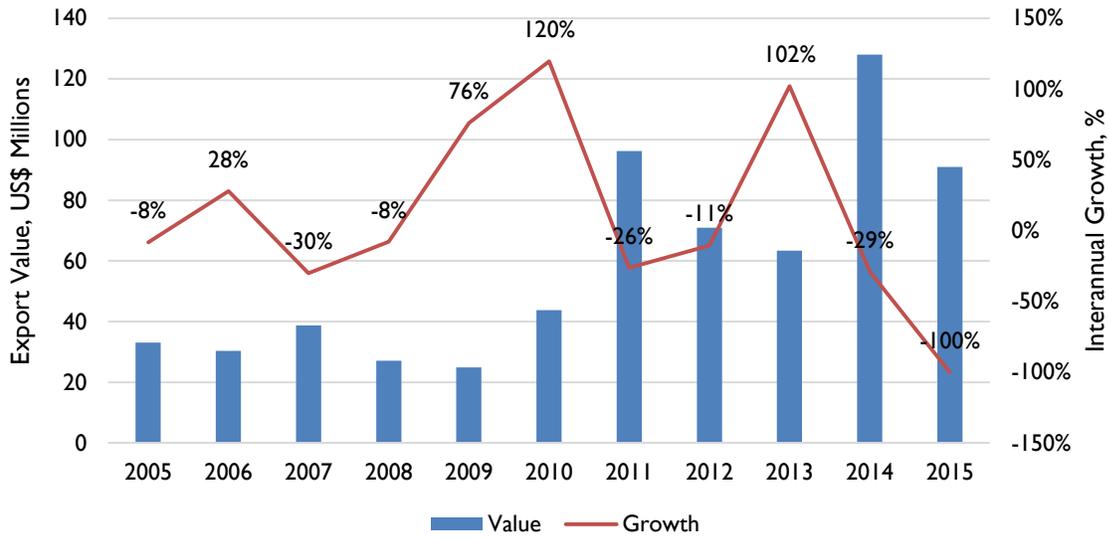
key firms active in the country at each stage of the value chain. From there, it highlights examples of upgrading before concluding with advantages and constraints that will shape future participation in the mango GVC.

3.1 Current Participation in the Mango Global Value Chain

The Philippines has been an important player of the global market since the 1980s. Exports took off in the 1990s, accounting for an average of 10% of world fresh and dried mango trade (FAO, 2016). Leading processors, which are domestically owned firms, started their businesses in the mid-1970s and, with the exception of the past years given low yields, have been steadily gaining access to regional and global markets.

The Philippines is the seventh largest exporter of mango worldwide (UNComtrade, 2016). With US\$91 million in total mango exports in 2015, the country contributed 4% to globally traded supply, including fresh and dried mango (UNComtrade, 2016). The country's competitiveness in the world market is most influenced by its export variety quality; the native Carabao variety is considered one of the finest and sweetest mangoes in the world.

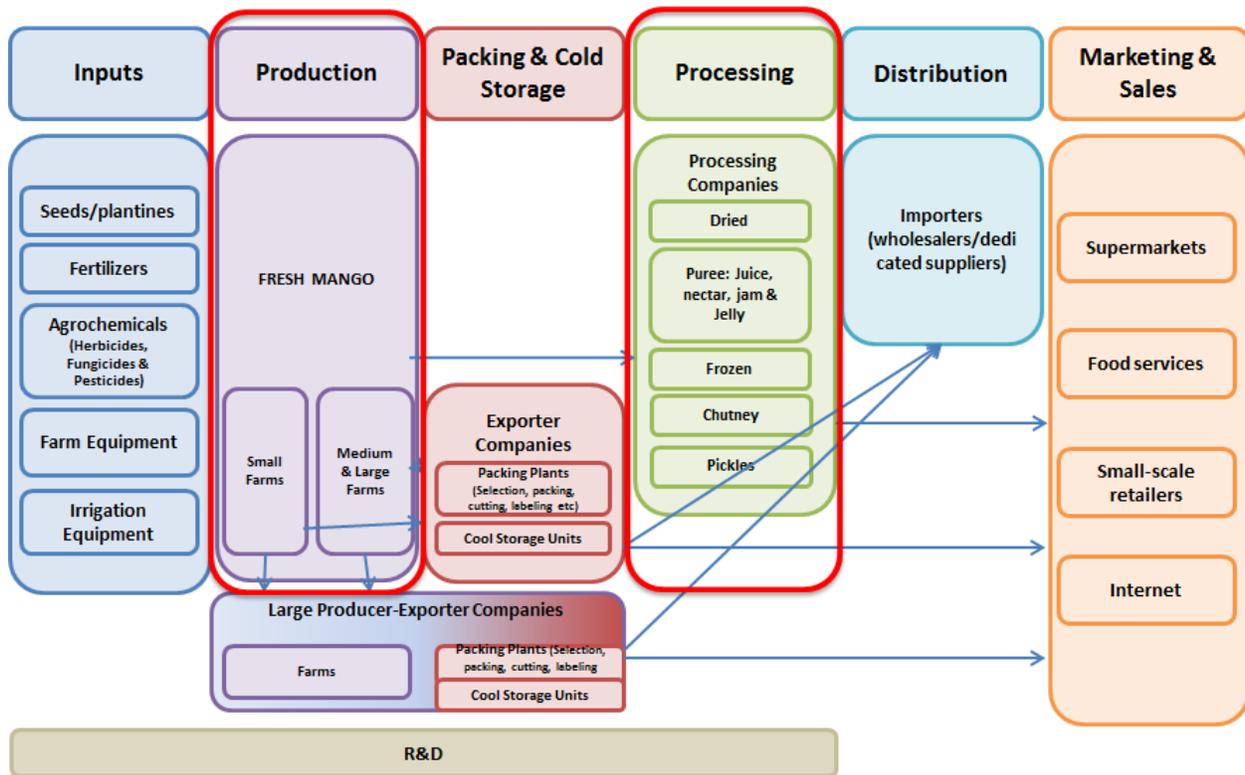
Figure 8. Philippine Fresh and Dried Mango Exports, by Value and Inter-annual Growth, 2007 – 2015



Source: UN Comtrade. HS 2002-080450, Based on All Exporters Downloaded 12/28/2016.

The current position of Philippines in this mango GVC is illustrated in Figure 9 by the red rectangles. The country is primarily present in the production and processing stages of the chain. R&D is limited, and the use of technology to manage risk is poor, even in the large-scale, more technically sophisticated agribusiness firms (Briones et al., 2013). With poor performance in cold chain management, packaging, and pre-export SPS treatments, the Philippines has not been able to sustain a strong position in the export of fresh mango as exporters are unable to comply with the standards required by key markets.

Figure 9. Philippine Participation in the Mango Global Value Chain



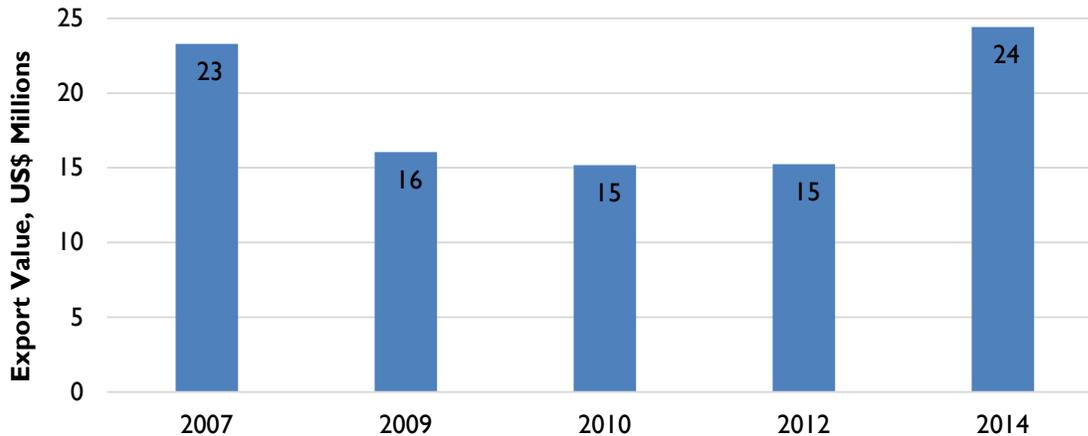
Source: Authors.

Production for export and downstream processing: In 2014, the Philippines exported approximately 21,000 MT of fresh mangos at an export value of approximately US\$24 million (PSA, 2007-2014).⁸ This accounts for 21% of total mango exports. While the Philippines participates in this segment of the GVC, most of the total production is absorbed by the domestic market (98%), either for immediate consumption or for further downstream processing. Fresh mango is aggregated from producers by informal intermediaries and certified traders.⁹ In 2014, there were approximately 63 companies exporting fresh mango. Nearly 80% of those firms are small and medium sized, exporting less than one half a million dollar. The companies with exports above that US\$500,000 (12) account for 19% of the fresh mango exporters and 87% of total fresh mango exports in 2014 in terms of value.¹⁰

⁸ As in the global industry, disaggregated statistics are not available in international trade statistics. Therefore, this section draws on a combination of UN Comtrade aggregated trade statistics and Philippine Statistics Authority (PSA) firm-level exports from 2007 to 2014. There may be slight discrepancies in the reported amounts as a result.

⁹ Informal intermediaries sell the produce to domestic wholesalers, processors, and international wholesalers, while certified traders sell exclusively to processors (Hambloch, 2015). International wholesalers supply the export market by selling the produce to brokers abroad, mainly Hong Kong, Japan and Middle East (Buguis, 2014; Hambloch, 2015).

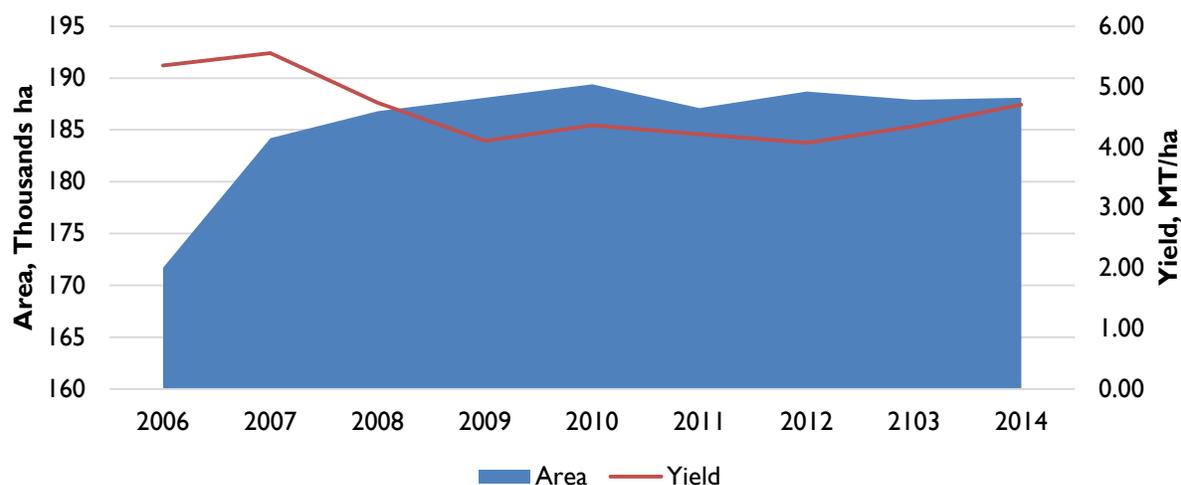
¹⁰ Author calculations based on Custom Data provided by (PSA, 2007-2014).

Figure 10. Fresh Mango Exports, by Value, 2007 – 2014

Source: Author based on Customs Data provided by (PSA, 2007-2014).

