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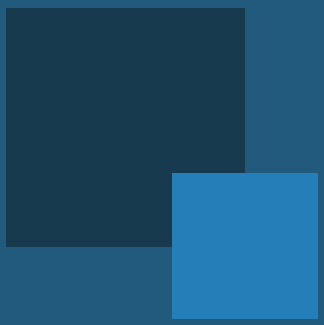
Dr. Artemio M. Salazar, Cenon D. Elca, Geny F. Lapiña, and Francis Joshua D. Salazar
Asian Social Project Services, Inc. (ASPSI)



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ACRONYMS

ARMM	Autonomous Region of Muslim Mindanao
ASEAN	Association of South-East Asian Nations
BAI	Bureau of Animal Industry
BP-IPO	Bureau of Patents Intellectual Property Office
BPI	Bureau of Plant Industry
DA	Department of Agriculture
DDDS	Distiller's dried grain with solubles
DENR	Department of Environment and Natural Resources
DILG	Department of Interior and Local Government
DOH	Department of Health
DOST	Department of Science and Technology
FAW	Fall Armyworm
FCI	Farm Cooperative Incorporated
FGD	Focus Group Discussion
FPA	Fertilizer and Pesticide Authority
GMO	Genetically Modified Organism
GTA	Global Trade Atlas
IRM	Insect resistance management
ISAAA	International Service for the Acquisition of Agri-biotech Applications
KII	Key Informant Interview
LGU	Local Government Unit
MAV	Minimum Access Volume
NFA	National Food Authority
NSIC	National Seed Industry Council
OPV	Open-pollinated variety
PCA	Philippine Competition Act
PCC	Philippine Competition Commission
PD	Presidential Decree
PHP	Philippine Peso
Pilmico	Pilmico Foods Corporation
PNTR	Philippine National Trade Repository
PSA	Philippine Statistics Authority
PPVPA	Philippine Plant Variety Protection Act
RA	Republic Act
RR	Round Up Ready
SEA	South East Asia
SEC	Securities and Exchange Commission
SMFI	San Miguel Foods Incorporated
UNAHCO	Univet Nutrition and Animal Healthcare Company, Inc.
URC	Universal Robina Corporation
USDA	U.S. Department of Agriculture

I. INTRODUCTION

Background

The corn industry in the Philippines could be better appreciated when separated into white and yellow, because they mostly have distinct uses. White flint corn, a substitute staple to rice, is processed into grits and consumed directly. Yellow corn, on the other hand, is an essential ingredient of feeds for hogs, poultry, and even for fish.

The demand for and productivity of white corn as food is relatively flat. In contrast, both the demand and the productivity of yellow corn are generally growing due to our increasing demand for meat. To meet its raw material requirement and address operational efficiency, the feed milling sector has tapped both the local yellow corn produce and imports. These imports are yellow corn itself, and its more significant substitute, quantity-wise, feed wheat.

Feed wheat is essentially wheat, which did not pass the standards for milling wheat for human consumption. However, its nutritive content is still good enough for livestock feed. In recent years, it has become cheaper than yellow corn and is readily available worldwide. Besides feed wheat, feed millers can import yellow corn from other countries at varying tariff rates, depending on the country of origin. Locally grown cassava is considered another yellow corn substitute.

Since the liberalization of imports for substitutes to local yellow corn, our local corn industry has, in a way, been subjected to competition, even much earlier than rice. We do not import white corn.

The main cost contributors in yellow corn production are seeds, fertilizer, and labor—these three (3) inputs make up around 80 percent of its total production cost. The yellow corn seed industry has expanded significantly since the commercialization of genetically modified (GM) corn in 2003. There are growing concerns in the seed industry because of rising seed prices and the limited participation of new players in the seed market.

The Philippine Competition Act (PCA) was signed into law in 2015 to promote free and fair competition across all sectors of the economy. The Act prohibits three practices: entering into anti-competitive agreements, abusing dominant position, and consummating anti-competitive mergers and acquisitions. These practices can lead to industry inefficiencies that can be detrimental to the consuming public. Therefore, the critical questions for the corn industry, from production to marketing, concerning the PCA are: (1) Were there past and potential violations of the PCA in the entire supply chain of corn (i.e., from corn grain to feeds) that should merit corrective measures? (2) How can a competition policy like the PCA assure inclusive growth for corn supply chain participants from farmers to users?

Objectives

The objectives of this issues paper are as follows:

1. Describe the Philippine corn industry, with a focus on white corn and yellow corn as well as its substitutes;
2. Describe the role of stakeholders in each level of the supply chain in key corn-producing regions;

3. Identify possible competition issues at each stage of the supply chain i.e., from production inputs to the marketing of output;
4. Describe policies and regulations relevant to possible competition issues; and
5. Propose recommendations to address the identified possible competition issues.

II. METHODOLOGY

Types and Sources of Data

The project used both primary and secondary data. Primary data was collected through key informant interviews (KIIs) and focus group discussions (FGDs). Main participants and experts of the yellow corn and white corn supply chains were identified and interviewed in the different study areas. These methods trace forward the movement of raw materials, primary products, and final products for. Supply chain participants were asked regarding their business operations, accounting for the sources of revenues, and costs. **Table 1** shows the specific date, province, and activities of the FGDs and KIIs.

Table 1. Areas covered by the project and type of activity

Date	Province	Activities
July 16, 2019	Manila	KII with the corn industry association
August 15, 2019	Batangas	KII with chicken and hogs feed miller
August 24, 2019	Manila	KII with a broiler industry player
		KII with an eggs industry player
August 27, 2019	Manila	KII with DA official at Bureau of Plant Industry (BPI)
		KII with seed company association
September 2, 2019	Laguna	KII with animal nutrition expert
September 8, 2019	Cebu	KII with corn farmer
		KII with corn trader in Cebu
September 9, 2019		FGD with corn farmers in Cebu
		KII with corn trader in Cebu
September 10, 2019		KII with Cebu Provincial Agriculturist
		KII with DA Region 7 regional corn coordinator
September 23, 2019	Isabela	FGD with corn traders, feed millers, seed suppliers, and input supplier
September 24, 2019		FGD with corn farmers in Isabela
September 28, 2019	Bukidnon	KII with corn trader
		KII with Bukidnon Provincial Agriculturist
		KII with feed miller
September 29, 2019		FGD with corn farmers in Bukidnon
October 7, 2019	Manila	KII with feed miller
February 14, 2020	Manila	KII with BPI Biotech Office

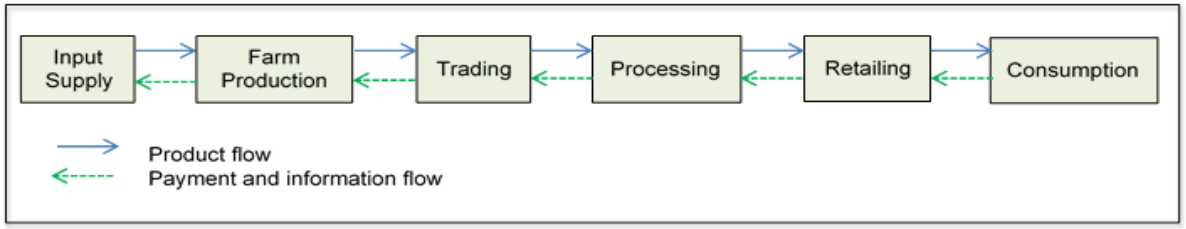
Data on production, consumption, and importation of corn and quantitative data relevant to the project were gathered from the Philippines Statistics Authority (PSA) and supplemented with data from other international databases such as the United Nations

Comtrade Database and the Global Trade Atlas (GTA). Additionally, there had been communication with the Bureau of Patents of the Intellectual Property Office (BP-IPO) and the International Service for the Acquisition of Agri-biotech Applications (ISAA) regarding some intellectual property issues.

Supply Chain Framework

A supply chain describes the movement of raw materials, farm outputs, and finished processed products from farm to market. The movement of these products entails the exchange of payment and information between farmers, merchants/traders, processors, retailers, and consumers. The supply chain participants are interrelated and interdependent. Any efficiency or inefficiency in any point of the chain will have corresponding effects on other parts of the whole system. The Philippine corn industry aligns with this general agriculture commodities framework. **Figure 1** shows the general framework of the supply chain of agricultural commodities.

Figure 1. Supply Chain Model



Source: Authors' own figure

Coverage

Given the limited time and research budget constraints, the study pursued case studies only among major producing areas and markets of white and yellow corn. Another consideration was the accessibility and travel budgets. The study also opted to concentrate more on yellow corn, because initial KIIs revealed that there were fewer competition issues foreseen with white corn. PSA estimates that out of the total corn produced in the country in 2018, 72 percent was yellow corn, while 28 percent was white corn.

Based on PSA data for 2018, Cagayan Valley and Northern Mindanao were the top producing regions for yellow corn. They both comprised about 43 percent of the total yellow corn production of the Philippines. In Cagayan Valley, the top producer was Isabela, with a 63 percent share of the region's total yellow corn production in 2018 (PSA). Bukidnon, on the other hand, contributed 85 percent of total yellow corn production in Northern Mindanao. Hence, these two provinces were chosen for the study. For white corn production, the significant producers are from the Autonomous Region of Muslim Mindanao (ARMM) and Northern Mindanao region (22% and 21% share, respectively, to the total white corn production in the country in 2018 according to PSA estimates). As mentioned above, due to access and logistical constraints, Cebu was chosen as the alternative. Its share to total white corn production is only 6 percent (the sixth highest in the country), but its area is 60 percent of the total for the entire Visayas region. Historically, Cebu has been noted as a major corn consuming province. KII with the Department of Agriculture (DA) national and regional officials, indicated that part of the produce from major white corn-producing regions in Mindanao find their way to Cebu. Choosing the

Visayas region would also allow the team to cover the entirety of major islands in the country and have more diverse views gathered concerning competition issues.

Using latest available corn consumption data from the PSA for 2015-2016, the highest per capita corn consumption was recorded in Zamboanga Peninsula (159 kg/year), Northern Mindanao (45 kg/year), Davao (41 kg/year), and Central Visayas (37 kg/year). The average Philippine consumption was 15 kg/year (2015-2016). It is safe to assume that this would mostly be white corn, since yellow corn is not consumed for food. In Central Visayas, Cebu had the highest per capita consumption with 46 kg/year. Based on the statistics and criteria above, the case studies were conducted in Cebu for white corn, and Isabela and Bukidnon for yellow corn.

III. RESULTS AND DISCUSSION

Description of the Philippine corn industry

The structure of demand: uses and users of corn

Among the world's three major staple crops: corn, rice, and wheat, corn (yellow and white) contribute the most in terms of human calorie intake *viz* 19.5, 16.5, and 15 percent, respectively. This is not surprising because productivity-wise, corn (or maize) is the most physiologically efficient having a photosynthetic mechanism different from rice and wheat (C4 vs C3). Furthermore, while rice is preferred in areas with sufficient water to saturate/irrigate the field and wheat is grown only in cold areas, corn is rainfed. It can be grown in both tropical and temperate environments. It is worthwhile to point out that these crops were grown and originally meant as food, while rice continues to be grown for food. Yellow corn in some countries was later grown for feeds and industrial uses. Wheat continues to be grown principally for food (bread), but discarded wheat (of substandard milling quality) could also be used as feeds. There is a substantial quantity of feed wheat available globally because wheat is the most widely grown crop in the world.

Corn can be classified depending on the nature of the grain, *i.e.* whether hard (flint), sticky (glutinous), or sweet. All of these can be yellow, white, or the rare other colors (red, purple, brown, blue, and combinations). **Table 2** below summarizes the different types and characteristics of corn.

Type of corn	flint	glutinous	sweet
yellow	milled (hammer type) for feeds; also used in cereals, *'chippy'*, in the brewery	(not common)	boiled when at soft dough stage
white	milled into grits as food	boiled when at soft dough stage; at matured stage processed to *'binatog'*, *'cornick'* or cornstarch	not common
other colors	not common	not common	not common

Source: Authors' own table

Yellow flint is preferred for feeds because of high carotene content and is very important in poultry, especially the egg-laying type (layers). For hogs, corn can be substituted by feed wheat or cassava. Finely ground yellow flint corn is also used in the preparation of *'chippy'* type snack items. *'Chippy'* are snack items made from corn flour and called as such because it looks like crisp chips flavored in different ways, mostly with cheese. Yellow flint is also used as a substrate for making alcoholic drinks like beer. In the United States (US), corn is also used for making alcohol for fuel. A by-product of alcohol manufacture is distillers' dried grain with soluble (DDGS), which is exported as a feed ingredient. In countries where corn is productively grown like in the USA and China, it can also be the raw material for high fructose corn syrup, a cheaper and sweeter substitute to cane sugar. Cooking oil can also be extracted from the embryo of yellow corn. Due to food, feeds, industrial, and medical products using corn as raw material, breeding and yield are much advanced in yellow compared to other types of corn.

White flint is the type used for food in the country. The outer (waxy) covering and embryo (oily) are first removed, and the remaining hard starchy part (endosperm) is milled into grits of the desired size.

The glutinous and sweet corn types are favorite snack items. However, the glutinous type is more flexible as it can still be processed to *'binatog'* and *'cornick' (*deep fried). The glutinous type is also preferred in making food-grade corn starch because it leads to a stickier syrup.

The other colors are associated with better nutrition because of the usual higher antioxidant content. These genetic materials however, are rare and are usually low yielding. The rarity and price typically go together.

In the Philippines, white flint corn is consumed mostly in mountainous areas in Visayas and Mindanao. According to PSA (2015), the per capita consumption/year for corn in 2006 was only 14 kg, which later increased to 22 kg in 2014. This is only about 20 percent compared to rice (114 kg) in 2014.

Meanwhile, in the Philippines, yellow corn is the type of grain extensively used for feeds, unlike other countries such as Mexico, where yellow corn is used for food.

The whole corn plant can also be processed as a forage crop, *i.e.,* cattle feed. As the grains approach hard dough stage or about 80 days after planting, with about 70 percent moisture content, plants are cut, chopped, and stored in anaerobic conditions. This is called silage corn.

The market for yellow corn is dominated by large feed producers, domestic and foreign, which are mostly concentrated in the vicinity of Metro Manila *i.e.,* Central Luzon and Southern Tagalog. These large feed producers, based on the information gathered from KIIs and San Miguel's SEC annual report for 2018[1], are as follows:

[1] See 2018 SEC annual report of San Miguel at https://www.sanmiguelfoods.com/page/annual-report-sec-form-17-a. Only San Miguel had on its website its SEC reports. Others were attempted to be reviewed but were not readily available on their official web pages.

Major Domestic Players

- B-MEG of San Miguel Foods Incorporated (SMFI), reporting to have an estimated of 25% share in the feed market
- Univet Nutrition and Animal Healthcare Company (UNAHCO), Inc.
- Pilmico Foods Corporation (Pilmico) Universal Robina Corporation (URC)

Foreign Players

- Charoen Pokphand Foods (CPF) of Thailand
- New Hope Group of China
- Sun Jin of Korea

All of the above players are major buyers of domestic yellow corn and sell their products in the Philippines.