Mango production is typically small-scale. In 2014, approximately 73% of the total area harvested was owned by small farmers (or backyard farmers) with areas less than 3 ha, followed by 24% of farms which size ranges between 3 to 9.99 ha, and 3% of 10 ha and more (Buguis, 2014). More precisely, in 2015, the average farm size of mango producers was only 1.34 ha. Interestingly, farms that export have the lowest average farm size (0.44 ha) compared to farmers selling to the local (1.47 ha) or processing market (1.45 ha). These smaller farms that export have higher yields than the ones that sell to the local or processing market. Higher productivity of this “backyard” mango cultivation is explained by the maturity of the trees and a proper spacing between them, allowing the trees to obtain better light, water, and nutrients (Department of Agriculture and Food - GWA, 2016; Field Research, 2016).

Of the 885,000 MT mango produced in the country in 2014, the largest production came from Luzon with 53.13% share. Mindanao and Visayas are second and third with a 33.30% and 13.57% share respectively. Production area and yields have remained relatively unchanged between 2009 and 2014, approximately 188,000 ha and 4-4.7MT/ha respectively (PSA, 2015).

Figure 11. Area (in thousands ha.) and Yield (MT/ha) of Mango in Philippines, 2006 – 2014


Source: Author based on (PSA, 2015)

Processing: This is the segment in which the Philippines has the most significant footprint in the GVC. About 85% of processed mango (e.g. dried, puree, and juice) is exported (Briones et al., 2013). In 2014, processed mango exports climbed to US\$91 million (PSA, 2007-2014). Dried mango represented the largest share among all processed products (77%), followed by juice (9%), airtight (8%), and puree (7%) (PSA, 2007-2014). In this segment, fruit quality is less of an issue, and destination markets do not require the strong SPS requirements that are mandatory for fresh exports.

Table 6. Processed Mango Exports Value and Share 2007 – 2014

	Export Value, US\$ Millions					Share in total processed exports (%)				
	2007	2009	2010	2012	2014	2007	2009	2010	2012	2014
Dried	15	9	29	48	70	62%	58%	82%	87%	77%
Puree	9	6	6	4	6	37%	37%	16%	6%	7%
Airtight	0.2	0.5	0.09	2	7	1%	3%	0%	3%	8%
Juice	0.07	0.3	0.6	2	8	0%	2%	2%	4%	9%
Total	25	16	36	56	91	100%	100%	100%	100%	100%

Source: Author based on Customs Data provided by (PSA, 2007-2014)

In 2014, there were approximately 66 companies exporting processed mango, including dried, puree, airtight, and juice. Nearly 70% of those firms are small and medium sized, exporting less than US\$500,000. The companies with exports above that threshold (19) account for 20% of the processed mango exporters and 95% of total processed mango exports in 2014 in terms of value.¹¹ Dried mango processors are mostly based in Cebu and processors of other mango products, operate in and around Metro Manila and Metro Cebu (Briones et al., 2013). Leading firms have been in the business for more than 30 years and are domestically owned. There are three large firms which lead the industry: Profood, M'Lhuillier Food Products, and FPD Food International (Box 1).

¹¹ Author calculations based on Custom Data provided by (PSA, 2007-2014).

In general, large companies export their production directly and also maintain direct relationships with their primary customers, including supermarkets and food service that use mango as an ingredient to prepare foods (e.g. nutrient bars, baby food). However, smaller processors use intermediary for exports. Lately, e-commerce is another marketing channel in large markets, especially for dried mango.

Box I. Top Mango Processors in the Philippines

Profood International Corporation was founded in 1980 and today, it is one of the largest mango processors in the country with exports including fresh IQF mango, dried mango, preserved mango, mango puree, mango concentrates, and mango juice. Headquartered in Cebu, it exports to Asia, Middle East, Europe, the US, and Oceania, from manufacturing sites located in the north, central, southern and western parts of the Philippines. The company is an ISO 9001:2008, HACCP, Kosher, Halal, and NSF certified processor. Mango is processed to several products under 8 different brands; the most popular is Philippine Brand.

FPD Food International Inc (7D Brand) is one of the leading producers of high grade fresh and processed mangos in the country with its brand 7D, including dried mango, mango juice, mango candy, and mango puree. The company was founded in 1972 and in 1978 it started processing fresh mangos into dried mango. Since then, mango production has been its major activity. Its main market destinations for fresh mangos are Australia, Hong Kong, Singapore, UK, and Japan; for dried mango, export markets are Hong Kong, Singapore, Malaysia, Japan, China, Taiwan, Canada, Guam, Saipan, and Korea.

M'Lhuillier Food Products, Inc. belongs to a group of companies that has transitioned from a financial firm to various industries, including food, real state, stainless equipment, among others. It was founded in 1989 and it is one of the major dried and fruit beverage processors in the Philippines. The company exports to 16 countries; the main destinations are the US (45%), Japan and Europe (e.g. UK and Germany). Mango is the company's main fruit group; the most important products are dried mango, followed by mango nectar, and mango puree. Almost 1/3 of fruits are exported in bulk, while another third is exported under the firm's own brand and the rest is exported under client brands. Fresh mangos for processing are sourced from Mindanao (50%), Luzon (35%), and Cebu (15%). Processing is done manually, except for the drying which is done mechanically. M'Lhuillier Food Products is certified in HACCP, Kosher, and Halal, and it is an US-FDA Registered Facility.

Source: Author based on (7D Mangoes Official Website, 2016; M Lhuillier, 2016; Profood International Corp, 2016).

3.2 Major Export Destinations

The major export destinations in 2015 for the Philippines' fresh and dried mango in terms of value were the US (24%), Hong Kong (17%), Republic of Korea (13%), and Japan (12%). Other important markets are China (8%), Canada (7%), and the UK (5%) (UNComtrade, 2016). In terms of quantity, the most important market is Hong Kong, followed by Republic of Korea, and the US (UNComtrade, 2016) (Table 7). The constraint in quantity and value figures is explained by the fact that while regional markets import mainly fresh mango, remote markets with stricter SPS regulations and for which cold chain treatment is essential (e.g. US, Canada and UK) import mainly dried mango.

As seen in Table 7, during the 2005 – 2015 period, the US, Korea and China experienced a significant increase as market destinations of Philippines fresh and dried mango in terms of value. Japan, on the other hand, experienced the sharpest decline in imports: while in 2005 it accounted for almost half of total fresh and dried mango exports, in 2015 the share went down to almost 12% (UNComtrade, 2016).

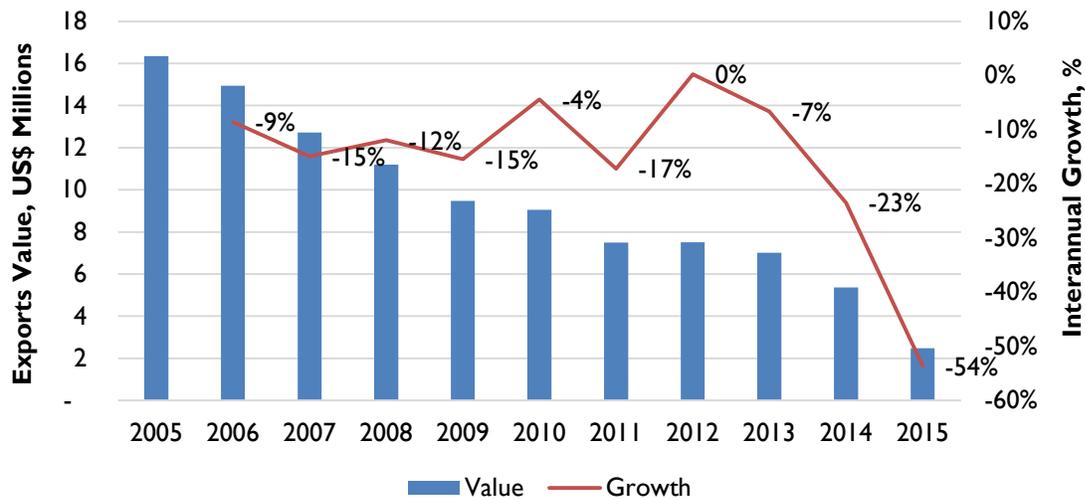
Table 7. Leading Export Destinations for Philippine Fresh and Dried Mango, 2005 & 2015

Import Partner	2005			2015		
	Quantity (Tons)	Value (US\$ Millions)	% of Total Export Value	Quantity (Tons)	Value (US\$ Millions)	% of Total Export Value
US	612	3	9%	310	22	24%
Hong Kong	18,635	8	23%	8,964	16	17%
Rep. of Korea	846	1	4%	4,568	12	13%
Japan	8,138	16	49%	1,597	11	12%
China	2,873	1	3%	889	7	8%
Canada	34	0	0%	1,014	6	7%
United Kingdom	20	0	0%	352	4	5%
Singapore	646	1	3%	526	2	2%
Ireland	1	0	0%	239	2	2%
Australia	3	0	0%	262	2	2%
Total of Top 10	31,807	30	92%	21,515	84	93%
Total	65,222	33	100%	72,210	91	100%

Source: UN Comtrade. Includes exports of fresh and dried Mangos, Mangosteens and Guavas. HS 2002-080450, based on Exports. Downloaded 12/28/2016.

Figure 12 provides a more nuanced view of the steep decline of Japanese imports by showing the dramatic decrease in fresh mango exports particularly. In terms of value, the Philippines went from exporting US\$16 million in 2005 to only US\$2 million in 2015 (Trade Statistics of Japan, 2016). In particular, exports to this market experienced a significant decline after 2011, when Japan introduced stricter regulations regarding quarantine controls for fresh fruits.

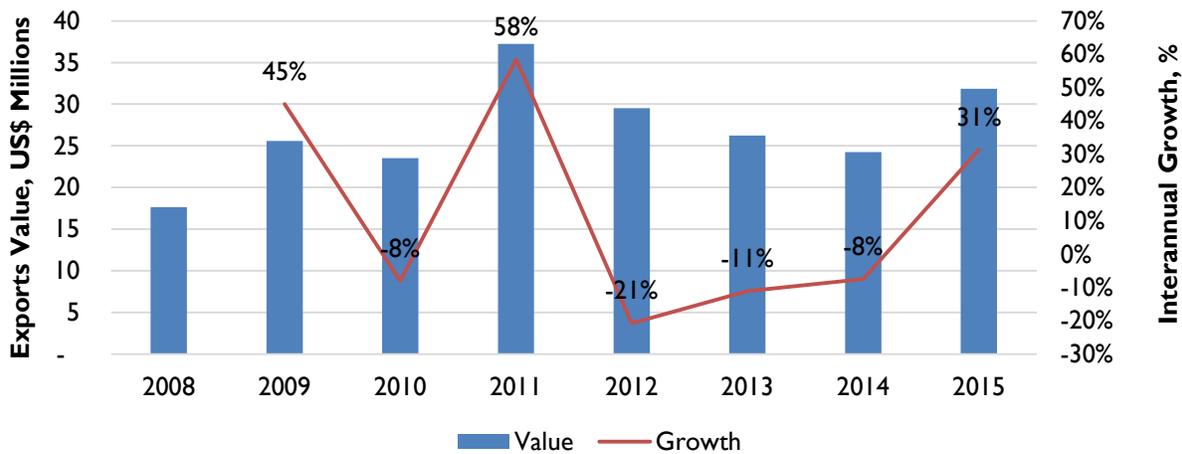
Figure 12. Fresh Mango Exports to Japan, by Value and Growth 2005 – 2015



Source: Author based on (Trade Statistics of Japan, 2016)

For the case of dried mango specifically, the US is Philippines’ major market destination. The exports trend to this country can be summarized as inconsistent: exports to the US increased from 2008 to 2011, peaking in this year to almost US\$37 million but declining since then to US\$24 million. While in 2015 exports experienced a recovery after a 31% increase from 2014, the Philippines lost the position as the number one dried mango exporter to the US, provided that Mexico surpassed it by US\$2 million (USITC, 2016).