The structure of supply

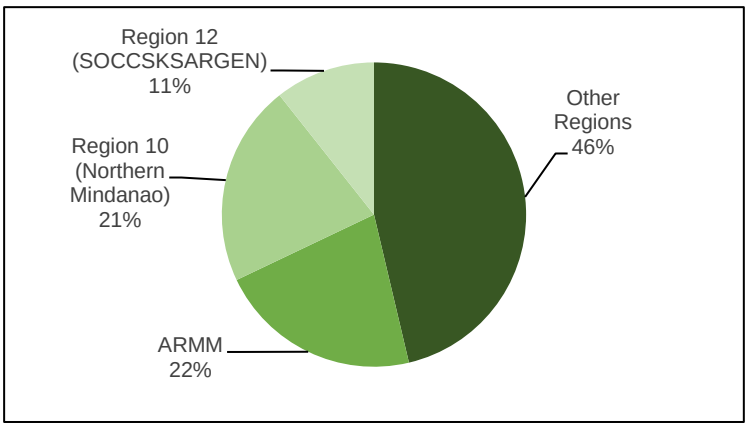
a. *Local Corn Production*

In the Philippines, corn is being produced on 2.5 million hectares, with a total production volume of eight (8) million metric tons in 2019. The provinces of Isabela and Bukidnon are the top producing provinces with a total production volume of 1.1 million metric tons and 0.8 million metric tons, respectively (PSA, 2019). Based on the latest census for agriculture, the country's average corn farm area is 1.30 hectares (PSA, 2015).

i. White Corn

White corn is predominantly produced in Region 12 (SOCCSKSARGEN), ARMM (now BARMM), and Region 10 (Northern Mindanao) (**Figure 2**). The combined white corn production of these three regions accounts for more than one half of total white corn produced in the Philippines (PSA, 2019). On a provincial level, the top three (3) producing provinces are Maguindanao, South Cotabato, and Lanao del Sur. Although Mindanao mostly produces white corn, one major market is still Cebu in the Visayas. The production regions are themselves, consumers of white corn, also.

Figure 2. Top white corn-producing regions in the Philippines, 2018



Source: PSA, 2019

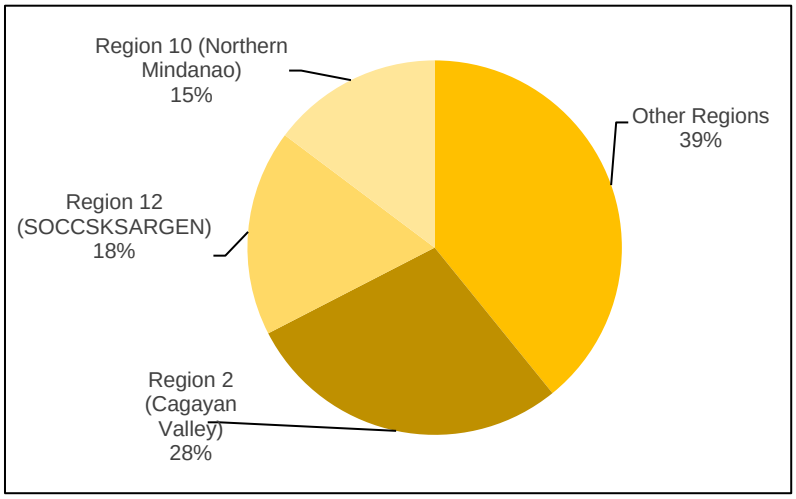
The white flint-corn-for-grits market in Luzon is limited because of the negative cultural perception of corn as a food staple. The difference in the overall market situation of white and yellow corn is reflected in the average yield of white corn, which is only half that of yellow corn. Demand could potentially increase in the future and even become a major food staple because of its nutritional advantage in avoiding and coping with diabetes. The food staple sufficiency program, especially the rice-corn blend, is worth looking into because of the impending water/rice crisis in the Mekong River Basin where the majority of global rice output is being produced. Philippine rice imports also come from these areas.

ii. Yellow Corn

For yellow corn, the regions of Cagayan Valley (Region 2), SOCCSKSARGEN (Region 12), and Northern Mindanao (Region 10) are the main contributors to national production (**Figure 3**). These three (3) regions supply around 61 percent of total domestic yellow corn production. The top producing provinces are Isabela, Bukidnon, and South Cotabato, accounting for 45 percent of the total national output.

The end market of yellow corn are mainly the feed mills. These mills, in turn, have business operations near hogs and poultry production areas in Central Luzon, Southern Tagalog, Central Visayas, and Southern Mindanao (PSA, 2019).

Figure 3. Top yellow corn-producing regions in the Philippines, 2018



Source: PSA, 2019

b. Factors affecting production

i. Weather pattern and its implication to crop production and grain quality

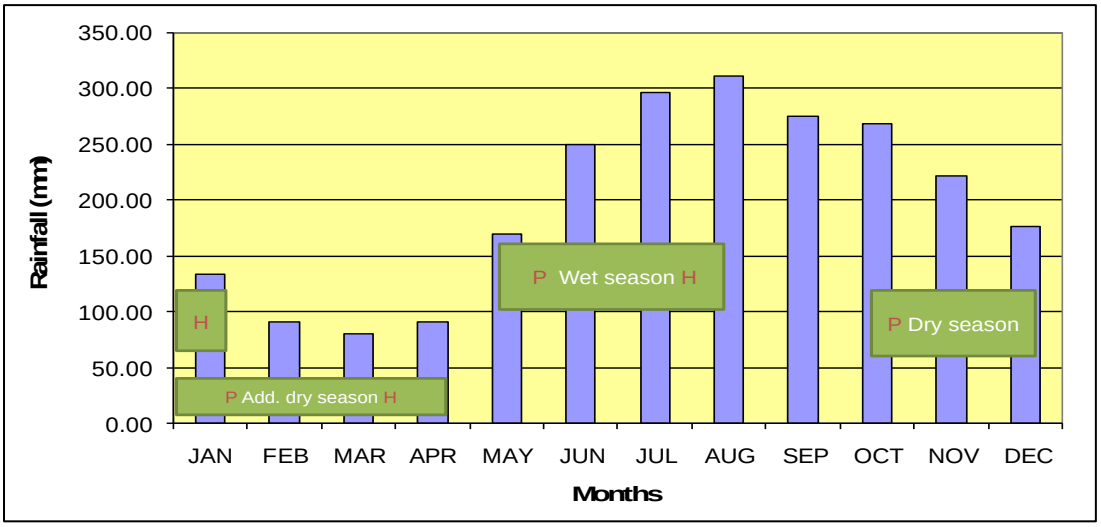
Corn is a rainfed crop, requires simple land preparation, and can be grown in upland, even in sloping areas. It is usually harvestable after 110 days. On the contrary, rice requires a more elaborate land preparation, a level area, and a continuous supply of water from before planting until near harvesting. Hence, rice needs irrigation infrastructure, which is expensive, since it requires watershed, dams, and distribution channel. Both rice and corn are about a 4-month crop.

Corn production in the Philippines could also be better understood when the two major cropping seasons are differentiated. These two major cropping seasons have unique conditions, opportunities, and limitations. The country essentially has a bi-modal rainfall pattern. Although corn and rice have similar maturity periods of 110 days, corn copes better with the weather pattern.

The first mode is the 'wet' season, starting when the rain comes in May or June. This is when planting starts. Day length is longer during the subsequent months of July and August. If this period coincides with vegetative and flowering stages of the crop, biomass builds up faster, and yield is higher. Rain usually continues until early "ber" months when the crop is up for harvesting. Unfortunately, harvest time could also coincide with heavy rains, especially in Luzon, but this also affects Visayas and Mindanao. Molds (producing aflatoxin) could develop within 24 hours in moist corn. Hence, post-harvest is a critical concern during this dominant production period, which is about 60% of year's total.

The second mode is the 'dry' season when farmers have to plant soonest during the still moist but typhoon-risky months of October and November, so that the vulnerable flowering stage of the crop will not fall in the relatively dry months of January and February. The rainless period extends up to April. This rainfall pattern is shown in Figure 4.

Figure 4. 30-Year Monthly Average Rainfall in the Philippines



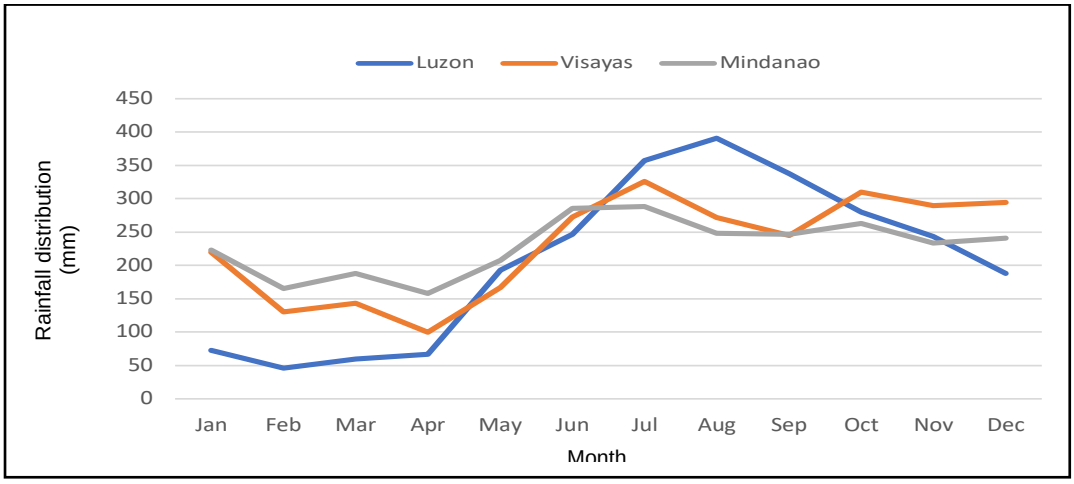
Source: PAGASA

There are some crop plantings outside the two modes in some areas. In Mindanao, farmers could risk a '*palusot*' crop, *i.e.,* January planting, if rainfall distribution is favorable. In Ilocos, Central Luzon, and Mindoro, farmers have irrigation facilities (basically meant for rice). Hence, they could plant in the rainless months of December and January with harvest coinciding with the very dry month of April, resulting in premium quality and price.

In essence, too much water is the concern for the wet season, while inadequate moisture is the concern for the dry season.

There is a difference in the rainfall pattern in Luzon, Visayas, and Mindanao, as shown in **Figure 5**. Mindanao has a more evenly distributed rainfall pattern compared to Luzon. This could probably be ascribed to it being nearer to the equator. With less typhoons and more evenly distributed rainfall, Mindanao has always been reputed as a food basket. It has a big role to play for corn if only the issues of post-harvest and logistics/transport are addressed. This is aside from the peace and order condition.

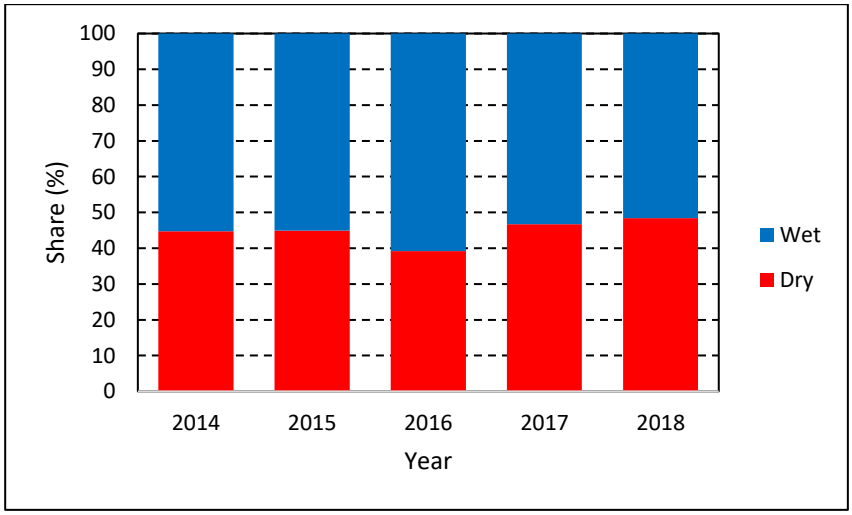
Figure 5. Monthly Rainfall distribution pattern for Luzon, Visayas, and Mindanao for the past 30 years



Source: PAGASA

Figure 6 shows the distribution of corn harvests in the two major cropping seasons (wet and dry seasons). PSA data across the years show that about 55 percent of production comes during the wet season (3rd and 4th quarter) and the rest during the dry season (1st and 2nd quarter). The extra dry season crop (2nd quarter harvest) is possible in Luzon if there is an irrigation facility. In rainfed areas of Mindanao, this extra dry season is also possible if rainfall is available, albeit limited. Still, farmers usually do not apply much input because of expected water stress.

Figure 6. Percent share of corn production between the dry and wet seasons, Philippines, 2014-2018

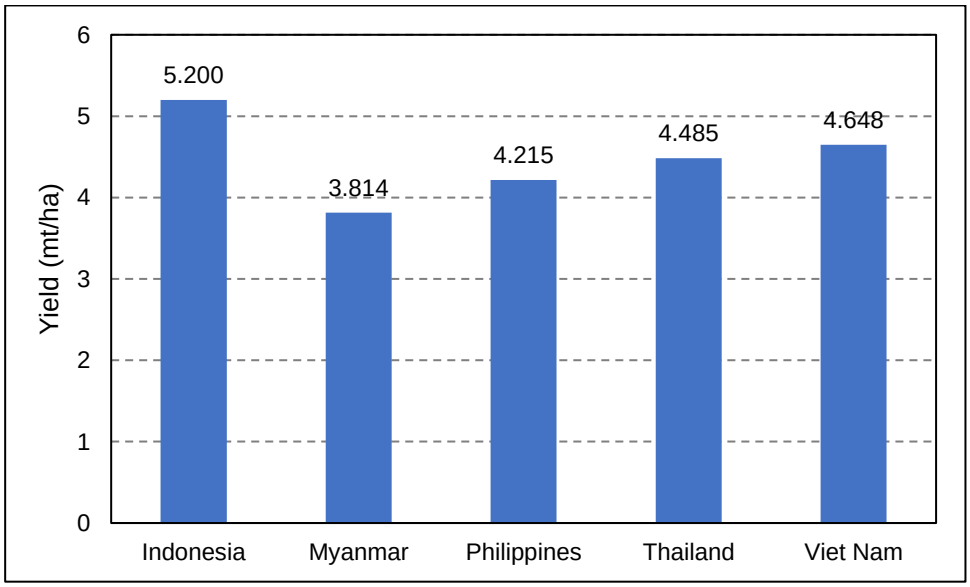


Source: PSA, 2019

Early land preparation would help avoid strong typhoons during the wet season harvest and avoid moisture-stress come flowering during the dry season. In both seasons, storage would be helpful to have available stock of the grains while waiting for the next harvest. There is the long waiting time between the dry season and wet season (harvests in January/February and August/September, *i.e.* five (5) months March-July) than between wet season and dry season (harvests in August/September and January/February, *i.e.* three (3) months October-December). However, if there are good '*palusot*' and after-rice crops, there is corn harvest in April, and users have corn while waiting for the significant August harvest. In case of drought, then there will be supply pressure from around April-July.