Figure 13. Dried Mango Exports Value to US, by Value and Growth, 2008 – 2015



Source: Author based on (USITC, 2016)

Entry into the US market for dried mango has been considerably easier than exporting fresh fruit, both from a time-to-market and standards perspective. Fresh mangos have only 2 to 3 weeks of shelf life and require a set of GAPs to enter into a demanding market in order to meet rigorous SPS standards and quality certifications (See Global Section on Standards). On the other hand, shelf life of dried mango is around 18 months and does not require GAPs, which are still not largely achieved by growers in the country. However, leading processors have been able to meet good

manufacturing practices, such as HACCP, ISO, and NSF, for which they could access stringent markets such as the US, but also Canada and UK. In fact, Profood is also an ISO 9001:2008 and NSF certified company, and M’Lhuillier is a US-FDA Registered Facility (M Lhuillier, 2016; Profood International Corp, 2016).

3.3 Governance Structure of the Philippines Mango Sector

In the Philippines mango sector, the local buyers hold considerable power over producers. This is explicit specifically when large processors (buyers) due to their economies of scales dictate the characteristics and price they will pay for the fruit (Field Research, 2016). To illustrate, in 2015 Philippines had an oversupply of mango since harvesting in the North and South areas of the country occurred at the same time. Buyers forced prices down and bought mango way at rates drastically below production costs, and since producers have no alternative market, they had to sell. Thus, many producers became severely distressed and some were even forced to declare bankruptcy. As a result, in 2016, producers lacked the trust and financial resources for cultivation creating a shortage of mango supply, for what prices increased tremendously. Negative sentiments against the large processors were also perceived by traders and wholesalers, who also had to sell their production below their costs. To illustrate the distressful situation, during the annual mango growers summit, producers, input suppliers and service providers, agreed to address the erratic supply and demand, but if aggrieved, they commit to put at risk the processors’ operations. In 2016 supply became insufficient for processors and lead companies were only able to meet one quarter of their global orders (Field Research, 2016). Table 8 depicts the severe increase of prices from 2015 to 2016.

Table 8. Fresh Mango Prices (US\$) and Volume Growth Rate (%), 2015 - 2016

	2015 (Mango oversupply)	2016 (Shortage of mango supply)	Growth 2015 – 2016 (%)
Fresh for local market	0.53	0.95 – 1.05	98%
Fresh for processing	0.21 – 0.25	1.26 – 1.47	500%
Fresh for export	0.74	1.90	157%

Source: Field Research (2016)

Most mango processors source their fresh mangos in the “open market”, buying from contract farmers, intermediaries or traders. Buyers exerts great control over the production and marketing stages, determining the inputs require, production and harvesting practices, and marketing of the produce to control the supply and quality of the mangos. However, they do not supply seeds, fertilizers, nor training. Only 23% of processors own production or have direct contract arrangements with farmers for obtaining mangos (Briones et al., 2013).

This number has been decreasing lately since processors do not want to get involved in agricultural activities (Field Research, 2016). Farmers and processors are usually not coordinated. It is an arm lengths relationship that is affecting the proper functioning of the value chain and undermining the potential to expand the industry and sustain Philippines’ position in the GVC.

In Philippines, farmers hold three main types of contracts:

- Leasehold: the owner agrees to lease trees to a producer (or contractor) for a minimum period of one year, who undertakes all the commercial activities from spraying to harvesting and marketing (Briones et al., 2013; Cruz, 2004). The leaseholder/producer is responsible for all

inputs and marketing costs. Payment per tree consists of a fixed amount of rent paid to the owner –based on age and size of tree – which begins with a down payment of 50% before fruiting and ends with a payment of 50% after harvest (Cruz, 2004). In this type of contract, the producer assumes temporary ownership of the trees and is given full authority to manage the orchards, as well as in performing production activities such as spraying of flower inducers, insecticides/pesticides application, pruning, fruit bagging, safeguarding and harvesting of fruits with the help of hired laborers (Cruz, 2004). Given that the contractor is interested in short-term profits, this structure can lead to abuse of the trees by over-spraying during the contract term or applying banned chemicals, severely harming their productivity in the future (Hambloch, 2015). The deterioration of trees (non-fruit bearing or shortened productive life) or death of trees is solely burden by the owner (Buguis, 2014; Cruz, 2004). On the other hand, the owner does not need to undertake any investments to cultivate the trees, since the contractor buys all the inputs and hire the labor and (Buguis, 2014). One of the main problems in this lease system is the sustainability of the trees, since the contractor is mainly focus on the short-term economic benefit without paying attention to the long-term environmental damage.

- **Output-sharing:** the owner of the trees agrees to share the output with a contractor who is either a sprayer only or a sprayer-trader. The sprayer applies flower inducers and chemicals, bearing all expenses of these operations (Cruz, 2004). The sharing is typically 50:50 to 60:40 of the output in favor of the contractor, whom gets the share as payment for his services (Buguis, 2014; Cruz, 2004). On the other hand, the sprayer-trader is also involved in the harvesting, packaging, buying output, and trading, bearing all expenses.
- **Broker (or contract-buying with intermediates or exporters):** the intermediate or exporter simply purchases fruit from the independent farmer at pre-determined rates (based on the prevailing market price) with no involvement in the production process. Intermediaries or exporters are responsible for buying the mango fruits from the farmer-owners; this is done usually through an agent who communicates with the farmer at the beginning of the production stage and provides cash advances or packaging/transportation services to the farmer-owners (Cruz, 2004). Since in this type of contract the owner cultivates his own trees, there is a more environmental protection for the trees and land.

Evidently, farmers are in the bottom of the governance structure, under powerful actors such as the contractors, buyers, intermediates, processors, and exporters. Farmers do not have access to financial resources, and lack information while their industry knowledge and market contacts are limited. For example, in Cebu almost none of the mango farmers keeps financial records of their mango production operations and only 2% is able to indicate the price received for their last harvest (Hambloch, 2015).

3.4 Upgrading in the Philippines Mango Sector

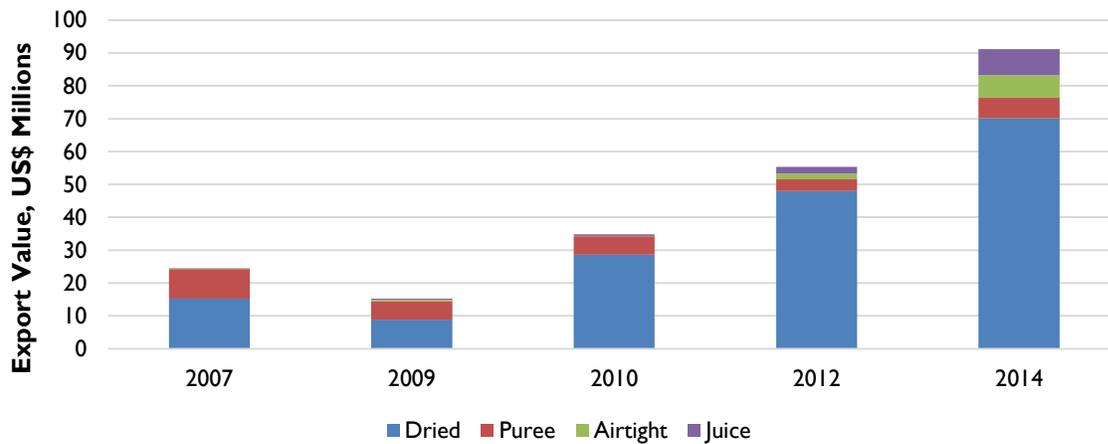
Figure 14 depicts the most significant upgrading experienced by the Philippines in the mango GVC to date, according to its export composition: the shift from fresh mango exports to processed mango products. Functional upgrading into manufacturing began in the 1980s, although exports have only expanded significantly in recent years. This upgrading meant the creation of skilled jobs and incorporation of modern manufacturing technology. The phenomenon has been mainly driven by a handful of domestic leading firms gaining access to a solid base of worldwide clients. However, this

recent progress is threatened by the current downturn in supply; they cannot meet their global demand due to the lack of raw material.

From 2007 to 2014, the share of processed mango exports in total mango exports increased from 51% to 79% in terms of value, and from 29% to 84% in terms of volume (PSA, 2007-2014). This encompassed not only functional upgrading into the processing stage of the value chain, but also product upgrading with the incorporation of a range of new processed products, including airtight mango and mango juice. During this period, exports of these two new products increased by 3,000% and 11,000% respectively, gaining a 6% and 7% share of exports respectively (PSA, 2007-2014).

While this functional upgrading step required significant investments in capital equipment and staff training, it allowed exporters to side step the stringent SPS regulations and private standards in their key markets. These problems stem from challenges deeply embedded in the agricultural sector and in the institutional set up of the country.

Figure 14. Processed Mango Exports, by Value, 2007 – 2014



Source: Author based on Custom Data provided by (PSA, 2007-2014)

3.5 Advantages & Constraints to Upgrading

While declining yields, lack of commercial agriculture and unchanged exports are notable characteristics of the Philippine mango industry in recent years, the expanding global demand has prompted the government to take steps to boost the country competitiveness. As it attempts to improve its participation in the GVC, the relevant departments will encounter advantages that may allow for future upgrading. Table 9 summarizes many of these along with some of the prominent constraints associated with the industry. The most prominent advantages and challenges are outlined in the section that follows. The potential upgrading section (Section 5) expounds on the potential opportunities.

Table 9. Advantages and Constraints of the Philippines in the Mango Global Value Chain

Advantages	Challenges
<ul style="list-style-type: none"> • Superior quality variety • Ideal climate conditions • Strong drive among domestic processors 	<ul style="list-style-type: none"> • Lack of scale economies at the production level • Lack of modern production and harvesting techniques • Poor Post-Harvest Management and SPS Control • Lack of coordination between growers and processors • Lack of coordination between industry stakeholders & high levels of bureaucracy
Opportunities	Threats
<ul style="list-style-type: none"> • Increasing global demand for mangos • Few countries have been able to penetrate the global market – limiting competition 	<ul style="list-style-type: none"> • Climate change • Competitors are increasing production & exports, and upgrading • Major export destinations are implementing more stringent SPS & quality standards

Source: Authors.

3.5.1 Advantages

1. **Superior quality variety:** the ‘Carabao’ variety, endemic to the Philippines, is considered to be one of the finest and sweetest variety in the world because of its tender taste, slight aroma and low fiber content (Buguis, 2014; K&R United, 2016). It is also characterized by its uniform yellow skin once it is ripe, for which as a fruit is also highly perishable (K&R United, 2016). The thin ‘Carabao’ variety was listed as the sweetest fruit in the world by the 1995 edition of the Guinness Book of World Records defeating other countries that also produce tropical mangos and up until today it is one of the leading commercial varieties worldwide (Castillo-Israel et al., 2015).
2. **Ideal climate conditions:** The Philippines (Luzon, in particular) possesses the ideal climate for mango growing mango, that is, relatively cool dried season with high heat accumulation during the flowering and fruit development period. This advantage is substantial, since mango production is highly susceptible to climate condition; for example, an extended wet season and exposure to moisture can encourage fungal diseases that causes severe production losses, as well as long droughts interrupt mango growing, particularly in operations with no irrigation.
3. **Strong drive among domestic processors:** Lead processing firms have been in the mango industry for the past four to five decades, pushing towards an increase of the productivity and accomplishing new programs and initiatives through strong lobby activity. For example, some large processors have attempted to implement strategies to support the growers’ production process, promoting GAP adoption and providing required technical assistance and capacity building for achieving sustained production of export grade mangos; these efforts are sometimes unsuccessful because of the governance issues in mango production, but in some cases growers have gradually adopted GAPs (Buguis, 2014).

3.5.2 Constraints

There is a diverse array of barriers to upgrading at different segments of the chain. Together, these shortcomings lead both to the prevalence of low production and failure to comply with international public and private standards, thereby impairing export growth. The following section outlines the most prominent constraints.

1. **Lack of scale economies at the production level:** The dependence on small-scale, non-commercial production fails to create the scale economies required to supply processors with sufficient raw material to deliver to their clients abroad. In 2016, one processor, for example, indicated that they will be able to fulfill just 25% of the orders from overseas clients due to a lack of supply of fresh mangos for processing (Field Research, 2016). Global buyers tend to favor suppliers that can consistently and reliably deliver on time, on price and on quality. Repeated failure to do so generally results in exclusion from their supply chains. There is a general absence of coordination amongst farmers, with few farmer organizations. This increases transaction costs and necessitates additional intermediaries between farmers and processors/exporters. The longer the chain between production and export, the more difficult it becomes for exporters to ensure that farmers are meeting the required practices to comply with international quality standards.
2. **Lack of modern production and harvesting techniques:** Due to limited knowledge on available technologies, little formal training/education and lack of financing, farmers continue to produce mango with outdated agricultural techniques and poor management. A recent study developed in Cebu¹² finds that a low percentage of the farmers adopted modern fertilization and irrigation technologies (35% and 8%, respectively) (Hambloch, 2015), while less than half of the growers have adopted the pruning (45%) and bagging (38%) technologies introduced by the Department of Science and Technology (DOST) to improve mango quality (Buguis, 2014). Furthermore, 12% utilize pesticides which are banned or restricted by the Fertilizer and Pesticide Authority (FPA). At the smallholder level, this latter issue is partly the result of lack of access to finance¹³ combined with the increase in the price of agrichemical costs. From 2010 to 2014, the farmgate price of 'Carabao' mango increased by only 7.79%, while the cash cost of inputs (e.g. fertilizers, flower inducers) increased by 23.14%, thereby significantly deteriorating the profitability of mango production (BAS, 2010; PSA, 2015). Even in large-scale and technically sophisticated agribusiness firms, technology use is far below that of competitor countries such as Mexico and Peru (Briones et al., 2013). These practices undermine productivity, contribute to a lower quality product and hinder the potential to comply with SPS regulations and quality standards required to access major markets. This is reflected in the low level of certification in the country; as of December 2016, no farm had achieved GlobalGAP certification, which is required for fresh mango in many large markets. The Philippines is the only leading participant in the mango GVC with no GlobalGAP certification among producers, while Thailand, Mexico and Peru have 17, 80 and 380 certified producers, respectively (GlobalGAP, 2017). Finally, research

¹² The sample of the study comprises 101 mango farmers from Cebu, from which 50 sell exclusively to the local market, 34 to the process market and 9 to the export market.

¹³ Even though the Mango Industry is one of the Priority High Value Commercial Crop sector with lending programs available for the mango industry, the great majority of capital comes from the farmers themselves, or from informal borrowers with very high interest rate (Buguis, 2014). In Cebu, the majority of mango farmers finance their agricultural activities through credit, while only 13% receive any forms of credit for agricultural purposes; interestingly, among the export farmers, none receives financial support through credit (Hambloch, 2015).

and development activities are generally reactionary to a problem of a particular commodity and fragmented (Espino & Espino, 2014). The lack of continuity, in addition to the limited funds invested on R&D, create a constraint to modernize production and increase production.

Box 2. Cost of Mango Production in the Philippines

Total cost for mango production is 18.02 PHP per kilogram in year 2014. Per hectare, production costs can be as high as 73,418 PHP, from which cash costs have the highest share (60%), including farm inputs (fertilizers, pesticides and interest payments on crop loan), labor and other utilities and fees. Non-cash costs include hired labor and rentals, and landlord and harvesters, consisting of 7% of the total cost. Depreciation, interest on operating capital, rental value of land and operator and family labor (the imputed costs) account for 33% of the total cost (PSA, 2015).

Table 10. Production Costs and Returns of Mango, 2014

Inputs	Cost per Ha. in US\$	Share in total
Gross Returns	2,218	-
Cash Costs	893	60%
Non-Cash Costs	97	7%
Imputed Costs	487	33%
Total Costs	1,477	100%
Net Returns	0.74	-
Net Profit-Cost Ratio	0.01	-
Cost per Kilogram	0.36	-

Source: PSA (2015).

- 3. Poor Post-Harvest Management and SPS Control:** Compounding the impact of poor production practices is the lack of capacity to comply with quality and SPS standards due to shortcomings in the cold chain system, poor SPS management and lack of packing skills (Field Research, 2016). Cold chain management is almost non-existent or deficient across the agricultural sector. Given the geographic distribution of production across the country, this essentially excludes farmers in distant locations from participating in the export and processing-sector. To illustrate, while most processing plants are located in Cebu, around 86% of production is based in Luzon and Mindanao. Freshly harvested fragile produce is exposed to sunlight and inadequate road and transportation infrastructure en route to export packhouses and processors, which are located in major cities (Hambloch, 2015). Furthermore, there are few exporters with VHT and HWT facilities required for fresh mango entry into the Japanese and Korean markets and these are located only in Davao and in Metro Manila (Briones et al., 2013; Hambloch, 2015). Finally, the equipment for handling and packaging are greatly inadequate and graders have no formal training on sorting or proper handling. As a result of this, post-harvest fruit damage and rejection rates climb up to 50% (Field Research, 2016).
- 4. GVC actors lack of coordination and high levels of bureaucracy.** While there are a number of programs and initiatives underway to support the growth of the cocoa sector, these efforts not aligned. The lack of coordination occurs both among government actors as well as industry associations in the Philippines. Table 11 highlights the range of public stakeholders that are engaged in the industry.

Table 11. Key Stakeholders Engaged in the Philippine's Mango Global Value Chain

Actor	Description	Role
Department of Agriculture (DA)	Public sector unit responsible for developing and implementing agricultural policy in the industry	Provides technical assistance and other support to smallholders in the country; carried out a road-mapping exercise for the cocoa industry in 2012
Department of Agriculture, High Value Crops Development Program (DA-HVCDP)	Program is designed to work closely with private sector, particularly smallholders and farmers	Through the provision of extension services, goals include food security, expansion of private sector investment and income as well as improved production techniques. Cocoa is a priority commodity
Department of Science and Technology (DOST)	Government agency that promotes and assists with, scientific and technological research and development in areas identified as vital to the country's development. It also facilitates technology transfer in the Philippines	Helps in the development and transfer of new production inputs and techniques to improve producer competitiveness
Department of Trade and Industry (DTI)	The Board of Investments, reviews and approves applications for investment incentives for the industry	A coordinating agency of technical working groups to overcome industry-binding constraints, it focuses primarily on processing activities
Mango Industry Foundation, Inc.	Local NGO that links growers (90% of total members), processors, exporters, input suppliers, and logistic providers. It is also an implementing partner of the DA.	Encourage industry organization and coordination with the goal of synchronizing production, as well as standardizing mango price. Before the government agencies, role is mainly advocacy and lobbying.

Source: Authors

Government Coordination: the sector is characterized by multiple government agencies offering similar services. The Department of Agriculture (DA) and the Department of Trade and Industry (DTI) have both issued separated roadmaps and planning documents for the mango industry. The implementation of these national strategies is uneven due to the autonomy of local governments to select which recommended initiatives to undertake. In addition, high costs of bureaucracy are often mentioned as constraints for accessing information, training and financial resources (Field Research, 2016). Finally, even though mango is considered a High Value Crop, some private stakeholders perceive that most interventions are directed towards increasing the productivity of other crops, such as rice and corn (Field Research, 2016).

Industry Coordination: On the private side of the CGV, growers and processors are not engaged in a coordinated effort aiming at improving the produce quality and increase supply; only producers are organized at the regional and national level and meet regularly to discuss main issues and opportunities, and processors do not participate.

4. Upgrading: Lessons for Philippine Upgrading from Global Experiences

While the Philippines has experienced considerable success in its processed mango participation in the mango GVC and global demand remains strong, in order to remain competitive in the face of rising production and upgrading in countries such as Mexico, Peru and Thailand, it will need to undertake upgrading. By adopting improved technologies, generating a new product or engaging

in an entirely fresh set of activities, upgrading can also allow actors to capture greater value from their participation in GVCs (Humphrey & Schmitz, 2002). In the mango GVC, a key strategy for generating higher value and ensuring a position in the global market has been 'process upgrading', that is introducing new technologies and procedures to improve productivity and quality. This has been key both in terms of increasing yields, but also in terms of satisfying the demanding SPS standards put in place in key markets. Additionally, countries are moving to certain niches, such is the case of the production of organic mango to satisfy the growing US market. Top fresh mango exporters are also processing mango such as dried, frozen, puree and juice. This functional upgrading has multiple country benefits, from introducing new technologies to the country to adding new jobs.

Table 12 summarizes the key upgrading trajectories that have typically been pursued by countries in the mango GVC.

Table 12. Selected Upgrading Strategies in the Mango Global Value Chain

	Description
PROCESS UPGRADING (AGRICULTURE)	Primarily focused on increasing the production on mango. Improved fertilizer, pesticides and irrigation techniques can all boost production. Achieving this upgrading requires access to training to familiarize producers with new production methods and affordable finance to support the integration of new techniques into the production operations.
	<i>Example.</i> Peru has embarked on a wave of new and large-scale irrigation projects to support the production of fruits and vegetables for exports. These new irrigation projects allow for improved mango production while also saving water, reducing the use of fertilizers and reducing labor costs (Fernandez-Stark et al., 2016; Pozo et al., 2015)
PROCESS UPGRADING (AGRICULTURE)	A critical process upgrading in agriculture is to obtain certifications to meet phytosanitary or quality requirements to enter into certain markets. The strictest markets for mango are the US, EU and Japan.
	<i>Example.</i> Many countries have obtained GlobalGAP certifications to supply fresh mango to certain countries that require this protocol. Peru has 380 mango farms certified, while Brazil and Mexico has each 80 mango farms certified GlobalGAP (GlobalGAP, 2017)
PRODUCT UPGRADING (AGRICULTURE)	There is a global tendency to prefer more natural produce without chemicals, generally classified as organic produce. Niche groups of consumers in developed countries demand this type of produce and they are willing to pay a premium for them. For this market segment, organic is favored over the conventional method of growing mango, which can have a higher environmental impact such as water contamination and soil erosion.
	<i>Example:</i> To meet US demand, during 2015, Mexico expanded its production of organic mango. Mexican Farms such as El Grupo Crespo obtained USDA organic certification to sell their mangoes to the US market. In 2015, the average price per conventional mango in the US was US\$0.96, while for organic mango was US\$2.05 (Fresh Plaza, 2016a; National Mango Board, 2015).
FUNCTIONAL UPGRADING to PROCESSING	Processing activities in the fruit sector involves moving from agriculture to manufacturing. This step requires capital investment for equipment, technical expertise and a team of workers that can take on these tasks. In the mango sector, the most common processed products are dried mango, mango puree and frozen (IQF).
	<i>Example:</i> The Philippines exports more processed mango than fresh. More than 70% of the exports are concentrated in puree, dried mango and other processed mango (PSA, 2007-2014). This boom for processed mango started a decade ago with the push of big Filipino companies, including Profood and 7D.

Source: Duke CGGC.

The potential upgrading trajectories open to a country at any one time, however, depend on the country's specific position in the value chain, a wide range of institutional factors, including infrastructure, the business environment, and trade and investment policy and importantly, the governance structure of the chain (Bamber et al., 2013; Gereffi et al., 2005). While the Philippines recently made important strides in functionally upgrading entering into the processing of mango, this is threatened by an unreliable supply of raw materials. In addition, the country has missed the opportunity to export its highly sought after sweet fresh mango, which can net much higher unit value prices than dried mango.