Due to the overall lack of storage capacity, when import delivery (corn and/or feed wheat) coincides with the local harvest, local prices of corn go down even if international market prices for yellow corn might be high. A lack of dryers exacerbates this during the wet season harvest. This dampens the interest and capacity of farmers to plant the next season. The feed millers then have to buy high the next time around because of reduced local supply, hence the boom and bust cycle in the Philippine yellow corn industry. But with the feed wheat imports, yellow corn might continue to be in a bust trend. This, despite the Philippine yellow corn productivity that is comparable already to its neighboring Asian countries. Indonesia was the most productive corn producer in Southeast Asia (**Figure 7)**. Corn yield in the Philippines, Thailand and Vietnam are in the range of 4.2 to 4.6 metric tons per hectare.

Figure 7. Yellow corn yield in Southeast Asia, 2017



Source: FAOSTAT, 2020

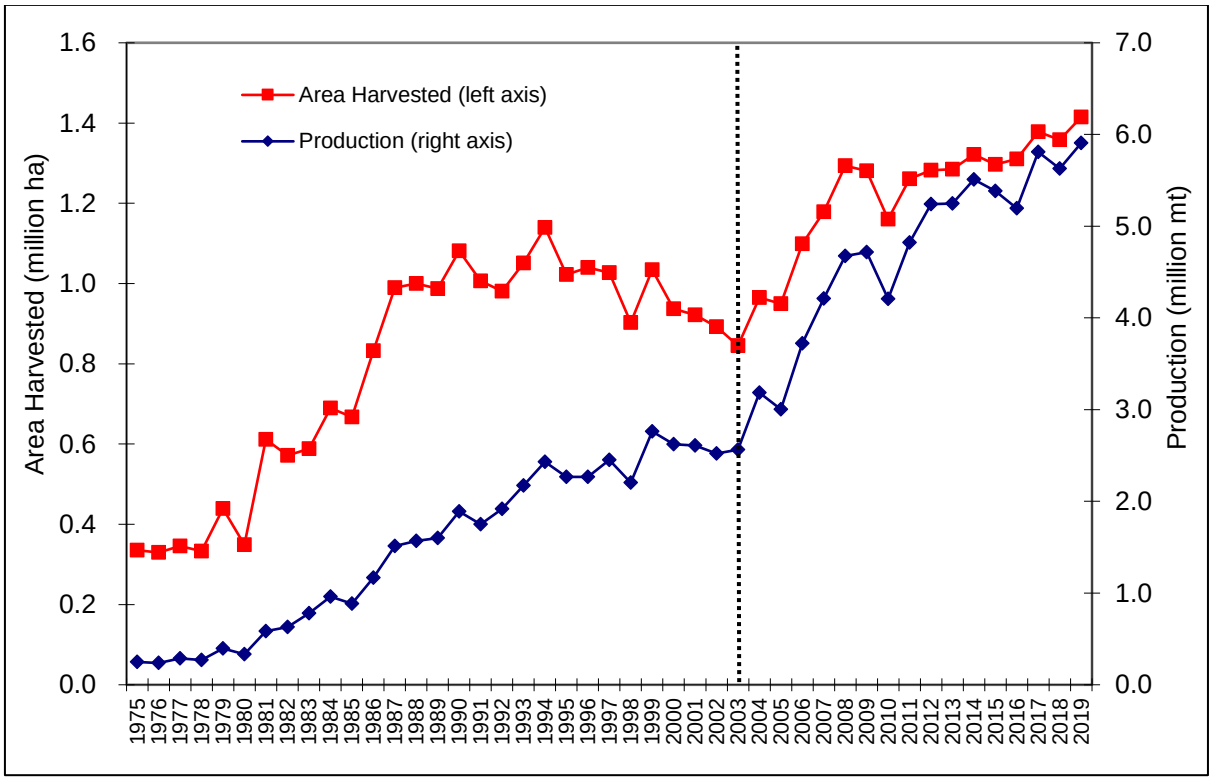
ii. Genotype (Variety) and Environment

Seeds can either be of an open-pollinated variety (OPV) or a hybrid. The latter has higher-yielding ability and uniformity, hence the higher price. Farmers always need to buy seeds of hybrids every time they plant to avail of the advantages. In contrast, the OPV harvest could again be used to plant the next crop. Native corn varieties are essentially OPVs.

With advances in genetics, genes for specific traits of critical importance could be incorporated into the parental materials of hybrids through the process of genetic engineering. Of course, the price of the genetically engineered hybrids is higher than that of non-genetically engineered hybrids. Almost all the yellow corn hybrids now in the market are genetically engineered, costing about PHP10,000/ha. During the start of using conventional hybrids in the early '80s, it was about PHP2,000/ha. The Philippine industry estimate for GMO corn is about 0.60 million hectares out of 1.3M hectares of yellow corn in 2017 (ISAAA, 2017).

The Philippines has been the only Asian country that commercializes GMO corn seeds since 2003. The technology was developed and marketed by a multinational company (MNC), Monsanto, and has led to increase yellow corn productivity in the country, especially the *Bt* gene developed to control Asian corn borer. A study of the STRIVE Foundation in 2012 has indicated the following positive impacts GMO corn adoption: 19 percent yield increase, 10 percent cost reduction, and 8 percent increase in farm income. However, the decrease in production cost and increase in yield did not lead to a rise in farm income despite no decline in corn prices. The evidence still shows that domestic yellow corn land area harvested was on an upward trend coinciding with the commercialization of GM corn in 2003. This rising trend continued from 2003 to 2012 but somehow slowed down from 2012 to 2019 (**Figure 8**).

Figure 8. Trends in yellow corn production and area harvested, 1975-2019



Source: PSA, 2020

The *Bt* gene (from Bacillus thuringiensis bacterium), which could effectively control the corn borer, was the first to be introduced. This was followed by Roundup Ready (RR) gene (from another microorganism Agrobacterium), which is beneficial in weed control. Weeds are a significant production constraint and, therefore very useful considering the Filipino farmer's ageing profile. These two genes (*Bt* and RR) were then combined and termed as stacked (genes). There was no new technology added – these stacked genes combined the two existing technologies, thru simple breeding, but it was passed off as "new" and sold at a higher price.

Environment refers to conditions where the crop grows. The realization of the production potential of a variety is dependent on soil fertility management. Farmers, therefore, tend to apply more fertilizers to make full use of the genetic potential of the expensive hybrid seeds - GMO or non-GMO (conventional). Hence the expense on seeds goes with the expense on fertilizers.

The expense on control of pests like corn borer and weeds has been incorporated in the seeds, hence the justification for the GMO's high cost. However, other insect pests and diseases have to be controlled as well. It should be noted that one emerging insect pest now is the fall armyworm (FAW), which could be partly controlled by the *Bt* gene.

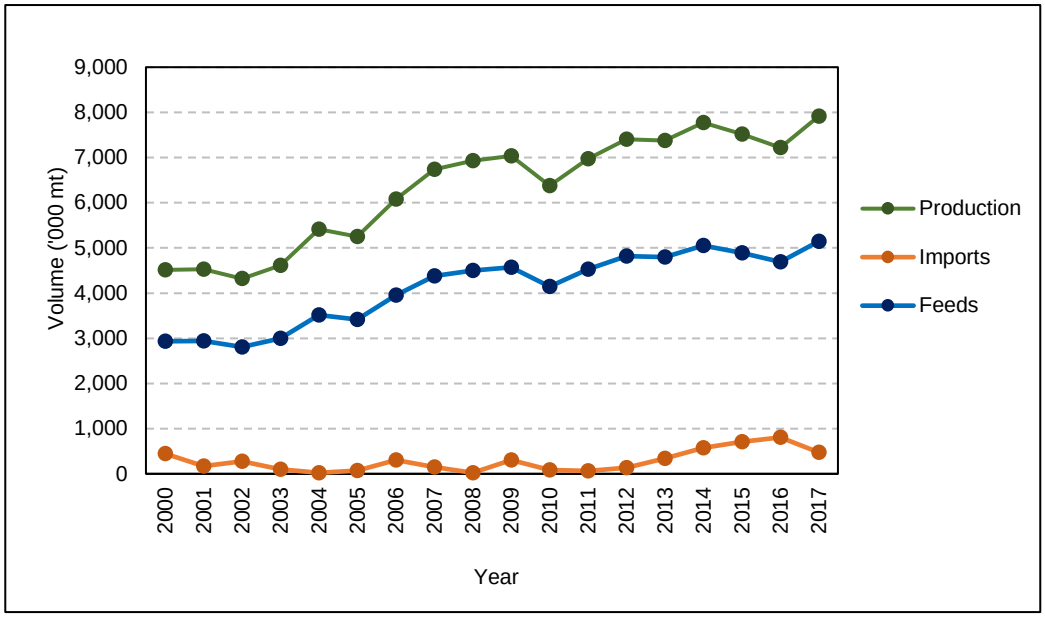
An assessment of the area harvested, yield, and production before and during the GM commercialization period in the Philippines was included as **Annex A**.

Imports – reasons, sources, prospects and effect on local production

a. Domestic Production and Imports of Yellow Corn

Domestic total corn production consistently improved during the last 17 years, from 2000 to 2017. From 4.5 million metric tons in 2000, corn production increased by 175 percent reaching 7.9 million metric tons in 2017. Around 65 percent of the total is yellow corn for feeds. Yellow corn imports ranged from 1 to 11 percent of the total corn supply in the said period. Feed millers seem to rely more on domestically-produced yellow corn than imported corn as the main ingredient in their feed milling operations (**Figure 9**).

Figure 9. Trends in domestic corn production, domestic corn used for feeds, and imported corn used for feeds, 2000-2017



Source: PSA, 2019

b. Understanding Feed Wheat

Wheat is the most widely grown food crop in the world. It is a temperate crop, i.e., not adapted in tropical environments. The grains are milled into flour and used to make bread and other food products. No country grows it for feeds. To quote from Wenger Feeds, "Wheat available for use in animal feed is typically feed-grade wheat and is often product rejected for human food production. Low test weight, sprouted grains, and the presence of mycotoxins are all factors which prevent the use of wheat in human foods… wheat contains less energy, but more protein and amino acids (methionine + cystine and lysine) than corn." At an acceptable level of quality, discard wheat can still be used for animal feeds at a lower price. But local good quality corn is essential to use the feed wheat, especially for poultry than for hogs.

There are two types of wheat: winter wheat and spring wheat, and they are harvested during our 2nd and 4th quarters. With proper storage, feed wheat can, therefore, be available throughout the year.

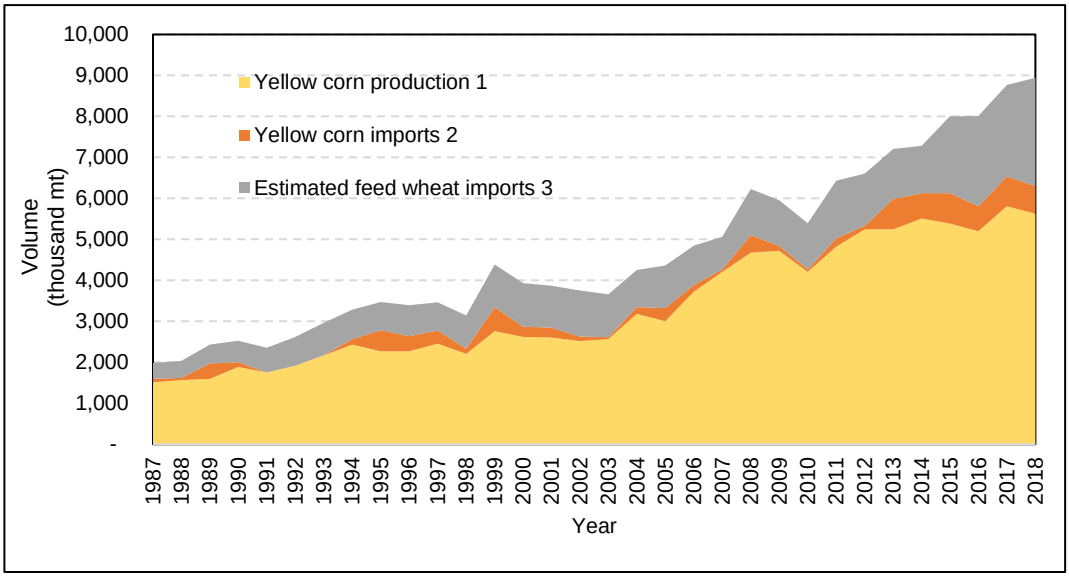
A relatively poor-quality grain cannot be stored for long. Therefore, when feed wheat comes in, it has to be used at the soonest possible time. The Philippines imports feed wheat every month, and therefore, when local corn harvest coincides with the arrival of feed wheat, domestic corn price is usually affected negatively. This is more pronounced during the 3rd quarter, when the Philippines has the big bulk of local harvest, the quality of which is affected by a lack of mechanical dryers.

c. Importation of Corn and Feed Wheat

The feed ingredients market comprises domestic yellow corn production, imports of yellow corn, and feed wheat. **Figure 10** shows each source of domestic yellow corn production, yellow corn imports, and feed wheat from 1987 to 2018. Domestic yellow corn production was below 2 million metric tons in 1987 but has now gone up to roughly

5.6 million metric tons. Yellow corn import share was about two percent but has gone up to roughly 15 percent of the total supply of feed ingredients. Feed wheat's share in 1987 was about 20 percent of whole feed ingredients, which is now about 30 percent in 2018. The estimated figures for feed wheat based on 2014-2017 data imply that 35 percent of the total wheat imports are used as feeds. Actual figures can be higher if one infers from a recent USDA (2019) report stating that feed wheat has become a vital feed ingredient due to the increase in livestock production (poultry and hogs), brought by rising demand for meat in the Philippines.

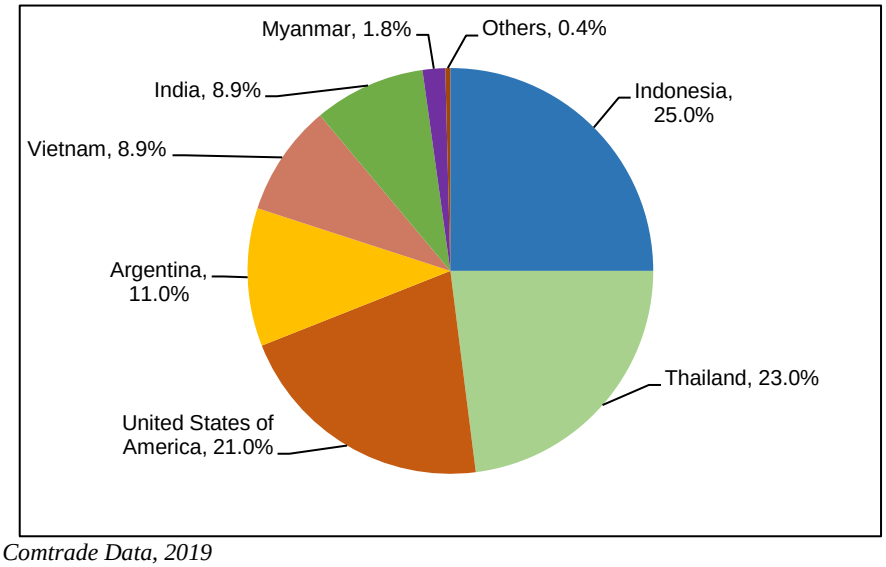
Figure 10. Share of domestic production, corn imports, and feed wheat imports



Source: PSA and USDA data

The private sector imports yellow corn formerly through the National Food Authority (NFA). From 2013 to 2017, it imported an average of 580,000 metric tons of yellow corn annually. This import level is approximately 6.9 percent of the country's total yellow corn supply (PSA, 2019). Corn imports are mainly sourced from the US, Argentina, and some from the Association of South-East Asian Nations (ASEAN) member countries (**Figure 11**).