In analyzing different prospective upgrading paths in the mango industry that could be pursued by the Philippines, it is useful to look more in depth at specific examples from countries at similar levels

of development and facing similar questions of how to upgrade in the mango GVC. This section examines the upgrading experiences of two countries, Mexico and India. Each represents a successful case of upgrading trajectories in the industry. Both Mexico and India offer insights for the Philippines on how to upgrade in the mango GVC.

- **Mexico** represents a case of process and product upgrading. The nation is the largest fresh and dried mango exporter of the world and the leading provider to the US, given its high compliance with SPS standards. It also began focusing on higher value stages (processed mango) and products, especially organic fresh mango. Policy interventions and efforts to diversify the types of mango, as well as production areas combined with the adoption of modern agriculture techniques helped to increase productivity in the nation. At the same time, the nation obtained key certifications, including GlobalGAP to facilitate export of mangos and recognition as suppliers of high quality fresh mango.¹⁴
- **India**, the largest producer of mango in the world, faces similar challenges to the Philippines including low productivity. Despite these limitations, India offers a unique case of functional upgrading through policy interventions and financial support, in post-harvest handling as well as investments in research and development. It also represents a case of process upgrading with a focus on exports. These interventions offer important lessons for the Philippines as it seeks to upgrade the mango industry.

Table 13 highlights key mango indicators in the three countries.

¹⁴ It is important to note that the nation is also using mangos that do not meet export specification for processed mango products, a representation of functional upgrading in the nation. However, this is often driven by strategic investments by firms in the industry and is not the focus of this case.

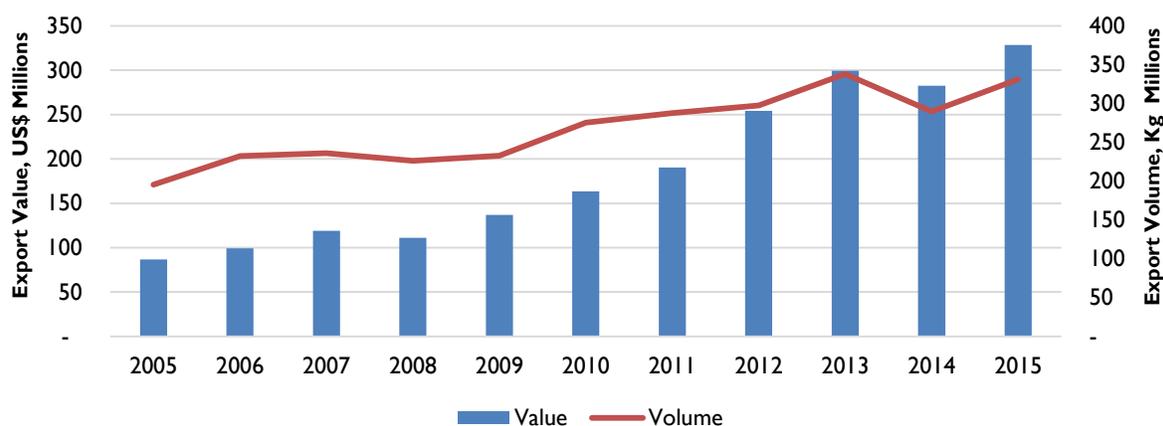
Table 13. India, Mexico and the Philippines in the Mango Global Value Chain

Indicator	India	Mexico	Philippines
GDP/Capita (2015, Current US\$) (World Bank)	US\$1,598	US\$9,005	US\$2,904
Mangos, Mangosteens and Guavas Production Volume (2014) (FAO)	18,431,330 tonnes	1,754,609 tonnes	899,014 tonnes
Mangos, Mangosteens and Guavas Area Harvested Volume (2014) (FAO)	2,515,970 ha	196,216 ha	196,412 ha
Mangos, Mangosteens and Guavas Yield (2014) (FAO)	7,32 MT/ha	8,94 MT/ha	4,57 MT/ha
Fresh and Dried Mangos, Mangosteens and Guavas Exports Volume (2015) (UN Comtrade)	2,529,813,006 kg.	2,941,703,680 kg.	302,558,425 kg.
Fresh and Dried Mangos, Mangosteens and Guavas Exports Value (2015) (UN Comtrade)	US\$139 million	US\$328 million	US\$91 million
Key Markets by Value (UN Comtrade) (2015)	United Arab Emirates, Saudi Arabia, Netherlands	US, Canada, Japan	US, Hong Kong, Korea

Source: As noted in indicator column. Downloaded 1/01/2017.

4.1 Mexico: Process and Product Upgrading

Mexico is the world's leading mango exporter by value, accounting for 16% of the global market in 2015. As depicted in Figure 15, Mexican mango exports rose sharply over the last decade, reaching US\$328 million in the same year, almost four times higher than export value in 2005 (UNComtrade, 2016). Mangos are the fourth largest agricultural export product in the country and a key source of employment, particularly for rural population. It engages around 1.6 million new hires annually in both the production and packaging stages of the value chain. (CONASPROMANGO, 2012).

Figure 15. Mexico Fresh and Dried Exports, by Value and Volume, 2005 – 2015


Source: UN Comtrade, HS 2002-080450, Based on Export Data, Downloaded 12/28/2016

Mexico can commercially produce several different mango varieties, thanks to its varied geographical conditions. Important varieties in the nation include Kent, Keitt, Tommy Atkins, Haden, Ataulfo, among others. The most important producing states are Chiapas, Guerrero,

Nayarit, Oaxaca, Sinaloa, and Veracruz (López, 2012). Mexican mango export began in the 1980s but experienced major growth in export volume from 1990s onwards. The country's rapid growth in the export-oriented mango sector is linked primarily to its compliance with the stringent SPS requirements imposed by the US, the adoption of international certifications and steady growth in production.

Mexico's mango sector is comprised of 44,000 small, medium and large plantations with highly heterogeneous productivity. Although the sector today is still built on a smallholder model, with the majority of mango being produced on small plantations and with low technological levels, new and large producing areas with advanced irrigation systems, highly modernized technology and active participation in the mango GVC are emerging. Large scale mango production already account for 15% of total production and yields in the country. The chain is generally well coordinated; most producers work under contract with intermediaries who sell the produce to processors and exporters (CONASPROMANGO, 2012). One advantage of the industry structure is its high level of organization; public efforts helped to create and maintain a mango national committee (CONASPROMANGO) in 2005 which comprises several private organizations representing producers, packagers, processors, R&D institutions, and wholesalers.

Recently, the nation shifted towards processed mango goods, capitalizing on its large and stable production, representing a move towards functional upgrading. Mexico's mango sector offers examples of both product and process upgrading. Each of these trajectories is examined below.

(i) Process Upgrading for Increased Competitiveness: Mexico's mango production continues to expand, reaching nearly 200,000 ha in 2014 - a 118% growth from 2004 (FAO, 2016). In 2014, it ranked fourth among the top 10 producers of mango worldwide, with yields almost twice as high as the Philippine (FAO, 2016). More importantly, since mid-1990s and especially after NAFTA (North American Free Trade Agreement), producers and distributors have engaged in trade with US buyers, improving their production process in order to expand exports. For instance, by scheduling production cycles according to the US market and the developing of systematic levels of fruit control, the nation has been able to grow its export activities (Alvarez, 2012).

Additionally, harvesting and processing of export mangos are aligned with US SPS and quality regulations as well as other stringent markets standards. For example, mango distributors have adapted to the FDA packing house certifications and other requirements, as well as to USDA certification of construction, equipment, truck, and fruit processing (Alvarez, 2012). By 2016, 80 farms (3,200 ha) in the country had been registered as GlobalGAP Certified, which significantly facilitates exports to consumer markets in the world. In addition, Mexico has been able to leverage its export knowledge in the broader fruit sector to penetrate the strict Japanese fresh mango market. Fresh exports to Japan began before the 1980s, and by 2006, it had become the country's leading provider of fresh mangos.

(ii) Product Upgrading: Focus on Organic Mango: Beyond increased production in conventional mangos, Mexico is also increasing its production and export of organic mango, which represents a case of product upgrading into higher value product lines. Prices for organic mango are high; in 2015, the average price per conventional mango in the US was US\$0.96, while the price of organic mango was US\$2.05 (Mango.org, 2015). It is estimated more than 110,000 farmers use organic practices in the country, higher than any other country in the world (Alberts Organics, 2016). Organic practices cover a vast array of crops, including mangos. By 2015, the state of Michoacán (the main Mexican organic mango producer and mango exporter to the US) 3,250 ha were used to produce organic

mango and an additional 1,200 ha were in the process of being certified, accounting for 16% and 6% of Michoacán mango production area, respectively (Fresh Plaza, 2016c). Organic mango production is driven by increasing US demand, particularly from the Hispanic population and also by the young high income Americans.

Policies and Programs

Mexico's current position in the mango GVC is the result of policy interventions to help build the industry. These programs represent a coordinated effort by the government, private sector and universities. This section looks at major policy initiatives in the industry that facilitated growth.

(i) *Process Upgrading*: Mexico's position as a lead mango exporter is the result of several project by various actors designed to increase the competitiveness of agriculture in the nation. Key actors involved in these programs include the Secretary of Agriculture, Livestock, Rural Development, Fishery and Food (SAGARPA)¹⁵ and the Mango Packers Association (EMEX). SAGARPA is the government organization tasked with increasing productivity and expanding agriculture production. It provides funding programs to help increase the productivity and competitiveness of agriculture. In particular, the Secretary funds the production of mango (among other crops) in an open or protected-tech nursery, as well as training.

After the signing of NAFTA in 1994, Mexico began a series of structural transformation and policy revisions across the nation. Notably for agriculture, the removal of domestic subsidies coupled with new export markets demanded new strategies to promote growth in a diverse set of products. *Alianza para el Campo* (Alliance for the Countryside)¹⁶ represents one of the three major agriculture initiatives established during this time to help maintain and grow the agriculture sector. It focuses on a variety of agriculture crops in Mexico, with specific products varying by location and project.

Alianza para el Campo promotes rural development through strategic investments in productivity and support services. A key feature of the program is its decentralized approach that targets programs to the needs of specific areas through small scale projects (Brizzi, 2001). Programs sought to help facilitate the transfer of knowledge, consolidate and streamline industry organization, promote best practices in terms of sanitation and post-harvest handling and other investments to increase farmer integration into agriculture value chains (Yunez-Naude & Paredes, 2002). To help solidify commitment across various levels of government, the program implemented a cost sharing approach with costs covered by various federal and state government bodies. SAGARPA, however, was a principal funder with program costs in 2004 accounting for 18% of the department's budget (Zahniser et al., 2005).

¹⁵ SAGARPA, an executive department within the federal government of Mexico, promotes public policies designed to improve the competitiveness of the agricultural sector by focusing on improving production techniques, integration of rural areas into value chains, promoting collaboration among producer associations through specialized programs and projects and supporting the goals of the National Development Plan with respect to the agriculture sector.

¹⁶ As *Alianza para el Campo* expanded to focus on development in rural and urban areas it was renamed *Alianza Contigo*.

Beyond productivity increases, the country also aggressively pursued international certifications to reflect its use of modern agriculture techniques. These certifications helped to facilitate the flow of agriculture exports from the country. Mexico started with the quality mark ‘Mexico Supreme Quality’ in 1999 and the homologation with GlobalGAP standards finalized in 2006; two years after Mexico Supreme Quality -GAP” became a fully approved national scheme with GlobalGAP (Valk & Roest, 2009). A joint project of the ministry of food safety and SAGARPA, the Mexico Supreme Quality programs help producers follow GlobalGAP standards by establishing stringent regulations on growing, harvesting, packaging, and processing. It also assists farmers by linking them to technical experts who can help them reach the specified standards for the certification and provide audits of farms to allow producers to maintain certification. Under the label program, over 30 different product specific regulations have been developed, including mango (SAGARPA, 2017). Mexico Supreme Quality projected that by the end of 2016 it would encompass 2,200 fresh produce growers — and 40,000 hectares (Hornick, 2012).