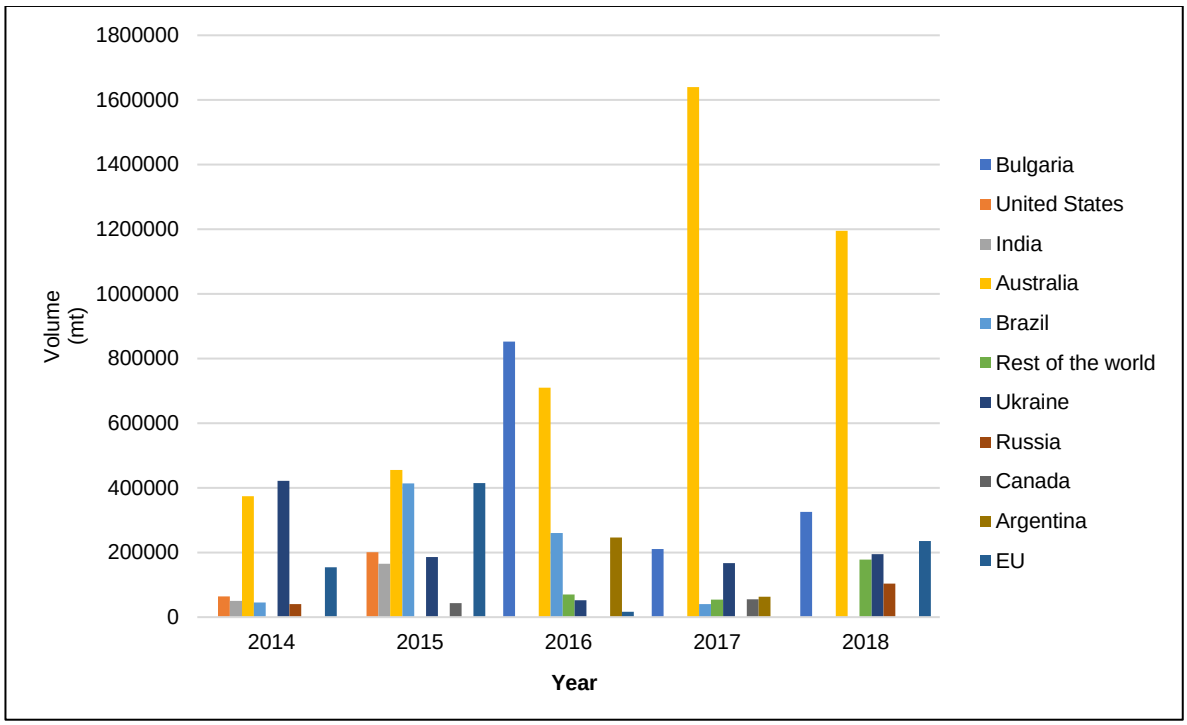
Figure 11. Philippine corn imports by country of origin, in percent shares, 2018



Source: UN Comtrade Data, 2019

Based on the GTA's international customs data, total wheat imports rose dramatically from 5.7 million tons in 2017 to 7.1 million tons (24%) in 2018. The increase is attributable to an increase in feed wheat demand in the country (USDA, 2019). Domestic yellow corn production, already affected by adverse weather events, especially during the wet season, is further challenged by such competition. Most of the country's feed wheat imports were recently from Australia, with massive volumes in 2017 and 2018 (**Figure 12**).

Figure 12. Feed wheat imports of the Philippines by country of origin, 2014-2018



Source: UN Comtrade data, 2018 and PAFMI

Total imports of feed wheat in 2018 until the third quarter was around 2.2 million metric tons (UN Comtrade). In November, it was 1.6 million metric tons. Quarterly imports show that at any quarter, importation can be substantial (**Table 3**).

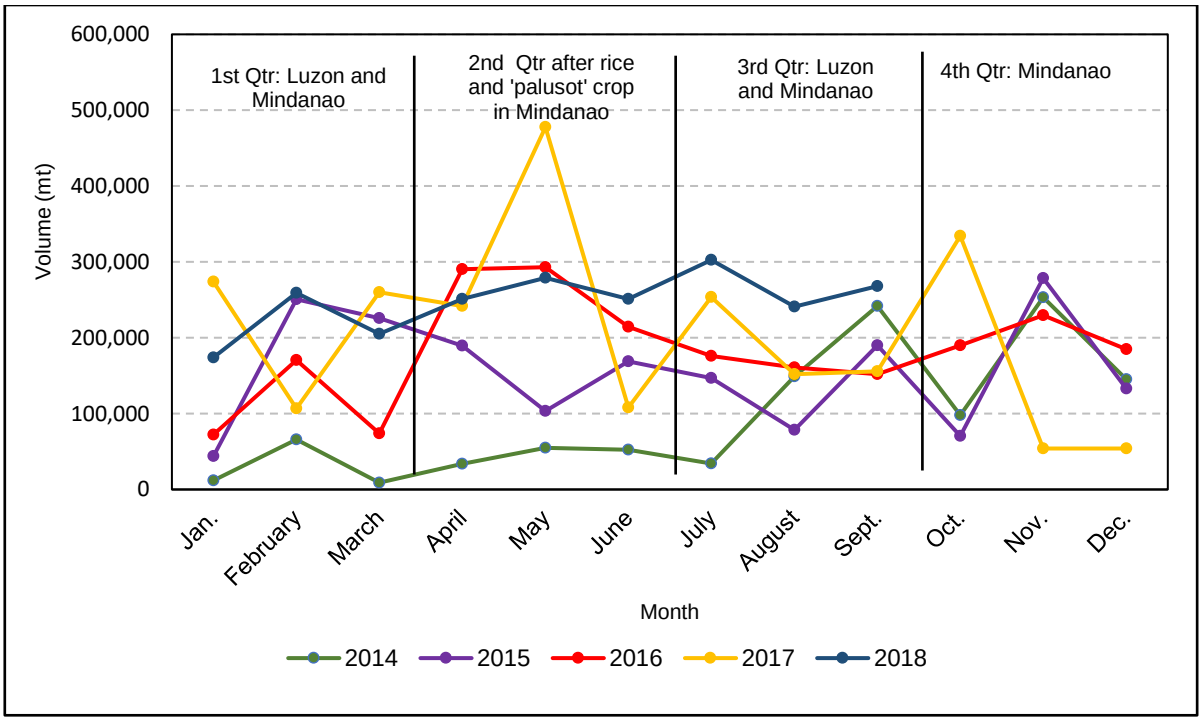
Table 3. Philippine feed wheat imports by quarter in 2018

Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
2014	87,000	141,340	425,179	496,292	**1,149,811**
2015	520,223	461,914	415,563	481,948	**1,879,648**
2016	316,703	797,966	489,092	604,429	**2,208,190**
2017	640,821	827,415	560,994	442,125	**2,471,355**
2018	638,295	781,130	811,730	-	**2,231,155**

Source: UN Comtrade Data and PAFMI, various years, 2018 data is untill 3rd quarter only

Figure 13 shows that the Philippines is importing feed wheat every month irrespective of time of the corn harvest.

Figure 13. Wheat imports of the Philippines by month, 2018 and its timing with local corn harvest



Source: UN Comtrade Data and PAFMI, various years, 2018 data is until 3rd quarter only

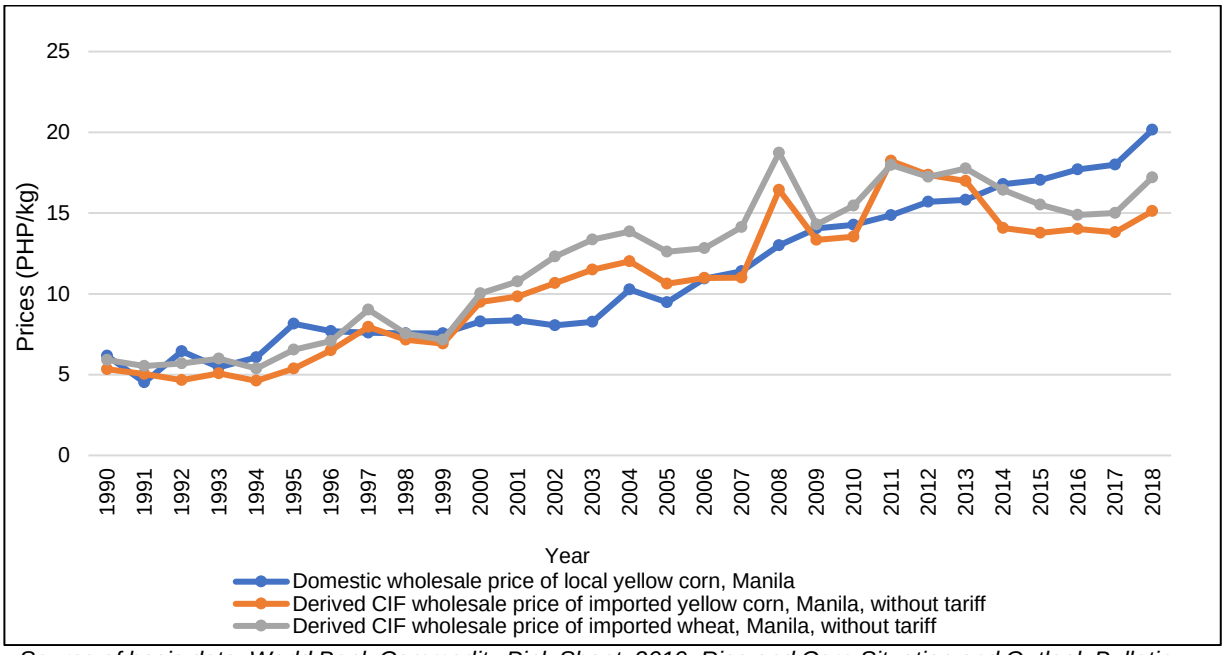
It should be noted that with the significant volume of imports any month, the price of the local harvest would inevitably be affected, especially during the wet season, which is the primary production season in the Philippines, and mechanical dryers are not enough.

An interview with a key player in Batangas confirmed that there is indeed a degree of substitution happening between feed wheat and corn. The deciding factor is the price. If feed wheat is cheaper by at least 50 centavos per kg, then substitution is done. However, it was also shared that there is a limit to replacement because it entails adding ingredients to compensate for other lost nutrients by not using corn. Based on one of the key informants, there is already a standard formula for this substitution process and existing software that recommend the optimal mix.

Figures 14a and **14b** show the comparison of prices of the three primary raw materials used in feed formulation without and with tariffs, respectively.

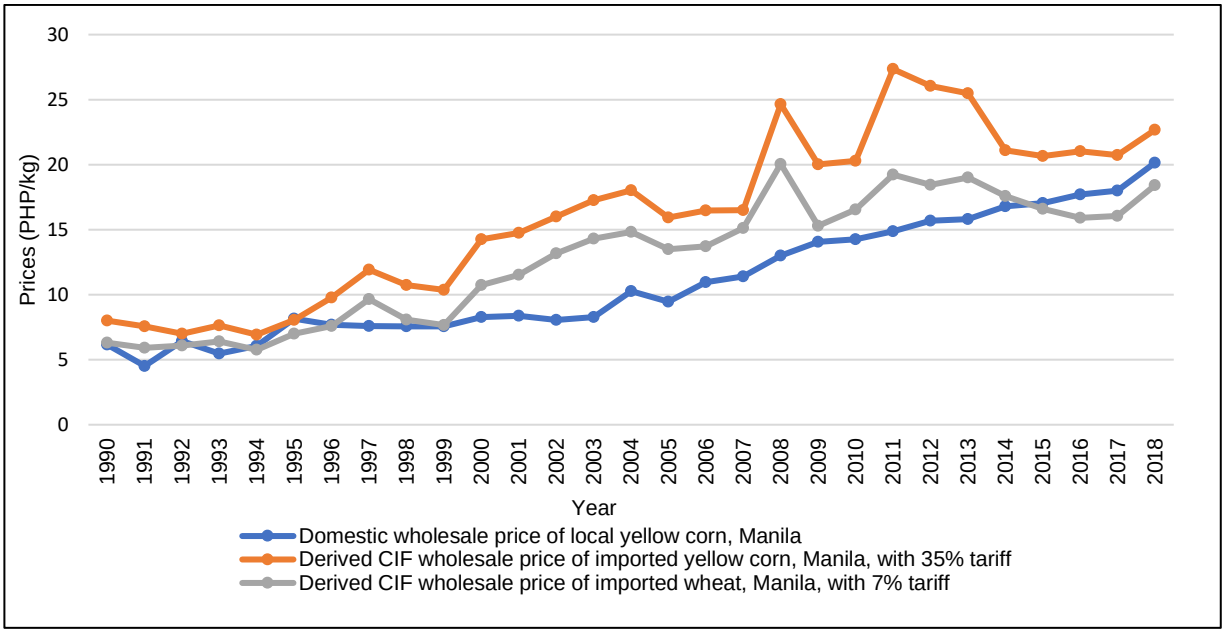
These are: 1) the wholesale price of domestically produced yellow corn quoted in Manila, which serves as a proxy for the buying price of feed millers, 2) the import price or cost of import plus freight (CIF) of imported yellow corn from the US and brought to Manila, and 3) the import price of CIF of imported wheat also from the US and brought to Manila.

Figure 14a. Trends in yellow corn and wheat prices, without tariff, 1990-2018



Source of basic data: World Bank Commodity Pink Sheet, 2019; Rice and Corn Situation and Outlook Bulletin, various years, 2019; and Tariff Commission of the Philippines, 2019

Figure 15b. Trends in yellow corn and wheat prices, with tariff, 1990-2018



Source of basic data: World Bank Commodity Pink Sheet, 2019; Rice and Corn Situation and Outlook Bulletin, various years, 2019; and Tariff Commission of the Philippines, 2019

From 1990 to 2004, the prices of all three inputs generally exhibited an upward trend. But from 2005-2018, the competitive edge of local corn against imported substitutes in terms of price, without tariff, started to decline. International prices of imported corn and feed wheat decreased while that of domestic corn did not. If based on price alone, feed wheat would be the foundation of the local feed milling industry, and local yellow corn would be added to compensate for the low quality of feed wheat.

According to USDA Foreign Agricultural Service Gain Report (2019), "… an industry contact considers feed wheat as an integral ingredient in feed rations and no longer a corn substitute." This means that feed wheat will continue to be a significant factor in the local feed milling industry.

Supply chain and role of stakeholders: Case studies in Cebu, Isabela and Bukidnon

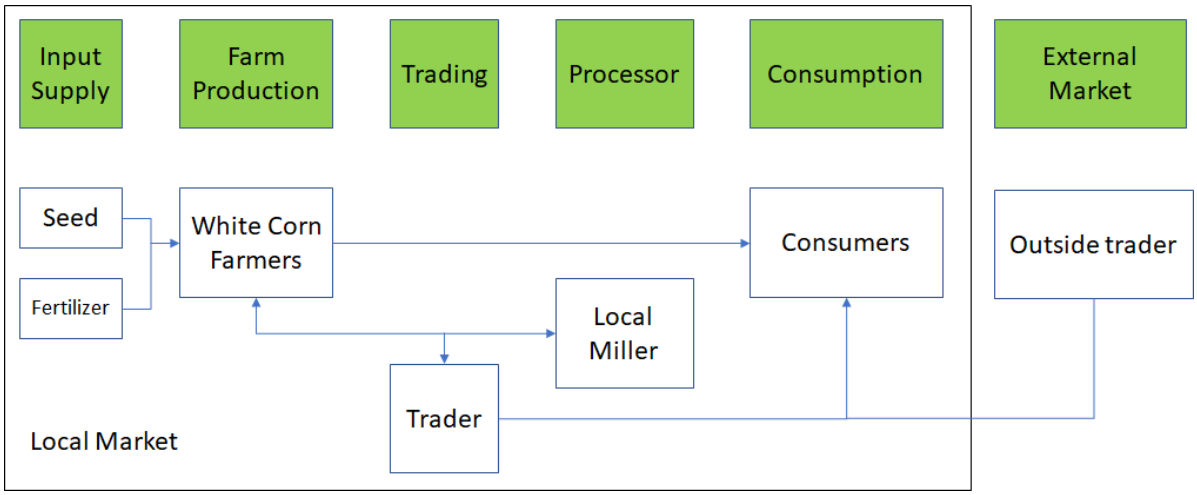
White Corn Supply Chain in Cebu

Inputs for white corn products such as seeds, fertilizers, and chemicals, are available within the same municipality of the farmers. Farmers usually plant their traditional varieties. OPV seed subsidies are sometimes given by DA thru its regional offices or the local government units (LGUs) in the provinces and municipalities.

White corn production in Cebu can be generally classified as subsistence farming. This means that farmers set aside most of their harvest for their consumption and perform all post-harvest practices. Farmers usually allocate one hectare or less for white corn production. This essentially for-home-consumption-only mode of corn production in Cebu is one reason for the low productivity of 0.85 metric tons per hectare, as reported by the PSA in 2019. The rest of the farm is usually devoted to other crops like vegetables, legumes, root crops, or even livestock.

The supply chain for white corn in Cebu (**Figure 15**) is very short since it does not travel far away from where farmers are situated. Local mills act as service providers: the corn grains need to be processed into grits before it can be consumed. For urban Cebu, white corn grits are still sourced from Mindanao.

Figure 16. White Corn Supply Chain in Cebu



Source: Author's own figure

Yellow Corn Supply Chain in Isabela

Input dealers of seeds, fertilizers, and chemicals provide the raw materials needed by yellow corn farmers. There are three primary producers of yellow corn seeds in Isabela and for the rest of the country. These are Syngenta (bought by China Chem but retained the name Syngenta), Pioneer (now Corteva), and Monsanto (now Bayer). Their seeds are are all GMO hybrids. According to the KII with two Syngenta seed dealers, they have two

famous brands in Isabela. These are NK 8814 priced at PHP4,700/9 kg bag and NK 60410 priced at PHP5,300/9 kg bag. Farmers need two bags of seed for every hectare. It is common knowledge in the yellow corn industry that aside from fertilizer, seed is a significant cost contributor to corn production.

Seed prices of the three companies are more or less even. To gain a competitive edge, they have their own sales promotion programs like discounts and longer payment terms. Other companies facilitate trainings and seminars to farmers through their technicians. These technical services serve as bundled benefits given to farmers when availing of their seeds.

There are generally two types of yellow corn farmers in Isabela, depending on capitalization. Some farmers self-finance their farm operation using their equity, while other farmers avail credit from trader-financiers. The borrowed money from trader-financiers is usually paid at five percent interest after corn harvest. The usual arrangement is that farmers borrow in cash and pay in-kind to trader-financiers. Yellow corn farms are generally productive due to the benefits derived from the adoption of genetically engineered seeds. According to PSA (2019), Isabela's average yellow corn productivity was 4.38 metric tons per hectare during the last five years, but farmers interviewed quoted higher figures.

Yellow corn farms are located in far-flung rainfed areas making logistics a challenge. Farmers have to negotiate with traders or consolidators who provide for transport and drying services. In some regions, there is only one trader-buyer. One small trader-processor interviewed in Isabela can accommodate up to six metric tons per day of operation. These small trader-processors usually tap the local market or feed millers of Isabela.

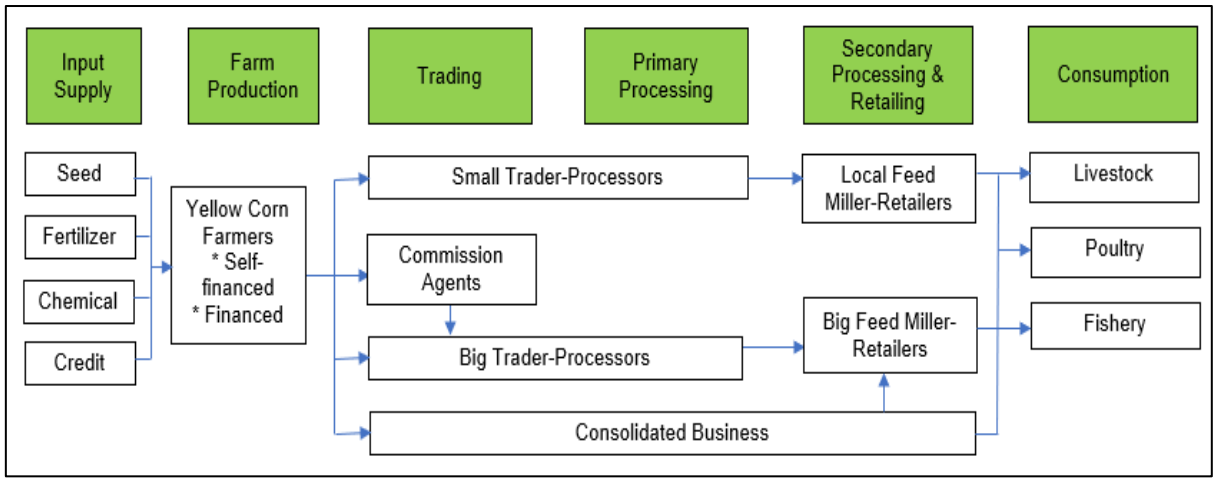
Farmers can also sell to big trader-processors. However, a transaction with this type of traders usually requires an intermediary called commission-agents. These agents are in charge of product consolidation from different locations to a typical area in a particular barangay or village. The big trader-processors pay for their services on a unit basis (*i.e.,* per sack of corn) or by a fixed amount (wages type). The big trader-processors will then bring the produce to their warehouse and perform grain drying using mechanical dryers. Drying is essential since their customers (*i.e.,* feed millers) require a certain moisture content level before proceeding with any transaction. One big trader-processor buys yellow corn from farmers at PHP14/kg and then sells the produce at a price of PHP16/kg to feed millers in Batangas. The PHP2/kg difference covers the costs of loading and unloading, trucking, the wage of labors, and "unofficial" charges (*i.e.,* unofficial toll fees charged by expressway inspectors amounting to PHP200 to PHP500 pesos per transaction). This particular big trader-processor can ship 28 trucks of yellow corn, where each truck has a load of 35 metric tons. Other big trader-processors also dispose of their products to feed millers located in Bulacan, Pampanga, and Tarlac. The feed millers situated in Central Luzon are B-MEG, Purina, New Hope, and iFeed.

A unique business operation in Isabela is the case of Mindanao Grains, which is situated in Reina Mercedes, but operates in surrounding municipalities such as Luna and Alicia. The primary purpose of this large processor in the past was to buy unshelled corn from farmers and use the cobs as fuel to dry corn grains. However, their business model adapts with the onset of a combined harvester and shellers forintact/unhusked corn ears. Currently, the operation of Mindanao

Grains in Isabela involves buying shelled yellow corn grains, and not anymore corn-on-cob. Mindanao Grains can accommodate a maximum capacity of 60 trucks per day, with each truck having 30 to 45 metric tons of corn. In their buying operation of corn grain, they classify corn either as feed or food-grade. They process this into their brand of feed for feed-grade corn through their sister company called Philippine Foremost Milling Corporation. After satisfying their feed milling requirements, the excess corn is sold to other feed millers in Central Luzon. Mindanao Grains plans to venture into swine farming and further develop their processed meat business in the future. For food-grade corn, they transform this into rice-shaped-corn called Rico. This is sold in various supermarkets and retail outlets.

Isabela's supply chain is characterized by the movement of yellow corn as raw material from farmers to trader-processors and finally to feed miller-retailers (**Figure 16**). The relevant final product here is feeds for hogs, poultry, and fishery industries. As the primary grain producer, the farmer contributes 33 percent for every peso of the retail price of feed at PHP22/kg. The provision of drying and marketing services by the trader-processor is equivalent to a three percent share of the consumer's peso. The transformation of yellow corn grain to feeds contributed 63 percent to the final selling price of feed. From these figures, it seems that feed miller-retailers have the largest share (*i.e.,* cost and income contribution) in the consumer's peso.

Figure 17. Yellow Corn Supply Chain in Isabela



Source: Author's own figure

Table 4. Breakdown of the consumer's peso from yellow corn grain to feed, Isabela

Chain player	Buying price (PHP/kg feed basis[b])	Selling price (PHP/kg feed basis[b])	Marketing margin[a] (PHP/kg feed basis[b])	Breakdown of consumer's peso
Farmer	0.00	7.30	7.30	0.33
Trader-Processor[c]	7.30	8.05	0.75	0.03
Feed miller-Retailer[d]	8.05	22.00	13.95	0.63

a *Selling Price - Buying Price*
b *All prices for farmer, trader and cooperative-processor were divided by two. This is to account for the conversion ratio of 500 grams yellow corn content per one kg of feed*
c *Processing in terms of drying*
d *Retail price of feed is based on the average price of various feeds given to hogs*

Yellow Corn Supply Chain in Bukidnon

The land area devoted to corn production in Bukidnon is relatively large compared to other provinces. The farmers interviewed for the FGD have landholdings in the range of 2 to 20 hectares. This figure is relatively high compared to the national average landholding of corn farmers of 1.30 hectares (PSA, 2016).

Like Isabela, the high cost of producing yellow corn in Bukidnon is due to material inputs such as, seeds, fertilizers, and chemicals, and the borrowed capital or credit. According to the FGD with farmers, the famous brand of seeds in the province based on production reliability are Pioneer, Bioseed, Evogene, and Maharlika. Seeds of Pioneer and Bioseed are registered at NSIC as GMOs while the others are not but are resistant to corn borer and glyphosate herbicide. Seed and input suppliers in Bukidnon have many branches all over the province. According to one of the key informants, input suppliers do not necessarily collude to set one standard price. Instead, to gain an edge against competitors, input suppliers try to develop loyalty among customers by giving discounts or lower fees. Most of the farmers interviewed preferred to plant Pioneer, costing PHP6,000 per 9 kg-bag and Evogene, which cost PHP2,800 per 9-kg bag.

Like Isabela's case, farmers in Bukidnon can either self-finance or borrow money for their farm operation. The working capital of one complete cycle of farm operation was in the range of PHP30,000 to PHP40,000 per hectare. For farmers who borrow money, the interest rate is six percent per one whole season of operation. One season of corn planting usually takes four months. However, an additional five percent on top of the initial interest is paid in case of late payments.

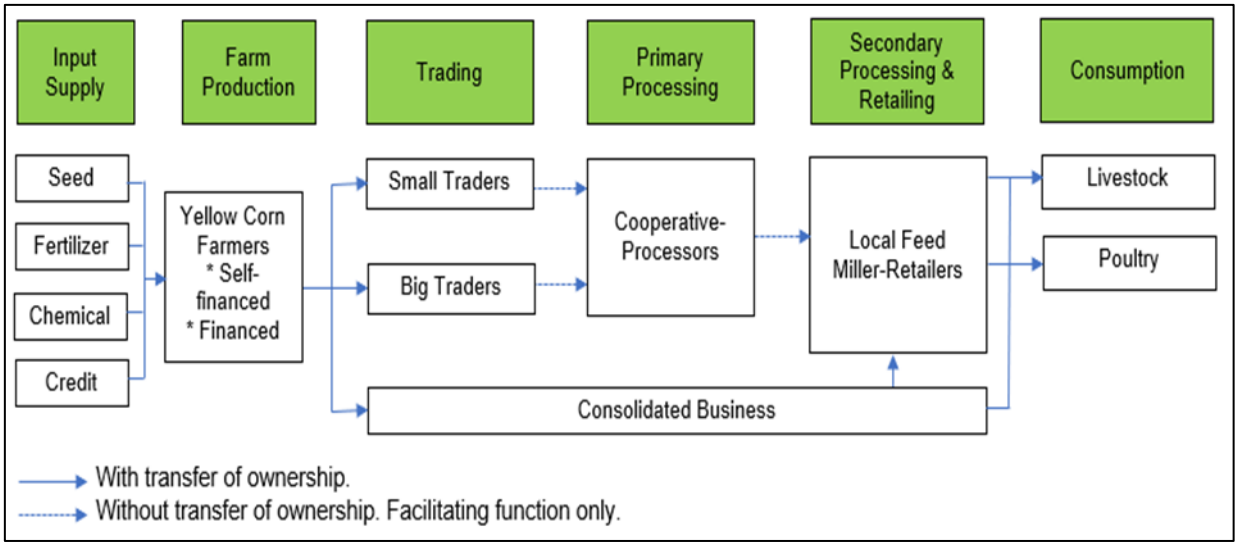
Farmland in the area can be rented to multinational companies that are into pineapple production. The cost of land rental can range from a low PHP18,000 per hectare per year to as high as PHP25,000 per hectare per year, with a corresponding contract of 10 to 25 years lease agreement. This arrangement has affected the land area devoted to corn production.

There are many types of yellow corn traders in Bukidnon, depending on procurement and business set-up scale. Traders can either be "small" or 'big" depending on the scale of procurement. One small trader interviewed by the Research Team in Sumilao, Bukidnon, buys about 200 metric tons per week, which he later sells to local feed miller-retailers. His four trucks could carry a 30-metric ton worth of load. At the time of the interview, he could afford corn for PHP12.00/kg. This particular trader disposed of a large portion of his produce to feed millers like BMeg and Cagayan Corn Products Corporation. The trader's preferred customer is BMeg because of the higher buying price of PHP12.50/kg as opposed to other buyers, which usually offer a lower cost of PHP12.30/kg. However, one disadvantage of selling to BMeg is the longer processing time, i.e., one to several weeks compared to 3-5 days by other buyers. The trader rented out an NFA storage warehouse at PHP20,000 per month, while his other two warehouses in other municipalities are family-owned. This trader practices competitive pricing against his other four competitors. He usually asked the buying price of other traders from customers, and then, based on quality, he later decided to adjust his offer to gain a competitive edge.

The cooperative-processor is an essential intermediary or facilitating agency of the yellow corn supply chain in Bukidnon. This segment of the chain provides postharvest processing services to farmers and traders of yellow corn. Cooperatives provide services for the drying and trucking of yellow corn for a fee. This cooperative, called Farm Cooperative

Incorporated (FCI), owns several postharvest facilities, including mechanical driers and trucks. After the drying process, the corn is sold to local feed miller-retailers. These feed millers, including BMeg, CJ Feeds, and Mambatangan Milling Corporation, have business operations in Bukidnon, while Bounty Agro Ventures and Pronatural Feed Corporation are operating in Cagayan de Oro City.