In addition to the Mexico Supreme Quality certification, certifications for export are overseen by EMEX. EMEX, a private institution comprised of mango packers, provides the required coordination between the Mexican and, namely, US authorities responsible for the compliance of mango SPS requirements. EMEX was originally created before the 1990s to collect payments of USDA charges to individual packing sheds and to keep accounts and submit payments to the USDA to cover salaries for the mango deputy inspectors and USDA activities of the USDA in Mexico (Alvarez, 2012). Since then, EMEX role expanded and it is now the promotional institution of export mango distributors, and its main task is providing assistance to packers in the inspection of mangos under a work plan authorized by SAGARPA and the USDA. Work plan activities provided by EPEX include technical assistance, accounting, certifying packers once approved by the USDA, and negotiating the interests of private actors with Mexican and foreign governments (Alvarez, 2012; EMEX, 2016). By law, exporters of mangos in the nation must be affiliated with EMEX and the agency generates its own budget revenue. One way it secures funds to invest in mango promotion and by charging a US\$0.01 charge on each box of exported mango. In 2002, this fee generated US\$400,000 for the nation (Alvarez, 2012).

(ii) *Product Upgrading*: Growing demand in the United States for organic produce represented another avenue to increase the competitiveness of the Mexican mango sector. SAGARPA is also supporting the advancement of organic certification in the nation, representing a case of product upgrading. By establishing a set of standards that mirrored USDA requirements, the government incentivized and promoted organic farming practices and increased certified organic production in the nation.

The increase of organic mangos production is supported by the Law of Organic Products; this law, established in 2006, includes similar regulations than the Organic Food Production Act of the US (2002), Mexico’s main export market (see Table 14). An advantage of SAGARPA’s organic program alignment with USDA’s policy is the facilitation of mango export of as organic products from the nation (USDA-FAS, 2013). This is accomplished by having a set organic baseline for products that is standardized across the two certifying bodies.

Table 14. Organic Certification Rules for USDA and SAGAPRA

Rule	USDA National Organic Program	SAGAPRA Organic Program
Use of Sodium Nitrate (Chilean)	Banned in 2012	Not permitted
Inspection during conversion process to organic	Minimum of one inspection	Minimum of one inspection
Length of conversion process for crops to organic	Three years before crops may be sold as organic	Three years before crops may be sold as organic
Ingredients in Organic Foods	With the exception of salt and water, product must be 95% organic	With the exception of salt and water, product must be 95% organic
Slash and Burn	Prohibited except for means of disease suppression or stimulation of seed germination	Organic operations cannot practice burning of vegetation, vegetated areas or organic products or waste.
Genetically Modified Organisms or laboratory derivatives	Not allowed	Not allowed

Source: (USDA-FAS, 2013)

Organic certification in Mexico involves on-farm audits and regular border inspections, as well as food safety testing. Currently, there are around 15 organic certifications agencies operate in Mexico (Alberts Organics, 2016). Other local strategies are also being implemented; for example, the Produce Foundation, Baja California Sur, A.C. has founded a project lead by academic stakeholders (Faculty Sustainable Agriculture in Dried Areas) (400) in order to train farmers (400 by 2016) in cultivation techniques required to grow organic mangos, as well as to eliminate the use of chemical pesticides and solving the water crisis by using a sprinkler irrigation system supplied with hoses from the outside of the community (Fresh Plaza, 2016b). The programs and policies around organic produce are helping clarify and promote organic standards expended in consumer markets. The result allows producers to capture higher prices for their crop and grow the industry in the nation.

Box 3. Promoting Process and Product Upgrading in Chiapas

Mexico's policies often help to simultaneously promote product and process upgrading. The case of Atalufo mangos in Chiapas offers one example. A specialized mango known for its high demand in US markets and its long growing season, increased production of the mango is a strategy for rural development in the nation. Increasing the competitiveness of the Atalufo mango revolved around several programs in the nation.

For example, PROCAMPO, a comprehensive agriculture program that encompasses many agriculture activities, had projects to promote the transition to mango from other crops, such as sorghum. In addition to PROCAMPO, the Mexican government also helped to encourage product upgrading by providing financial assistance for mango producers seeking organic certification. SARGARPA covered 50% of organic certification costs for mango growers to help incentives farmers to become organic certified.

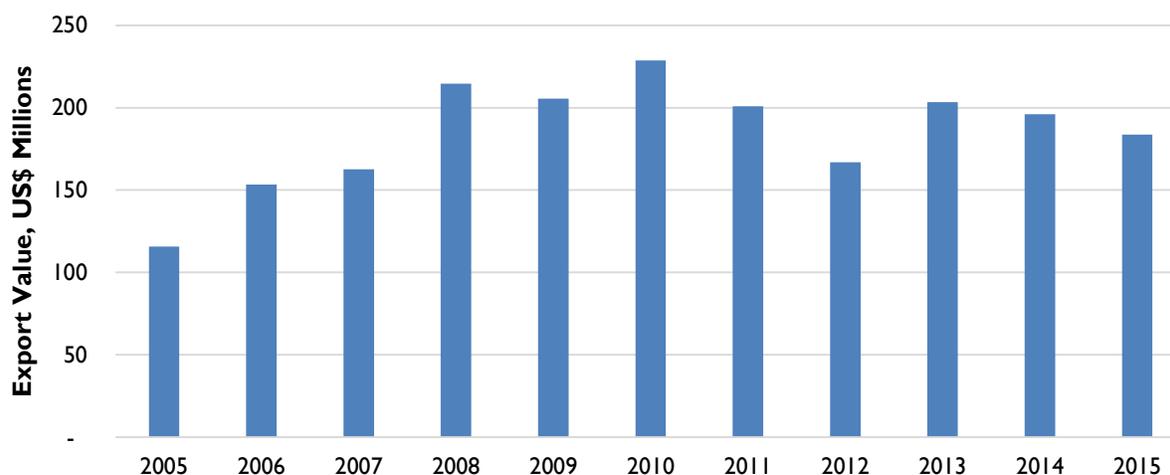
Finally, the government helps cover irrigation costs, a major expense for farmers. The National Water Commission covered many of the costs associated with irrigation, with regional government bodies providing additional support. The average support given by government bodies helped to cover 47% of irrigation system costs, however due to the financial burden associated with irrigation, even with these supports, the program is normally primarily used by larger scale operations in Chiapas.

Source: (Hanemann et al., 2008)

4.2 India: Process and Functional Upgrading

India is a leading global mango exporter in terms of value, accounting for 9% of the total market in 2015. As depicted in Figure 16, Indian mango (fresh and dried) exports reached US\$183 million in the same year, almost twice the value of 2005 exports (UNComtrade, 2016). Its major export markets include United Arab Emirates (21%), Saudi Arabia (20%), Netherlands (9%), Kuwait (6%), UK (6%), and United States (5%) (UNComtrade, 2016).

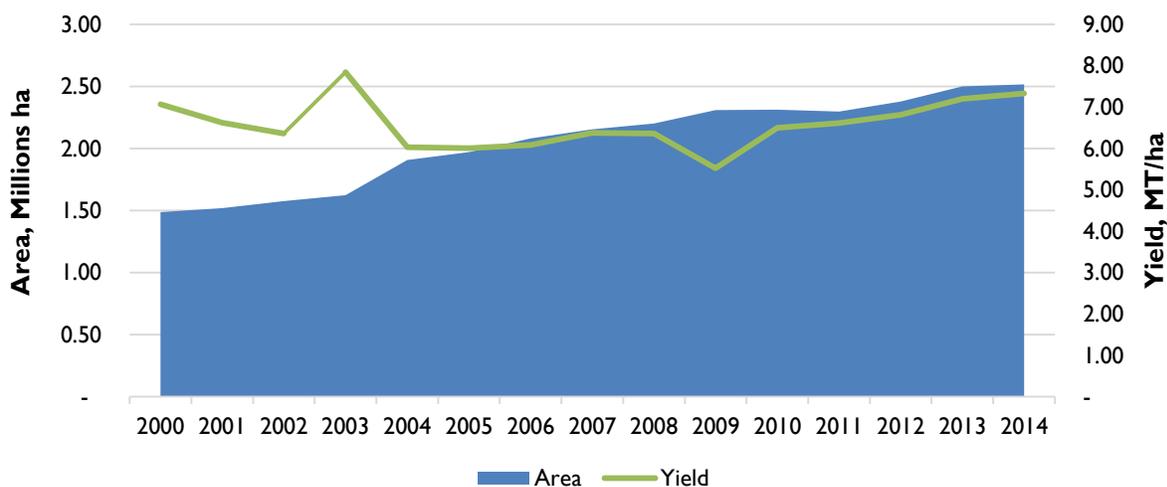
Figure 16. India Fresh and Dried Exports, by Value 2005 – 2015



Source: UN Comtrade, HS 2002-080450, Based on Export Data, Downloaded 12/28/2016

Market diversification and production expansion, both the result of an increase in mango acreage and yields between 2004 and 2005, propelled early export growth between 2005-2008. From 2004 to 2014 production area increased by 139% and yields grew 122% (Figure 17). In 2008, many of the trees initially planted matured and began to enter production. Since 2008, exports of mango remained relatively stable. According to the FAO, India’s mango yields in 2014 were 7.32 MT/Ha, much higher than those in the Philippine yields, which were 4.57 MT/Ha in the same year (FAO, 2016).

Figure 17. Area and Yield of Mango in India, 2000 – 2014



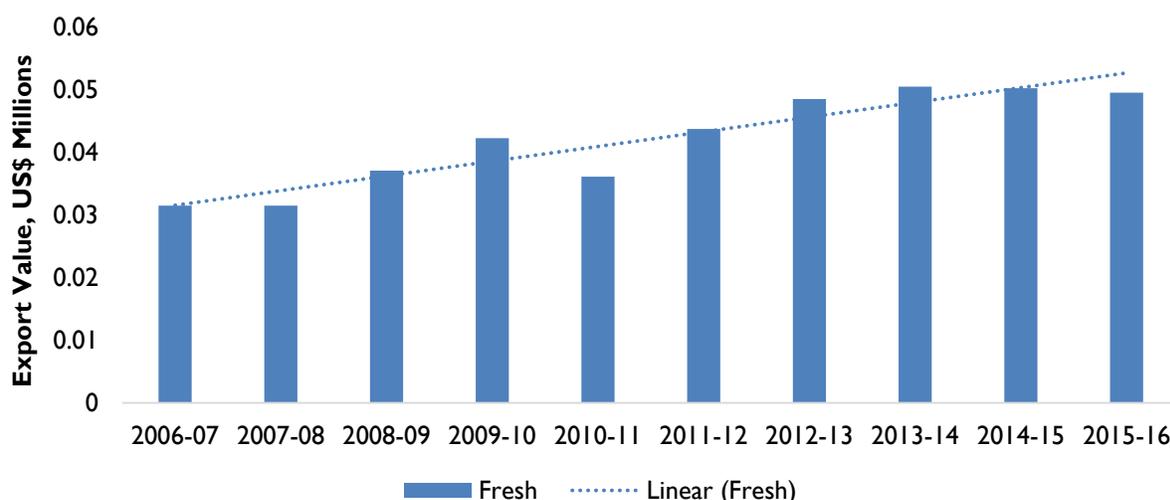
Source: (FAO, 2016)

Mango production in India accounts for 21% of total fruit production, reaching 18.5 million MT in 2014-15. The nation accounts for nearly half of the world’s mangos cultivation. The harvested area for mangos is 2.5 million ha, representing 35% of total fruit crop area in India (Ministry of Agriculture & Farmers Welfare, 2015). India grows a variety of commercial mangos, The most

prominent varieties include Alphonso, Banganpalli, Bombay Green, Chausa, Dasheheri, Kesar, Langra, and Totapuri (APEDA, 2016a).