Figure 18. Yellow Corn Supply Chain in Bukidnon



Source: Author's own figure

The same procedure of tracing each chain participant's contribution to the final selling price of feeds was done in the case of Bukidnon. It should be noted that the buying and selling prices of the farmer, trader, and cooperative-processor were discounted by one-half to account for the 500-gram requirement of corn per one kg of feeds. The feed miller-retailer and the farmer contributed the most in terms of cost and margin, to arrive at a final feed product. The trader and the cooperative-processor contributed the least in the supply chain (**Table 5**).

Table 5. Breakdown of the consumer's peso from yellow corn grain to feed, Bukidnon

Chain Player	Buying Price (PHP/kg feed basis[b])	Selling Price (PHP/kg feed basis[b])	Marketing Margin[a] (PHP/kg feed basis[b])	Breakdown of Consumer's Peso
Farmer	0.00	6.00	6.00	0.25
Trader	6.00	6.25	0.25	0.01
Cooperative-Processor[c]	6.25	6.35	0.10	0.004
Feed miller-Retailer[d]	6.35	24.00	17.65	0.74

a *Selling Price - Buying Price*
b *All prices for farmer, trader and cooperative-processor were divided by two. This is to account for the conversion ratio of 500 grams yellow corn content per one kg of feed*
c *Processing in terms of drying*
d *Retail price of feed is based on the average price of various feeds given to hogs*

Pricing and costing at each level of supply chain

The source of raw materials to end market, farm inputs, finished products, and information is exchanged between supply chain participants. The same is the case for the white corn supply chain in Cebu and yellow corn supply chains in Isabela and Bukidnon. These chain participants set output prices that would generate an acceptable level of profit. Along the supply chain, expenses are incurred in the form of operating capital and fixed capital investments. This section discusses the different sets of prices and costing made by typical supply chain participants in yellow corn marketing. The focus is on the yellow corn supply chain since it is the more developed market as compared to white corn, where the supply chain is generally intended for home consumption. Significant costing or huge investments are also associated with yellow corn as compared to white corn.

a. Pricing and Costing of Seed Production: A Focus on the Development of the Bt Corn Technology

Published documents on the actual cost of producing GM corn, whether of the corn-borer resistant type (*Bt* corn), glyphosate-tolerant type *(*RR corn), or Stack (combined *Bt* and RR) is minimal. Most of the published documents are in a developed country setting like the US, the technology's original developer. An attempt was made by the Research Team to solicit costing and pricing information from the top three seed companies; however, there was a negative response that prevented an analysis of GM corn's costing and pricing. As an alternative, the publication of Manalo and Ramon (2007) documented the cost of developing the *Bt* corn technology from laboratory testing and greenhouse activities in the US to a counterpart in the Philippines for laboratory and greenhouse activities, the conduct of field trials, commercial propagation, and post-commercial application. The distribution of costs is summarized in **Table 6**.

Table 6. Cost of developing *Bt* corn in the Philippines by major activity grouping, 2004

Area/Activity	Cost (PHP)	Share (%)
Laboratory/greenhouse (US)	**5,199,741**	**4.1**
1980s study	696,075	
1990s study	4,503,666	
Greenhouse (Philippines)	**1,988,113**	**1.5**
1997 laboratory/greenhouse	922,638	
1998 laboratory/greenhouse	1,065,476	
Confined field trial	**7,009,088**	**5.5**
1999 trials	3,762,657	
2000 trials	3,246,431	
Multi-location field trial	**44,379,128**	**34.7**
2000 activities	7,392,247	
2001 activities	16,120,342	
2002 activities	20,866,539	
Commercial propagation	**16,312,461**	**12.8**
2002 studies	13,793,309	
2002 activities	2,204,703	
Public information sheets	26,975	
Application fee	287,474	
Post-commercial application	**53,088,637**	**41.4**
2003 activities	14,052,274	
2004 activities	11,265,589	
2003 promotion material	15,203,283	
2004 promotion material	12,567,490	
Total	**127,977,169**	**100**

Source: Manalo and Ramon (2007)

The accumulated cost of developing the *Bt* corn technology from the laboratory to post commercialization is around PHP 128 million. The majority of the cost is attributed to post-commercialization activities (e.g., activities to convince farmers to buy the product), accounting for 41.4 percent of total development cost. Whereas the multi-location field trials or actual testing of the product in various provinces in the Philippines make-up around 34.7 percent of the total cost. The other minor components of development cost are the costs of commercial propagation and confined field trials. Laboratory activities conducted in the US and the Philippines costs only around 1.5 to 4.1 percent of total development cost. Given an average price of PHP 400 per kg of *Bt* corn seed in 2004, the area planted to *Bt* corn of 50,000 hectares in 2004, and a seeding rate of 18 kg per hectare, this translates to around PHP 360 million in seed sales. This implies that during the first year of *Bt* corn commercialization in 2004 alone, the accumulated cost of developing *Bt* corn in the Philippines was already recouped in seed sales. The application of *Bt* corn for the succeeding years of 2005 to 2011 are already additional benefits derived from *Bt* corn commercialization.

b. Pricing and Costing of Yellow Corn Grain Production

A typical cost and return analysis of yellow corn production in Isabela for 2018 is shown in **Table 7**. The study was disaggregated based on the type of seed technology adopted by farmers: GM corn and conventional or ordinary hybrid, and corn without corn-borer resistance and weed protection. Traditional corn production costs more labor to produce than GM corn since farmers will have to implement insect and weed management in terms of chemical spraying and hand weeding. These costs are avoided in the case of GM corn. However, GM corn adoption costs more for material inputs costs, particularly in terms of seed procurement. Seed cost was PHP 10,900 per hectare for GM corn and PHP 5,000 per hectare for conventional corn. This significant cost difference comes with the trade-off of avoiding the cost of insect and weed management. GM corn's productivity is higher than conventional corn farms with a yield advantage of 1,000 kg per hectare. Given a selling price of PHP19.00 per kg for GM and conventional corn, net farm income was higher for GM corn than traditional corn. The results also showed that GM corn was more cost-efficient per unit of yellow corn grain than conventional corn. It means that GM corn farmers are spending less than conventional corn farms per one kilogram of corn grain production.

Table 7. Cost and Return of GM and Conventional Corn Production, Isabela, 2018

Item	Yellow Corn	
	GM Hybrid Corn (PHP)	Conventional Hybrid Corn (PHP)
A. LABOR		
Land Preparation (2x)	3,000.00	3,000.00
Crop Establishment		
Furrowing	900.00	900.00
Fertilizer Application	720.00	720.00
Planting	1,800.00	1,800.00
Crop Care and Maintenance		
Off-Barring		900.00
Handweeding & Thinning		2,700.00
Insecticide Spraying	-	720.00

Item	Yellow Corn	
	GM Hybrid Corn (PHP)	Conventional Hybrid Corn (PHP)
Sidedressing	720.00	720.00
Hilling-up		900.00
Post-Harvest Activities		
Harvesting	2,160.00	2,160.00
Hauling per cavan @ 15/cavan	2,740.00	2,250.00
Shelling @ 22/cavan	6,028.00	4,950.00
Drying (2x)	1,440.00	1,440.00
Milling for grits		
Sub-total	***20,228.00***	***23,160.00***
B. MATERIALS		
Seeds	10,900.00	5,000.00
Herbicide		
Pre-emergence (box)	-	350.00
Post-emergence (liter)	700.00	700.00
Glyphosate (liter)	400.00	
Fertilizer		
14-14-14 (bags)	8,750.00	8,750.00
Urea (bags)	4,000.00	4,000.00
Insecticide	1,000.00	1,000.00
Sacks	3,288.00	2,700.00
Twines and Needle	60.00	60.00
Miscellaneous (snacks, meals, etc)	5,000.00	3,000.00
Sub-total	***34,098.00***	***25,560.00***
C. TOTAL COST OF PRODUCTION	**54,326.00**	**48,720.00**
D. YIELD		
Yield per hectare (kilogram/ha)	7,000	6,000
Selling Price per kilogram	19.00	19.00
F. GROSS RETURN	133,000.00	114,000.00
G. NET FARM INCOME	78,674.00	65,280.00
H. COST EFFICIENCY (Total Cost/Yield, Php/kg)	7.76	8.12

Source: Cagayan Valley Research Center, 2019

c. Pricing and Costing of Yellow Corn Grain Trading

Yellow corn traders are bringing the produce from farms to feed millers located in the province of Isabela itself, Pampanga, Bulacan, or Batangas. A typical yellow corn grain trader operating in Isabela will have to pay around PHP 13,030 per 1,000 kg of corn operation. The cost of raw material procurement represents around 57 percent of the total operating expenses. The remaining 43 percent comes from hired labor and transportation cost. To become fully operational, a corn trader will have to invest in purchasing a truck and weighing scales. A truck can cost around PHP 2.5 million per unit, while a floor weighing scale can be purchased at PHP 75,000 per unit (**Table 8**).

Table 8. Operating and investment requirements of yellow corn traders per 1,000 kilograms of yellow corn sold, Isabela, 2019

Items	Per 1,000 kg of yellow corn sold	
	Values (PHP)	% Share*
OPERATING COSTS		
Yellow corn bought	13,060.71	56.64
Hired labor and transportation	10,000.00	43.36
TOTAL OPERATING COSTS	23,060.71	100.00
INVESTMENT COSTS		
Trucks	2,500,000.00	97.09
Floor weighing scale	75,000.00	2.91
TOTAL INVESTMENT COSTS	2,575,000.00	100.00

Source: Elca et al (2020)

d. Pricing and Costing of Feed Milling

Yellow corn is one of the main ingredients in feed formulation. The study of Elca et al. (2020) included an assessment of the operating and investment costs of small-scale and large-scale feed millers in Luzon. The bulk of the large-scale feed miller's operating costs in Pampanga was mainly composed of the annual fixed operating costs of business registration, the Mayor's permit, and sanitary permit. These cost items account for 96 percent of the total operating cost. The other cost items of the large-scale feed miller are feed ingredients aside from yellow corn. The small-scale feed miller in Cagayan, on the other hand, only had yellow corn, soya, *darak*, and molasses as feed ingredients. The Majority of its operating cost is also attributed to electricity and water. However, the share is relatively smaller at 23 percent compared to the operation of the large-scale feed miller. There is a significant amount of fixed capital investment needed to operate a feed mill. Even for a small-scale producer, the total investment requirement is PHP 1.3 million due to the purchase of a warehouse and boiler/ feed miller. Fixed capital investment will be significantly higher if one wants to expand its operation to become a large-scale type of feed mill. The investment requirement is around PHP 81 million, mainly composed of investments in a warehouse (61%) and trucks (18%). Depending on the type of feeds produced, the feed millers' selling price can range from PHP1,250 to PHP 1,350 per 50-kg bag for the small-scale operation and PHP 900 to PHP 1,500 per 50-kg pack for the large-scale operation (**Table 9**).

Table 9. Operating and investment requirements of feed millers per 1,000 kilograms of feeds produced, Cagayan and Pampanga, 2019

Items	Per 1,000 kg of feeds produced			
	Small-scale in Cagayan		Large-scale in Pampanga	
	Values (PHP)	% Share*	Values (PHP)	% Share*
OPERATING COSTS				
Yellow corn bought	8,051.20	33.32	5,250.00	1.02
Wheat	-	-	1,580.00	0.31
Pollard	-	-	1,520.00	0.29
Soya	7,020.00	29.05	2,380.00	0.46
Copra	-	-	1,250.00	0.24
Corn bran	-	-	1,550.00	0.30
Rice bran	-	-	1,500.00	0.29
Medicine	15.00	0.06	1,500.00	0.29

Items	Per 1,000 kg of feeds produced			
	Small-scale in Cagayan		Large-scale in Pampanga	
	Values (PHP)	% Share*	Values (PHP)	% Share*
Darak and molasses	2,336.00	9.67	-	-
Annual fixed operating costs*	-	-	500,000.00	96.71
Electricity and water bills	137.50	0.73	466.67	0.09
Sacks	240.00	0.99	-	-
Other costs	1,000.00	4.14	-	-
TOTAL OPERATING COSTS	24,162.20	100.00	516,530.00	100.00
INVESTMENT COSTS				
Warehouse	500,000.00	38.46	50,000,000.00	61.09
Pelletizer	-	-	5,000,000.00	6.11
Crumbler	-	-	5,000,000.00	6.11
Boiler/feed miller	800,000.00	61.54	3,000,000.00	3.67
Trucks	-	-	14,850,000.00	18.14
Truck scale	-	-	2,000,000.00	2.44
Silo	-	-	2,000,000.00	2.44
TOTAL INVESTMENT COSTS	1,300,000.00	100.00	81,850,000.00	100.00

** Composed of business registration cost, Mayor's permit, and sanitary permit*
Source: Elca et al (2020)

Possible competition issues at each stage of the supply chain from production inputs to marketing of output

Inputs

The table below shows the breakdown of the farmer costs for yellow corn farming in the country's biggest corn-producing province: Isabela. Seeds, fertilizer, and labor account for 80 percent of GM hybrid corn farming's total production cost.

Table 10. Breakdown of the farmer costs for yellow corn grain, GM hybrid, Isabela

Input	Cost (PHP/hectare)	Percent share to total cost (%)
Seeds	10,900	20
Fertilizer	12,750	23
Labor	20,228	37
Other Inputs[a]	10,448	20
Total Cost	54,326	100

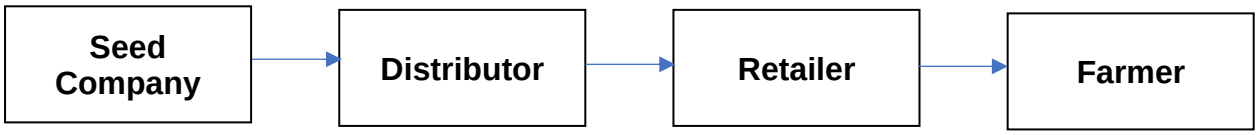
[a] Includes herbicide, insecticide, sacks, and food cost
Source: Cagayan Valley Research Center, 2019

a. Seeds

The seed companies (MNCs) distribute their products through traders-financiers and dealers of seeds, and other agricultural inputs, primarily chemicals, and fertilizers, all over the country (**Figure 18**). They have their different distinguishable brand names and logos: Pioneer (now Corteva), Monsanto (now Bayer), and NK for Syngenta (now China Chem).

There is not much difference in the percent share among the big three (3) seed companies in different countries' corn-growing regions. Pioneer might be a little bit ahead because it was the first country's hybrid corn seed company in the country. Monsanto was the first that introduced GMO hybrids. Syngenta later came in strong with their good performing GMO hybrids. The latest unofficial assessment of hybrid corn seed growers is that Syngenta is now ahead of the competition. The packaging is standard: 9 kg/bag good to plant one-half hectare.

Figure 19. Distribution of seeds from seed producer to farmers



Source: Author's own figure

As earlier mentioned, seeds of GM corn are expensive. Farmers' feedback on the prices paid for GM corn seeds ranged from PHP5,000 to PHP6,000 per 9-kg bag, which the farmers have to buy every time they plant. Each hectare requires at least two bags. Thus, on seeds alone, the farmer needs to shell out PHP10,000 at the minimum. OPVs, in contrast, would cost about P2,500 per 18-kg bag good for one hectare. **Table 11** shows the GM corn adoption by different regions during the wet season of 2019.

Table 11. GM corn adoption by region, March 2019-July 2019 (wet season)

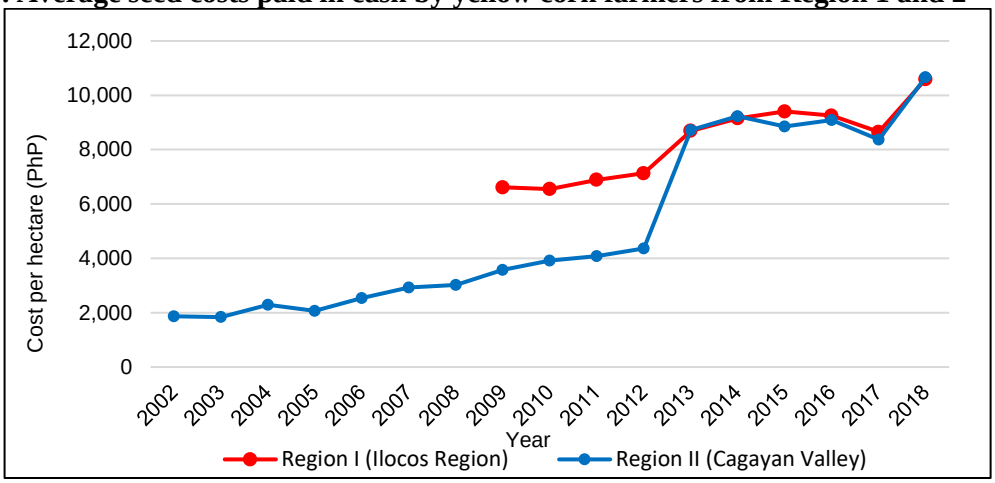
Region	Region Name	Herbicide Tolerant, hectare	Insect Resistant + Herbicide Tolerant, hectare	Total, hectare	Percent share to total hectarage of GM corn adoption
II	Cagayan Valley	950	190,892.65	191,842.65	51.2
X	Northern Mindanao	0	38,396.00	38,396.00	10.2
XII	SOCCSKSARGEN	1,700	29,095.00	30,795.00	8.2
VI	Western Visayas	500	29,089.75	29,589.75	7.9
CAR	Cordillera Autonomous Region	1,700	23,058.00	24,758.00	6.6
I	Ilocos Region	350	12,899.00	13,249.00	3.5
ARMM	Autonomous Region in Muslim Mindanao	500	10,216.00	10,716.00	2.9
V	Bicol	400	8,386.55	8,786.55	2.3
XIII	Caraga	0	6,683.50	6,683.50	1.8
III	Central Luzon	0	5,920.45	5,920.45	1.6
IV-B	MIMAROPA	0	4,478.00	4,478.00	1.2
XI	Davao	0	4,267.00	4,267.00	1.1
IX	Zamboanga Peninsula	0	3,058.00	3,058.00	0.8
IV-A	CALABARZON	0	2,389.81	2,389.81	0.6
Total		**6,100**	**368,829.71**	**374,929.71**	**100.0**

Source: DA Bureau of Plant Industry – Biotechnology Division

To visualize, **Figure 19** presents the seed costs paid by farmers from Regions 1 and 2, which almost completely adopt the technology. From close to PHP2,000 per hectare in 2002 (Region 2), it has gone up to over PHP10,000 per hectare. Such a figure translates to almost 20 percent of the total production cost in Cagayan Valley (**Table 10**). The 2017

estimate for GMO corn was 0.6M, which would translate to PHP6B shared between the big three multinationals: Pioneer (now Corteva), Monsanto (now Bayer), and Syngenta (allied to China Chem), *i.e.,* American, German and Chinese companies. About 15 percent of the locals' production area remains based on informal Filipino Hybrid Corn Seed Producers Association assessments. Other seed companies would also like to avail of patented events for GM corn but have to pay a royalty to the technology developer even if the patent for such genes already expired in its country of origin. According to Schonenberg (2014), the first Monsanto Genetically Modified or GM Roundup Ready traits expired in September 2014, and several more GM traits are to expire in 2020.

Figure 20. Average seed costs paid in cash by yellow corn farmers from Region 1 and 2



Source: PSA, 2019

It is believed by some local stakeholders that if local seed companies could use those expired genes, then there would be greater participation by local seed companies. They could openly sell their hybrids at a lower price. "*Sige sige*", the advanced generation or continuous planting using the harvest from original GM seeds with reduced yield, vigor, and uniformity, and "*ukay-ukay*", the pilferage or theft of seeds from seed production areas, (ISAAA, 2017) are the consequence of the restrictive price of the accredited GMO hybrids. Some locals have also developed new GMO hybrids that are cheaper but also high yielding, out of original GMO hybrids. Although they would not apply for formal accreditation, nor declare those as GMO because they could not pay the licensing fee. One consequence of this is that they do not integrate insect resistance management (IRM) in their seeds as prescribed by the BPI. IRM is a means to minimize the possibility of developing *Bt*-resistant corn borer insects.

According to ISAAA (2017), officially accredited GM corn adoption decreased from 0.81 million hectares in 2016 to 0.62 million hectares in 2017, primarily because of the proliferation of such seeds. It shows that there is a market for lower quality corn seeds at an affordable price. Toward this end, more duly accredited participants in the seed market coming from the local hybrid seed developers should favor competition.

Expired GM patents and the transition to a generic seed market

Schonenberg (2014) provided a review and legal commentary on the transition to a "generic" market for patented seeds (i.e., the unrestricted use of expired GMO genes). In her study, she cited that the first Monsanto Roundup Ready seed traits or the herbicide-tolerant traits expired in 2014, based on US patent records.

Several more GM technologies are expiring in 2020. This would also include *Bt* corn used in the Philippines, with the Monsanto 810 patent expired in 2015 (GEMAA, 2013). Schonenberg (2014) reported that the private companies like Monsanto, with other agricultural biotechnology companies made an initiative to handle this transition of expired patents on GM technology. However, it is seen as more favorable to the industry than the general public. It is argued that there is a need to learn lessons from the US pharmaceutical industry where once a patent expires, other companies could openly manufacture those as a "generic", equally effective but regulated brand, bringing down the cost of the medicine.

A key question now is whether there is an opportunity to transition to a "generic" seed market, which should foster greater competition in the Philippines' seed market. This will benefit the farmers and the entire corn industry. However, this is a new area for GM technology and is still evolving in the US, and will probably impact the Philippines. The issues on these GM seeds will include legal, technical, social, and economic aspects that are wide in scope that this issues paper cannot entirely cover. It is worth mentioning that a 2018 OECD report regarding concentration in seed markets does propose that this transition to a "generics seed market" as an option to ensure seed markets still work well. However, there are regulatory challenges concerning off-patent events related to GM seeds. It was further cited in the OECD report that there is a private initiative in the US, the AgAccord. Based on the official website, below is a short description of its purpose:

> *"The AgAccord establishes a contractual framework to support business opportunities for those seeking to use off-patent events in the United States while ensuring important global regulatory commitments are maintained for off-patent events so that U.S. exports of products containing these events are not disrupted. The AgAccord comprises two separate agreements that cover the full spectrum of issues related to patent expiration — the Generic Event Marketability and Access Agreement (GEMAA®) and the Data Use and Compensation Agreement (DUCA). The GEMAA entered into force in November 2012 and has 10 signatories. The DUCA opened for signature in December 2013 (AgAccord, 2019)."*

Even if the idea of a "generic seed market" is complex, it is worth exploring as one option for the Philippine seeds market. This will ultimately involve a more in-depth look and require a broader mix of participants involving legal experts, scientists, private sector representatives, and policymakers to make it work. The PCC can facilitate and initiate these discussions. It will most likely be the National Biosafety Committee of the Philippines (NBCP) who must take up the issue and eventually carry it forward with PCC, an interested agency as it does have a direct bearing on competition.

GM corn seed industry players

MNCs dominate GM corn seeds technologies because they own the patents for such technologies, including newer ones that they apply for in the country. A discussion on patent expiry is discussed separately by this report in the preceding section. Overall, it is a real challenge to get detailed information or data to analyze market shares globally and locally. Three major mergers have impacted the global seed industry; these are the mergers of Dow and Du Pont, Syngenta and ChemChina, and that of Bayer and Monsanto (Deconinck, 2019).

According to information collated and analyzed by Howard (2018) from Michigan State University (MSU)[2], there are now four major agrochemical and seed firms in the world. These are DowDupont, Chemchina-Syngent, Bayer-Monsanto, and BASF. These four are estimated to control about 60 percent of global seed sales. Monsanto was the first to patent the MON 810 and was also the corn seed initially used in the Philippines' early commercialization period. There are now more new varieties that combine insect resistance with herbicide tolerance. A vital merger is that of Bayer and Monsanto. Monsanto has the seeds technology together with its patents, while Bayer produces the herbicides. In this regard, the potential for market dominance is there, even if data is not readily available for now.

This last point brings a vital policy implication wherein there must be closer monitoring of seed prices, sales volume, and market shares of GM seed players, both time series and panel data. Even if there are counterfeit seeds, which must be addressed, there is a need for better market monitoring on yellow corn production. This implies the need for more market information and disclosure, perhaps through the SEC, which should be readily available publicly for scrutiny. This would allow for a more informed debate on the impact of the concentration of major players. More analysis is needed on the effects on input prices and innovation, as pointed out by Deconinck, 2019. Lastly, while there is a concern for market dominance that may be unfavorable to farmers as the primary consumers of seeds and chemicals, it is also crucial that this is balanced with the need to encourage innovation through private sector research and development investments. As shown above, GM seeds were vital in ensuring an increase in yellow corn. Overall, dominance must not translate to higher input prices or fewer options for farmers in terms of technologies.

Investments in research and development for continual innovation in agriculture

It is relatively established that investments in agriculture R&D are crucial for innovations that are useful for society. These investments are either private sector driven or publicly funded. According to Pray and Fuglie (2015) and an OECD (2018) report on seed concentration, the private sector has a considerable investment in the agriculture chemicals, farm machinery, seed, and biotechnology sectors. In 2008, the private sector had invested more towards R & D related to seed and biotechnology, overtaking R & D's traditional area of farm chemicals and machinery (Pray and Fuglie, 2015). It is already a signal that there are benefits foreseen by the private sector in the input supply chain of the agriculture sector.

Investment in R & D and innovation may not guarantee incentives if there are regulatory barriers, such as, restrictions that aim to limit market dominance. The private sector, such as multinational companies in the seed industry infer that they may not be incentivized to invest in R & D and develop innovations if there are regulatory barriers. Since this is a valid concern, the PCC will have to balance this perspective in a way that ensures continuous innovation and that the farmers have access to these innovations. Nonetheless, there is space for encouraging public R & D in agriculture inputs that mainly include seeds and biotechnology as a counterbalance to the market dominance of private industry (OECD, 2018). However, as with public expenditures, there is a risk of crowding out private investments. Thus,

[2] See website https://philhoward.net/2018/12/31/global-seed-industry-changes-since-2013/

the PCC needs to keep this in mind if it advocates for policy related to public investments in agriculture R & D. The OECD recommends several options about this policy that the PCC could use as it revisits and establishes further possible scenarios in the Philippine context.

b. Fertilizer

Fertilizer is another input around 8 to 15 percent of farm production costs based on PSA data on average national costs and returns. Briones (2016) and Galang (2017) concluded that there is no evidence for "localized monopolies." Instead, regional price differences are possibly attributed to logistics-related costs related to port operations and lack of adequate infrastructure on other islands. Key informant interviews also seem to indicate the same.

Corn Output

The leverage that the feed millers have in terms of liberalized import of corn and substitute anytime in the year is something that corn producers do not have in the other direction through export. In the earlier discussion on imports, the local price of corn in many years was lower than the international price, and yet importation was still done. It could be due to the insufficiency of supply to the volume requirement by the feed milling sector.

However, given the sector's improving productivity, it can expand its potential markets, including exports. This should help improve the farmers' income from their produce. However, it is the capability to consolidate their output to meet volume commitment and quality. This is an area that they are currently unable to meet due to a lack of post-harvest facilities like dryers, warehouses, and grains transport. It will be extremely beneficial to corn farmers if relevant agencies can work on these support services; otherwise, the scenario is that farmers will remain poor, and the Philippines will always be importing.

Policies and regulations relevant to possible competition Issues

Seeds

a. Accreditation of conventional crop varieties

RA 7308 or the Seed Industry Development Act (1992) regulates the accreditation of new crop varieties through the National Seed Industry Council (NSIC). It is chaired by the DA Secretary with members coming from different government and private sectors involved in the seed industry. The secretariat agency is the Bureau of Plant Industry (BPI), which works with other technical working groups assigned to different crops. New varieties have to undergo a series of tests and pass the standards, mainly based on yield before they get accredited. With a certificate of approval (accreditation), the seed developer can now openly sell their products and even avail of publicly funded crop seeds subsidy programs. Farmers need not patronize those accredited varieties, but they are left to their resources and risks. The procedure is simple, and many could compete even with the local ones. That was, until the advent of GMOs.

b. Accreditation of GMOs

The accreditation of GMOs was made possible through the Republic Act (RA) 9168 or Philippine Plant Variety Protection Act (PPVPA) and DA Administrative Order 8 (DA AO8), both in 2002.

PPVPA provides the legal basis of a *sui generis* system of intellectual property rights and provides "plant breeder's rights". This right is a recognition of intellectual creation, as applied on plant varieties transformed through breeding, whether done the classical way or through modern technology such as genetic engineering.

Under the PPVPA, the National Plant Variety Protection Board (NPVPB) shall manage the implementation of the Plant Variety Protection (PVP) system that would determine ownership over new plant varieties. The Board is composed of the Secretary of DA as chairman, Secretary of DOST as co-chairman, Director General of IP Philippines as vice chairman and other members from BPI, Institute of Plant Breeding from UPLB, Seed Industry Association President, Representatives from the Federation of Small Farmer's Organization and the scientific community, and the Registrar or the Plant Variety Protection Office based in BPI.

A PVP is an administrative procedure that an applicant complies with to secure a Certificate of PVP, which are granted for varieties that are new, distinct, uniform, and stable. The term of protection is from 20 to 25 years from the date of grant of the certificate depending on the type of plants. To maintain the validity of the certificate, the holder shall pay an annual fee prescribed by the Board. Holders of certificates shall have the right to authorize any of the following:

i. Production or reproduction;
ii. Conditioning for the purpose of propagation;
iii. Offering for sale;
iv. Selling or other marketing;
v. Exporting;
vi. Importing; and
vii. Stocking for any purpose mentioned above.

The plant breeder's right is a form of an exclusive right that enables the owner of the right to stop anybody from exploiting or using the protected plant variety without any permission or license from him or her.

The DA AO8, on the other hand, provides for the rules and regulations on importation and release into the environment of plants and plant products derived from the use of modern biotechnology. It covers the importation and releases into the environment of the following:

1. any plant which has been altered or produced through the use of modern biotechnology if the donor organism, host organism or vector or vector agent belongs to any of the genera or taxa classified by BPI as meeting the definition of a plant pest or is a medium for the introduction of noxious weeds; or

2. any plant or plant product altered or produced through the use of modern biotechnology which may pose significant risks to human health and the environment based on available scientific and technical information.