Although the largest global producer of mango, India's participation in the fresh mango exports is relatively small compared to its' domestic consumption. Leveraging its local production to increase exports has become a recent, specific focus of industry stakeholders. To date, the country has made considerable progress into the export of processed products, functionally upgrading into the export of mango pulp, the main mango processing activity in the nation. By 2015-16, there were 242 exporting mango pulp firms clustered in four main states: Gujarat (74), Maharashtra (71), Delhi (20), and Tamil Nadu (20) (APEDA i-Track System, 2017). Fresh mango production for export is comprised of approximately 234 exporter firms, with almost half of them located in the state of Maharashtra (112 firms in total) (APEDA i-Track System, 2017). The country is ahead of most developing countries in terms of technological innovations in horticulture, and during the past decade the Government has worked to address several remaining challenges regarding technology upgrading within the farming community, post-harvest treatment and regarding issues of climate change (Tirlapur et al., 2014). India's mango sector offers examples of both process and functional upgrading. Growth in production of fresh mangos is complemented by increased in mango processing for pulp, with a growing focus on export markets. Each of these trajectories is examined below.

(i) Process Upgrading for Increased Exports: Despite fresh mango exports representing only a small portion of mango exports, it has grown over the past decade at an average growth rate of 6% with total revenues of US\$49 million in 2015-16, as noted in figure 18 (APEDA, 2016a). Fresh mango exports expansion is due to major increases in the harvested area, which grew from 1.91 million ha in 2004 ha to 2.52 million ha in 2014, an increase of nearly 32%. Additionally, significant rises in productivity and yields, from 6,03 MT/ha in 2004 to 7,33 MT/ha in 2014 (FAO, 2016) helped facilitate export growth. Finally, export growth was the result of solid public efforts to provide the necessary technical inputs and financial assistance to improve farming and post-harvest techniques, as well as the implementation of common infrastructure facilities, such as Centers for Perishable Cargo, treatment and irradiation facilities for export to consumer markets, packhouses, pre-cooling facilities, and high humidity cold stores to maintain cool chain and guarantee the mango quality (PIB, 2014). These three factors combined to help increase India's participation in the mango GVC.

Figure 18. India Fresh and Pulp Mango Exports 2006/07 - 2015/16

Source: Agriexchange. India Fresh and Pulp Mango Exports, 2006/07-2015/16, Downloaded January 12, 2017.

(ii) *Functional Upgrading*: Capitalizing on high domestic production, India entered the processed mango stage of the value chain in the early 2000s. It is currently exporting dried mango, frozen mango, mango juice and mango pulp. In 2015, it was the largest exporter of mango pulp in the world, using primarily its Alphonso, Totapuri and Kesar mango varieties (APEDA, 2016a). In fact, mango pulp exports represent the largest share of the processed food and vegetables exports for the nation, reaching US\$121 million in 2015-16 (APEDA, 2016b). These accomplishments are a result of the implementation of several initiatives and policy decisions by the Government of India aimed at further commercializing agriculture with specific attention dedicated to high tech horticulture and to the development of fruit processing, preservation and packaging sectors to its full capacity (Bung, 2013). One strategy to help encourage the move toward processing is clustering of mango pulp firms. The majority of processing firms are in Chittoor in the state of Andhra Pradesh and Krishnagiri in the state of Tamil Nadu (APEDA, 2016b).

Policies and Programs

India's participation in the mango GVC, growing from domestic producer to exporter of fresh and processed mango is the result of strategic policy interventions to help build the industry. These programs represent a coordinated effort by the government, private sector and universities in the industry. Specifically, India's policy efforts have focused on R&D to increase productivity and product quality in the sector, as well as efforts to support production and post-harvest handling to ensure compliance with international SPS and quality requirements. This section examines the major policy initiatives in the industry that helped facilitated growth.

(i) *Process Upgrading*: Growth in mango production and the subsequent increase in export is the result of several decades of government support and promotion of agriculture. Specifically, programs designed to help decrease crop loss in the country, programs to increasing quality in fresh mangos and policies aimed at developing research and knowledge creation programs in country all are occurring in India.

Post-harvest crop loss is a problem throughout the agriculture sector in India, topping 15% in some crops (Fresh Plaza, 2015). For mangos, some estimate post-harvest losses to be as high as 30% (Subramanian et al., 2014). To increase supply, efforts to target loss along the value chain are occurring along with increased plantings. One way this is occurring is through projects led by the Agricultural Processed Food Products Export Development Authority (APEDA). APEDA provides financial assistance for infrastructure, quality and market development to help facilitate the flow mangos in country. The Infrastructure Development scheme finances from 40% to 90% of the costs of establishing facilities involved in several packing stage, such as handling (e.g. sorting, grading, washing, ripening, packaging, and palletization), pre-cooling, storing, treatment, and post-harvesting (APEDA, 2016c).

In addition to reducing post-harvest loss, programs are focusing on increasing quality of mangos in the nation. The Quality Development scheme provides assistance for the installation of quality testing equipment, as well as quality management, quality assurance and quality control systems such as ISO series, HACCP, BRC, and GAP. Under this scheme, subsidies are available for upgrading APEDA's recognized labs for export testing (APEDA, 2016c). The Market Development scheme supports exporters in the use of packaging material as per standards and specifications developed or adopted by APEDA, as well as for the development of feasibility studies, surveys, consultancy and database upgrading (APEDA, 2016c). In addition, the country implemented modern pack houses in major production zones for maintaining high quality standards and compliance with export destinations requirements. Facilities that enable produce to follow internationally recognized treatment like HWT, VHT and Irradiation have also been set up at various locations across the production belt (APEDA, 2016a). In addition, by 2016 APEDA decided to bear 90% of expenses incurred for stationing of quarantine inspectors during the VHT process from 2015 to 2017, with the goal of increasing fresh mango exports to Japan (Agriexchange, 2015).

Finally, investments in research and development are helping grow the domestic industry. The government has central and state level research institutions that produce mango plant material and impart training to the farming community on different technologies and production methods (CABI, 2008). The Central Institute for Subtropical Horticulture (CISH), Lucknow is the major center for mango research of the Indian Council of Agricultural Research (ICAR)¹⁷ and serves the country on all aspects of research on subtropical fruits. In the last three decades, it has developed an array of export varieties and standardized technologies for the mango growers of India (CISH, 2011). The main propositions of the CISH to improve India's positioning in the GVC include: the creation of state of art facilities for the production of quality planting materials, the identification of off-season mango varieties for extending the mango availability period, the rejuvenation of mango orchards, the standardization of high density plantation, the management of pest and diseases, the development of export response models and alternate markets, and the development of value added, processed and fermented products (CISH, 2011). For instance, in Malihabad (Lucknow district) ICAR supported the training of community members in proper harvesting, ripening, handling, and marketing, as well as the establishment of community nurseries; among the positive results, farmers obtained better prices for its produce and participated in national and regional diversity fairs, as well as the community varieties multiplied and planted in multi-variety orchards.

¹⁷ The ICAR is an autonomous organization under the Department of Agricultural Research and Education (DARE) of the Ministry of Agriculture & Farmers Welfare, Government of India.

(ii) *Functional Upgrading*: As the country developed, a push to transform from simple agriculture producer towards a processor followed. Several internal factors and programs helped spur this transition. These include promotion of liberalized and decentralized processing policies and partnerships with local and global firms that use mango pulp in products.

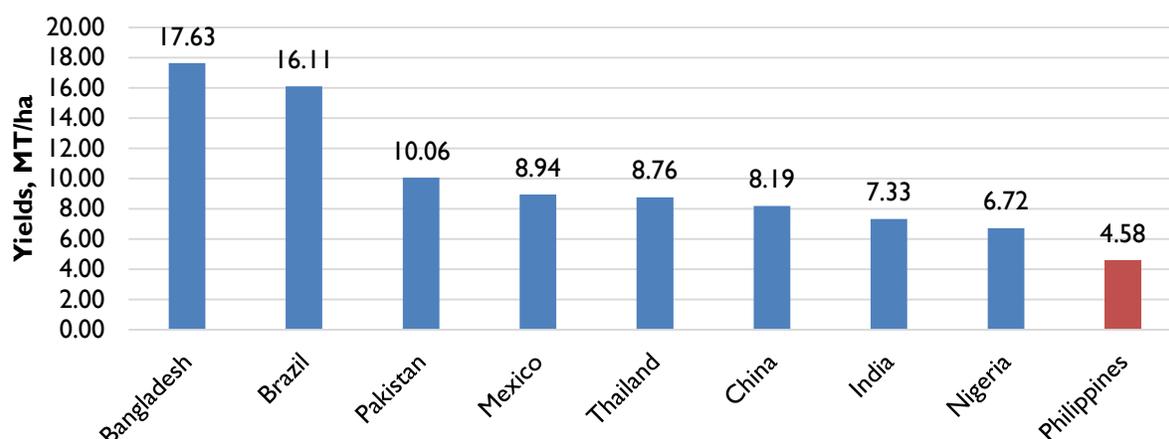
Initial growth in mango processing is attributed to large-scale policy shifts in the 1990s towards market liberalization (Bung, 2013). For example, approval for 100% export oriented processing firms helped attract investments from abroad. Further, the reduction of excise duties on fruit and vegetables helped to facilitate functional upgrading by allowing exporters to capitalize on steady supply while also benefiting from growing global demand for mango products (Bung, 2013). Investments by large scale and multinational firms in processing have the capacities of 5 to 30 tons per hour in fruit and vegetables (Bung, 2013).

More recently, mango processing is benefiting from the 2014 Made in India initiative. Announced by the Prime Minister, the initiative seeks to promote the nation as a global manufacturing and design hub (Made in India, 2017a). Food processing, which was designated as a priority sector in 2011 and incorporated in the Made in India program, benefits from the creation of food processing parks and special government funding to establish units in these areas. It also has preferential terms for FDI (Foreign Direct Investment) in the nation and transport tax exemptions for produce (Made in India, 2017b). The result is helping to grow mango processing. For example, Coca-Cola announced in 2015 that it now focuses on Maaza Juice, a popular juice brand in the region, with the goal of growing it to a billion dollar product line by 2023. Maaza is a mango based drink that is the leading brand in Coca-Cola India's portfolio (Coca-Cola India, 2016). While too early to determine the success of the program, increased investments does indicate excitement around the program.

4.3 Lessons for the Philippines from Mexico and India

Most top mango exporters have a long tradition on the mango production; however, they have only recently started exporting fresh and processed mango. Thus, many mango producers are still learning how to operate in this complex global value chain. Key markets destinations, especially for fresh mango have imposed strict SPS regulations to guarantee the health of their citizens, as well as their local fruits and vegetables from pest and diseases.

Presently, producing countries are competing to participate and upgrade in the mango GVC. Governments and NGOs are implementing policies and programs to enhance and improve the production of mango. The cases presented above shows how countries are designing policies to upgrade their sector. Mexico has a long trajectory of exporting fruit and vegetables to the US market and has been able to leverage all its previous knowledge to supply the US with mango. On the other hand, India, the largest mango producer in the world, is focusing heavily on boosting productivity and exporting processed mango products. Both countries are ahead of the Philippines in terms of yields. Mexico is producing 8.98 MT/ha and India 7.33 MT/ha, while the Philippines is only producing 4.58 MT/ha (Figure 19).

Figure 19. Yield of Fresh Mango of Top 10 Producers, 2014

Source: Author based on FAO. Includes Mangos, Mangosteens, Guavas. Retrieved on December 9, 2016.

In the case of Mexico, the Philippines has important lessons to learn in term of adjusting cultivation practices to meet market standards. This requires a change in old practices and the introduction of modern technologies and practices to align them with the latest norms and standards. Cultivation of mangos according to GAPs recommendation and meeting all USDA requirements are important aspects of Mexico's competitiveness. In addition, Mexico is doing a good job of determining shifting market demands, offering an upgraded product, organic mango, that satisfy a growing niche of consumers who are looking for products with no chemicals and protection for the environment. This is largely accomplished by allowing in country organic standards to mirror those of primary export destinations.

Additionally, India offers the Philippines important lessons in the mango sector. The country is investing heavily on improving the productivity by programs to reduce crop loss and investments in research and development. Due to limited resources at the farm level, the government has taken a strong lead in establishing research institutions to produce mango plant material, introducing new technologies, rejuvenation of mango orchards and running training for farmers among others. There has also been a significant focus on improving the post-harvest handling, including the financing of essential infrastructure. While India is still in the path to improve their productivity and the SPS processes, this top down approach can be useful for the Philippines to replicate. Furthermore, the country is achieving functional upgrading by providing an attractive investment environment for processors seeking to capitalize on the large supply of mangos in the nation. Once the Philippines increases its productivity, creating a favorable environment for processors will be key to functional upgrading in the nation.

5. Potential Upgrading Trajectories

The Philippines has major opportunities to continue expanding in the global mango industry as the country is well-known for its mango products. However, in order to sustain its participation in the GVC, it is mandatory to undertake the series of upgrading trajectories detailed below:

- (1) **Short to Medium Term: Product and Process Upgrading (agriculture):** Since mango productivity is declining in the country process upgrading will be essential to improve yields and

production. As seen in Figure 19, the Philippines mango yield is below other countries. Poor economies of scale and a lack of implementation of good agricultural practices seriously undermine the country's potential to remain in the industry. The country needs to incorporate good agricultural practices and train the farmers with modern agricultural techniques to meet the global standards. This is the base for continue expanding into the processed segment of the value chain. Local companies have been able to move into processed products. However, in order to continue the expansion of these mango products it is necessary to have enough raw materials. Processors need to have a consistent supply to meet all their commercial obligations. This upgrading will also require coordination among farmers and processors to work together and create a united strategy. In addition, the country should invest in R&D to increase productivity, improve their varieties and specially to extend their seasonality. As India's experience illustrates, a R&D center can focus on the major issues that the mango sector is facing in the country and help farmers to adjust their production to the new era.

- (2) **Short to Medium Term: Product Upgrading (agriculture):** As with process upgrading, the country should make a serious effort to improve the way it is producing mango to create a better product. The Philippines has an opportunity to expand the export of fresh mango, not only to regional markets that has low barriers to entry, but also to developed country markets. However, these markets require a product with low levels of chemicals, and free of pest and diseases. In addition, Mexico's growing success in the organic mango category, where products earn twice the price as conventional mango illustrates the potential to improve contributions to export revenue. These changes need to be undertaken in the short term, as it can take up to three years for orchards to become free of trace chemicals to qualify for organic production.
- (3) **Medium Term: Functional Upgrading (packing, cold storage, SPS controls):** As efforts focus on increasing the output and product upgrading for fresh fruit exports, the country needs to develop strong capabilities in the packing and cold storage stage of the chain. This is to ensure that the fruit can arrive in its final destination in good condition. This requires major enhancements of skills, capital investments in cold storage equipment, as well as increased coordination with firms offering the necessary treatments such as HWT to enter key markets.

6. Appendix

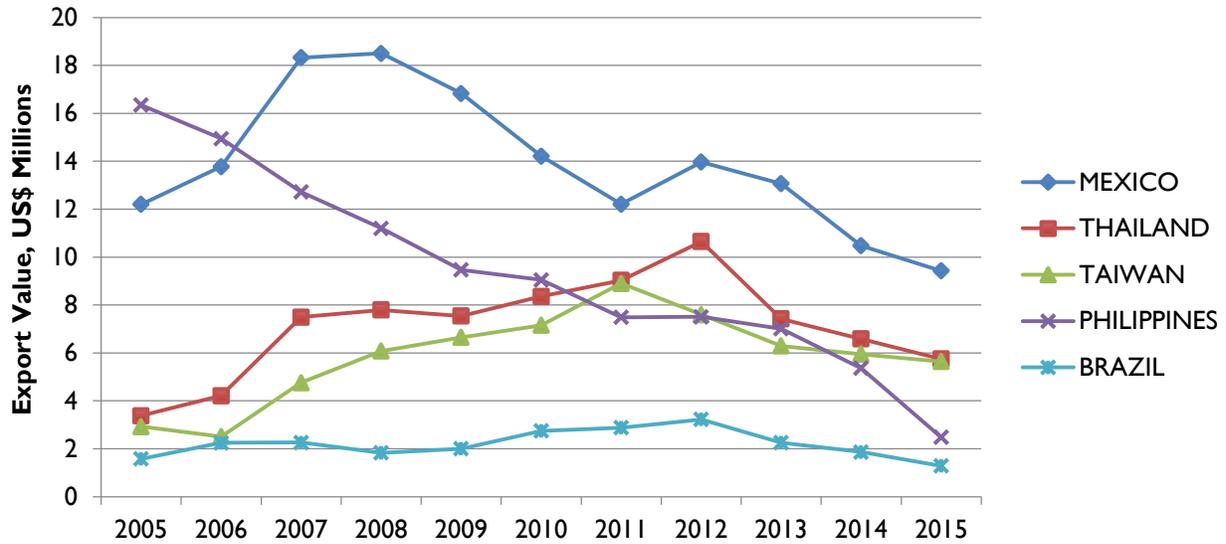
Table A-I. Top Stabilized Mango Varieties (ranked in decreasing order of commercial importance on Western markets).

Varieties	Description
Tommy Atkins	A Floridian variety with medium to large fruits (450 to 700 g), ovoid in shape, with a rounded apex. Green-red coloration, numerous large green-yellow lenticels. Firm orange juicy flesh, containing fibers. A productive and fairly hardy variety.
Kent	A Floridian variety with large fruits (up to 800 g), round in shape. Green-red coloration, sometimes with yellow-orange areas, which varies considerably between production zones. Firm yellow-orange flesh. Thick, tough skin. A productive, mid-season and hardy variety. Good taste quality. Kent has gradually become the benchmark.
Keitt	A Floridian variety with medium to large fruits (500-700 g), oblong in shape. Green-yellow-pink coloration, with a pastel tinge. Numerous small yellow lenticels. Firm, juicy orange flesh, with thin unobtrusive fibers. Good taste quality. A productive end-of-season variety It often tops up the export campaigns after Kent.
Palmer	Medium to large fruits (450-700 g), elongated and oblong in shape, with a slight apical lip. Red to purple coloration. Thick, tough skin. Yellow to yellow-orange flesh, firm. Satisfactory taste quality. Fairly productive late mid-season variety.
Amélie	West Indian variety with medium fruits (300-600 g), round in shape, with a more or less pronounced lip. Green to yellow-orange coloration. Intense orange flesh, free from fibers and tender. Good taste quality. An early and mid-season variety, behind the growth in African exports to Europe. Gradually falling out of favor because of its unappealing, mainly green coloration and its sensitivity to sea-freight.
Valencia	A variety with medium to large fruits (400-700 g), elongated in shape. Green-yellow coloration with an orange tinge. Yellow-orange flesh. Good taste quality. Fairly early.
Haden	A Floridian variety with medium fruits (350-550 g), rounded in shape. Yellow and red coloration with lenticels. Not very productive. Yellow-orange flesh, slightly sour. Good taste quality.
Irwin	A Floridian variety with small fruits (200-350 g), ovoid in shape with slightly flattened cheeks. Yellow-orange to intense red coloration. Good taste quality.
Osteen	A variety with medium to large fruits (400-800 g), elongated in shape. Green to purplish coloration. Yellow-orange flesh. Productive. Good taste quality. Nearly exclusively cultivated in Spain and, to a lesser.
Maya/Aya	An Israeli variety with small fruits (200-350 g), oblong in shape. Green to intense yellow coloration. Yellow-orange flesh. Good taste quality.
Kasturi/Omer	An Israeli variety with medium fruits (300-600 g), rounded in shape. Green-yellow to bright red coloration. Yellow-orange flesh.
Alphonso, Chausa, Totapuri	Indian varieties with small to medium fruits (200-500 g), elongated in shape, with a more or less pronounced lip. Green to more or less intense yellow coloration. Highly aromatic orange flesh. These varieties are aimed at the fresh market, but are also widely used in processing.
Smith	A Floridian variety with elongated large fruits (550 g.) of an orange-yellow base color combined with a deep crimson blush. The apex is broadly rounded and there is no beak. The thick tough skin is covered with large white lenticels. The orange-yellow flesh is juicy, spicy, of a firm texture and almost fibreless. Good

	taste quality.
Zill	A Floridian variety with small to medium fruits (225 – 345 g) rounded with a small beak. Yellow-brown color. Flesh is deep yellow, juicy, soft and without fiber. Good to excellent eating quality.
Kensington	Medium fruits (319 g.). Yellow with a slightly orange-pink blush. The skin is thick and adherent and the flesh yellow, sweet, soft and juicy with moderate to little fiber. Excellent eating quality.

Source: Authors based on data from (Griesbach, 2003; UNCTAD, 2016). This list is not exhaustive.

Figure A-I. Top Exporters of Fresh Mango to Japan 2005-2015



Source: (Trade Statistics of Japan, 2016)

Table A-2. Area, Production and Yield of Fresh Mango, Top 10 Producers, 2014

Country	Area (ha.)	Production (MT)	Yield (MT/ha.)
Bangladesh	56.296	992.296	17,63
Brazil	70.317	1.132.463	16,11
Pakistan	170.714	1.716.882	10,06
Mexico	196.216	1.754.609	8,94
Thailand	410.707	3.597.589	8,76
China	571.002	4.674.951	8,19
India	2.515.970	18.431.330	7,33
Nigeria	130.200	875.000	6,72
Philippines	196.412	899.014	4,58

Source: FAO (2016). Includes Mangos, Mangosteens, and Guavas. Downloaded December 9, 2016.

Table A-3. Private Standards Required by Importers and Retail Supermarkets

Name	Description
GlobalGAP	It is a private sector partnership of agriculture producers and European retailers that sets voluntary standards for the certification of production processes of agricultural products around the world. The GlobalGAP standard is primarily designed to reassure consumers about how food is produced on the farm by minimizing detrimental environmental impacts of farming operations, reducing the use of chemical inputs and ensuring a responsible approach to worker health and safety as well as animal welfare. GlobalGAP serves as a practical manual for good agricultural practice (GAP) anywhere in the world.
British Retail Consortium (BRC) Global Standards	The British Retail Consortium (BRC) Global Standards is a leading safety and quality certification program, used by over 23,000 certified suppliers in 123 countries, with certification issued through a worldwide network of accredited certification bodies. The Standards guarantee the standardization of quality, safety and operational criteria and ensure that manufacturers fulfill their legal obligations and provide protection for the end consumer.
IFS (The International Food Standards)	IFS has been designed as a uniform tool to ensure food safety and to monitor the quality level of producers of retailer-branded food products. The standard can apply in all steps of the processing of foods subsequent to their agricultural production.
SEDEX (Supplier Ethical Data Exchange)	The SEDEX is a data sharing system which allows participants to access information from suppliers about labor standards and ethical and responsible business practices. An on-line self-assessment questionnaire and ethical auditing protocol guidance is located on the SEDEX website (www.sedex.org.uk).
The Ethical Trading Initiative (ETI)	The ETI is an alliance of companies, trade unions and voluntary organizations created to improve the lives of workers across the globe. Ethical trade means that retailers, brands and their suppliers take responsibility for improving the working conditions of the people who make the products they sell. Companies with a commitment to ethical trade adopt a code of labor practice that they expect all their suppliers to work towards. Such codes address issues like wages, hours of work, health, safety, and the right to join free trade unions.

Source: Authors based on (BRC, 2016; FAO, 2005; USAID, 2011)

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