Aside from the BPI, the involvement of the Bureau of Animal Industry (BAI), the Bureau of Agriculture and Fisheries Product Standards (BAFPS) as well as the Fertilizer and Pesticide Authority (FPA) is essential to ensure safety assessment and compliance. The BPI is the single-entry point for the applications and issuance of permits and in-charge in looking at the overall environmental impacts. The BAI evaluates the safety of biotechnology in feeds while the BAFPS deals with the safety of

biotechnology materials as food products. If the regulated article is a pest-protected plant, its transformation event must be duly registered with the Food and Fertilizer Authority (FFA).

A permit to field test must be secured from the BPI before releasing a regulated article into the environment for testing. On the other hand, the release for propagation requires a permit inclusive of substantiation based on field testing; the regulated article will not pose any significant risks to the environment and human health.

Only those who developed the GMOs can get the proper accreditation. The standards involve both field and molecular tests. Because local seed developers do not have the biosafety permit to commercialize the said varieties, they were practically left out unless they got licensed by the technology owner for a flat fee. The locals are now waiting for the patents in the country of origin to expire.

c. Revocation of DA AO8 and Institution of Joint Department Circular No. 1

In 2016, the Supreme Court nullified the DA AO8 regarding GMOs, citing it lacked the National Biosafety Framework's minimum requirement, established under Executive Order 514, series of 2006. Subsequently, the DOST, DA, Department of Environment and Natural Resources (DENR), Department of Health (DOH), and Department of Interior and Local Government (DILG) signed the Joint Department Circular No 1, series of 2016[3] (JDC 1, 2016). This enabled the continuation of applications for field testing and the use of biotechnology in the country. Farmers need to have options for seeds, including access to GM technologies. Otherwise, if the requirements for application become too stringent, it will not be beneficial to the seed market as it lessens options, especially farmers' access to better technology. According to an inquiry made at BPI, the implementing rules and regulations are being drafted and scheduled for public discussion in the first semester of 2020.

In DA AO8, the technology owner could always renew their application to commercialize their technology every five years. This could mean forever as long as they intend to. In their country of origin, however, there is a limit. One of the issues in JDC1, aside from the technology itself, is how long could those owners hold on to it.

One issue related to this is the nature of corn as a cross-pollinated crop. Almost all of the Philippine white corn (and yellow corn to some extent) is planted to OPVs. Many of which are native varieties. Most of those native varieties are now "contaminated" by GMOs. This is unlike in the US, where almost all the cornfields are GMOs.

Another critical issue for regulation is to ensure that it does not become a "barrier to entry" for firms to compete and provide technology options in the seed market. In the study of Manalo and Ramon (2007), they estimated that two-thirds of the development costs to commercialization went to compliance and support of government regulatory requirements. These regulatory requirements are essential for public safety, but it must be balanced to ensure that it facilitates innovation, technology development, and end-users' access. Generally, these regulatory costs can vary depending on how stringent regulatory requirements are in a country.

[3] See link for details of JDC1 http://biotech.da.gov.ph/upload/Final_DOST-DA-DENR-DOH-DILG_JDCs2016.pdf

Outputs: Markets for Local Corn

The domestic yellow corn industry is currently protected via an import quota or minimum access volume (MAV). This protection is limited to the importation of 217,000 metric tons of yellow corn annually. Any importation above the MAV pays an import duty of 50 percent (out-quota rate), while imports below the MAV pays a lower duty of 35 percent (in-quota rate). However, importers can avail of lower import duty of 5 percent as long as the produce comes from any ASEAN-member country (USDA FAS, 2019). In one instance, PhilMaize once filed a complaint that one ASEAN country (which does not produce GMO corn) exported to us a sizable quantity of corn far beyond its regular harvest figures. The transshipment allegation was that it was GMO corn from South America that should be given higher tariff rates. A simple molecular test on the shipment would have confirmed, but based on one of the key informants (2019), no action was taken on the complaint.

The importation of feed wheat has no quantitative restriction, but there is a seven percent tariff to protect the local corn industry. According to the Philippine National Trade Repository (PNTR), wheat imports for human consumption are regulated by BPI. However, if for feed (including corn), then regulation is made by the Bureau of Animal Industry (BAI). Overall, since yellow corn and feed wheat import trade is liberalized, anyone can now import, provided they comply with standard clearances as defined by regulations (*i.e.,* MAVs and tariffs).

Importation is essentially open, but export is not. The contention of the feed milling sector is that exporting is not a smart thing to do when we cannot produce enough corn. Only NFA could export if it could be proven that there is an excess supply of corn. However, when the oversupply is determined, the harvest has already been disposed of, most likely at a low price. Hence, there is nothing more to export.

Because of the NFA's reduced role in grains importation due to the recently passed Rice Tariffication Law, this practical ban on corn export should also be reviewed. It is in Section 6, xiii, of Presidential Decree 4 (P.D. No.4) (Providing for the Development of the Rice and Corn Industry and Creating for this Purpose the National Grains Authority)[4], that states:

> *"Section 6. Administration- Powers, Organizations and Management, and Exemptions…*
>
> *xiii) To establish rules and regulations governing the export of rice, corn, and other grains and/or their substitutes and their by-products/end-products (Sec. 6 A (xiii) and to collect fees and charges for such exportation at rates to be determined by the Council.*
>
> *In the exercise of this power the Authority shall directly undertake the exportation of rice, corn and other grains and/or their substitutes and/or by-products/end-products whenever there is an excess in production and/or supply, or it may allocate export quotas among certified and licensed exporters; Provided, however that the Council shall first certify such excess production and/or supply after proper consultation with the Office of the President."*

[4] See link for a full copy of P.D. No. 4 http://nfa.gov.ph/images/files/archive/PD-04.pdf

PhilMaize, an organization of corn farmers, had been lobbying for this export restriction to be lifted. They have argued that they should also liberalize exports since there is an import-liberalized regime where yellow corn and substitutes are freely imported. By lifting this restriction, corn farmers will have an incentive to explore other markets, especially when domestic farmgate prices are too low. PhilMaize asserts that traders could also consider world prices of corn. If these move up, then farmgate prices may also rise, which would be favorable to corn producers[5].

It is essential to review the rice tariffication law as it was more focused on liberalizing imports. Likewise, it is vital to check whether it was repealed in the newly enacted laws that liberalized agriculture and rice trade. If it remains in force, then a sort of "export restriction" through this policy prohibits farmers' opportunities to tap other markets. For fair competition, our farmers should be allowed to tap other markets, especially if farmgate price is potentially affected by corn imports and feed wheat. By removing such restrictions, farmers will be encouraged to improve quality and aim for favorable prices. This view would be consistent with an open competition that benefits both the farmers and consumers of yellow corn.

Although **Figures 14a** and **14b** seem to show that the Philippines' local corn is cheaper than imported only because of the high tariff, it is worth noting that these figures are averaged across seasons. The Philippines may not be able to export during the wet season because of the present lack of post-harvest facility, but exporting can be done during the dry season. The proximity to neighboring possible market countries will be a logistical advantage. Almost all of the corn (and soybean) traded in the world are GMOs, and therefore the Philippines should have no regulatory problem exporting its GMO corn. Indeed, the corn industry in the Philippines is an issue of quality. The private sector is not investing in it that much because the facilities involved will only be highly useful during the wet season. Incentives and support are necessary to protect the more voluminous wet season harvest. Although the export competitiveness analysis (**Annex B**) revealed that price-wise it is advantageous for corn producers to sell domestically than the foreign market, farmers should be allowed to export when the quoted price is higher.

The rice tariffication law stipulates that the tariff collected from rice import would be used to enhance the productive capacity of rice farmers. The same clear support should be provided to corn farmers, especially in their need for post-harvest facilities to save the bountiful wet season harvest and for various modern equipment for production up to harvesting. Support should also be given to the development of technologies that would enhance our corn farmers' productivity capacity considering our unique environmental conditions.

IV. SUMMARY, CONCLUSION, AND RECOMMENDATIONS

Corn grows all over the country, but some regions have excelled more production-wise than others. For yellow corn, Cagayan Valley (Region 2) is foremost in Luzon, and Northern Mindanao (Region 10) and SOCCSKSARGEN (Region 12) in Mindanao contribute most. The difference in weather patterns during the wet and dry season is an important factor in

[5] See Business Mirror articles 1) https://businessmirror.com.ph/2018/12/12/philmaize-slams-retentionof-no-export-rule-on-local-corn-produce/ and 2) https://businessmirror.com.ph/2017/05/03/philippines-continues-to-reckon-with-qr/

appreciating the potential, limitation, and opportunities between Luzon, Visayas, and Mindanao.

Overall, both the supply and demand for yellow corn in the Philippines are growing. The yield level is already comparable to neighboring Asian countries; however, there is still room for improvement in the local corn. It can better cope with almost very regular weather patterns, with some variations, but the Philippines has enough rainfall to grow the crop. Field operations must be adjusted, and necessary machinery should be provided for early land preparation and grains drying at harvest time, especially during the wet season.

But still, local supply could not cope with the needs of the feed millers or livestock raisers because of our increasing demand for meat. Feed millers then have had to explore all possible sources to sustain their operation. Yellow corn and feed wheat were therefore imported, liberally at a particular tariff, at any time of the year. This is mostly for feed wheat since its importation has increased significantly in recent years and is expected to increase in the coming years.

For white corn, the productivity has remained low and flat due to limited demand for the grain as food ascribable to negative perception (in Luzon) of white corn as a staple, but it has immense potential in terms of nutrition and food security. Namely, white corn could slow down the increasing diabetes rate in our country. White corn could still be adequately produced in the country since it is rainfed. Because of this, we do not even have to rely on SEA countries for imports.

The supply chain analysis conducted for yellow corn in Isabela and Bukidnon shows that, on average, the contributions of the farmers, traders, and feed millers for every peso of feeds are 0.29, 0.02, and 0.69 respectively.

The pricing and costing analysis conducted for seeds, corn production, trading, and feed milling show that more significant capitalization is needed to develop a more profitable product or service. This is evident in the ratio of feed millers and farmers' share for every peso of feeds.

To further bring down the local corn production cost, steps should be taken to reduce the cost of seeds, which has gone up significantly with the advent of GMOs owned by multinational seed corporations. The patent for essential genes has expired in their country of origin and opening up their use would lead to more players and result in cheaper seeds for the farmers.

Implementing the MAV system for protecting the local corn industry has also been allegedly manipulated to allow corn from a high-tariff country producing GMO corn cheaply transshipped to a low-tariff ASEAN country. A farmers' group has raised this issue, but nothing came out of it.

The corn sector cannot depend solely on a market that can source other cheaper substitutes for it in substantial magnitude anytime. The paradigm has to shift from corn-for-local-feeds alone to corn-for-other-markets, as well, if it is expected to thrive. One option is to export corn liberally to match the facility to import corn and substitutes liberally. This is because meager economic returns for the primary producer will certainly have a dampening effect on the other industries dependent on corn as a critical raw material.

There are some policies and regulations relevant to competition issues. DA AO8 provided some modifications to the usual procedure of accrediting corn varieties and hybrids enunciated in the Seed Act of 2002. Together with the Philippine Variety Protection Act of 2002, DA AO8 stipulated how to accredit GMO Corn. As plant varieties could not be patented in the Philippines, a biosafety permit system was instead instituted, which practically recognizes the GMO corn technology owner. As the benefits from those technologies were realized, the price also rose, but it was almost marginalizing the local seed companies. This has led to various seed production practices to 'cope' with the restrictive cost of officially accredited GMO hybrids. The Supreme Court recently ruled to replace DA AO8 with Joint Departments Circular 1, which will involve the DOST, the DENR, the DILG, and the DA. The implementing rules will be for public discussion within the first semester of 2020.

On the output side, the P.D. No. 4 provision is still invoked to ban the export of corn, i.e. by providing that we could only export corn if it could be shown that we have excess corn. Aside from problematic operational considerations, the recent Rice Tariffication Law liberalized the import and export of rice, but there is no clear policy on this, yet. Meanwhile, local corn cannot be exported even if the international market price is higher.

Furthermore, as in rice, focused support on post-harvest and equipment related to modernizing Philippine corn production should be supported with tariffs collected from importing corn and substitutes.

Recommendation for competition issues

The proposal related to competition issues identified in this study are as follows:

1. For the input side, specifically on GM seeds

There is a need to investigate further the implications of the expired GM patents to Philippine local seed markets. The implications for the seed industry are significant enough to warrant attention if we want to bring down the cost of seeds and ultimately the corn production cost by bringing in the small local seed producers.

As discussed earlier in this report, it is important to explore several policy options that may include:

a. Facilitating or initiating discussions of a possible transition to a "generics seed industry" with the National Committee on Biosafety of the Philippines (NCBP) as a lead agency. The potential being eyed is for more local seed players to participate further, not only through licensing, which is being done now, but through possible access to off-patent technologies. This is a complex issue that requires a more in-depth look with broader stakeholder participation (i.e., legal experts, scientists, private sector representatives, and policymakers).

b. Exploring advocacy for public investments in agriculture inputs and R&D especially on seeds and biotechnology, since this can also reduce input prices for farm input users. However, it must be carefully analyzed that it does not crowd out private investments.

2. For the output side, specifically yellow corn exports

Expanding markets is essential for a healthy competitive market. In this regard, it makes sense to further look into the legal provisions restricting corn exports only in surplus (i.e., P.D. No. 4 provisions). Other stakeholders in the feed industry can take advantage of world markets for corn and feed wheat. Farmers should be given a chance to explore regional markets as well. PCC can initiate this policy review in collaboration with the Department of Agriculture. Both agencies can then articulate a policy position that can be forwarded to the executive and legislative bodies of the government.

3. Systematic collection of market-related information (prices and volume of sales)

Given the consolidation of the significant players in GM seeds at the global level and other inputs (*i.e.,* Monsanto and Bayer), there is a need for closer market monitoring especially determining input prices, sales volume, and market shares. This ensures that the mergers do not translate to market dominance unfavorable to farmers as primary consumers of their products, and other end consumers, such as the feeds and livestock industry.

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VI. ANNEX

Annex A: GM Corn Context

This section of the issues paper assessed the area harvested, yield, and production: pre-GM commercialization and GM commercialization period.

Table A.1 below summarize the area harvested, yield, and production of both white and yellow corn in the Philippines from 1987 to 2019 (roughly last three decades). The indicators are averages of the pre-GM commercialization period (1987 to 2002) and the GM commercialization period (2003-2019). In terms of area harvested, there is clearly less devoted to white corn (a reduction of 35 percent from pre-GM commercialization to GM commercialization period) and more to yellow corn (an increase of 20 percent from the two reference periods). Generally, the total area harvested to corn had declined by 16 percent between the reference periods (summing both yellow and white corn area harvested). Both white corn and yellow corn average yields in the periods mentioned have also increased. White corn yield increased by 46 percent while yellow corn yields have gone higher with 73 percent increment between the pre-GM commercialization and GM commercialization period. Due to the increments in yield, there was an increase in total corn production of 52 percent when comparing the two reference periods. A big proportion of total corn production increase was due to yellow corn production (an increase of 110 percent from pre-GM to GM commercialization).

In view of the above statistics, the approval of GM corn seed commercialization in the country did help improve the country's ability to increase its domestic yellow corn production. In fact, yellow corn production increased despite the overall reduction in area harvested to corn. This did entail shifting white corn area harvested to yellow corn production (**Figure A1**). Farmer interviews by the research team in their past studies in Cagayan and Isabela also reveal that farmers shifted some of their crops from other crops such as coffee to yellow corn production. This was largely due to the high demand for yellow corn by the livestock and poultry industry.

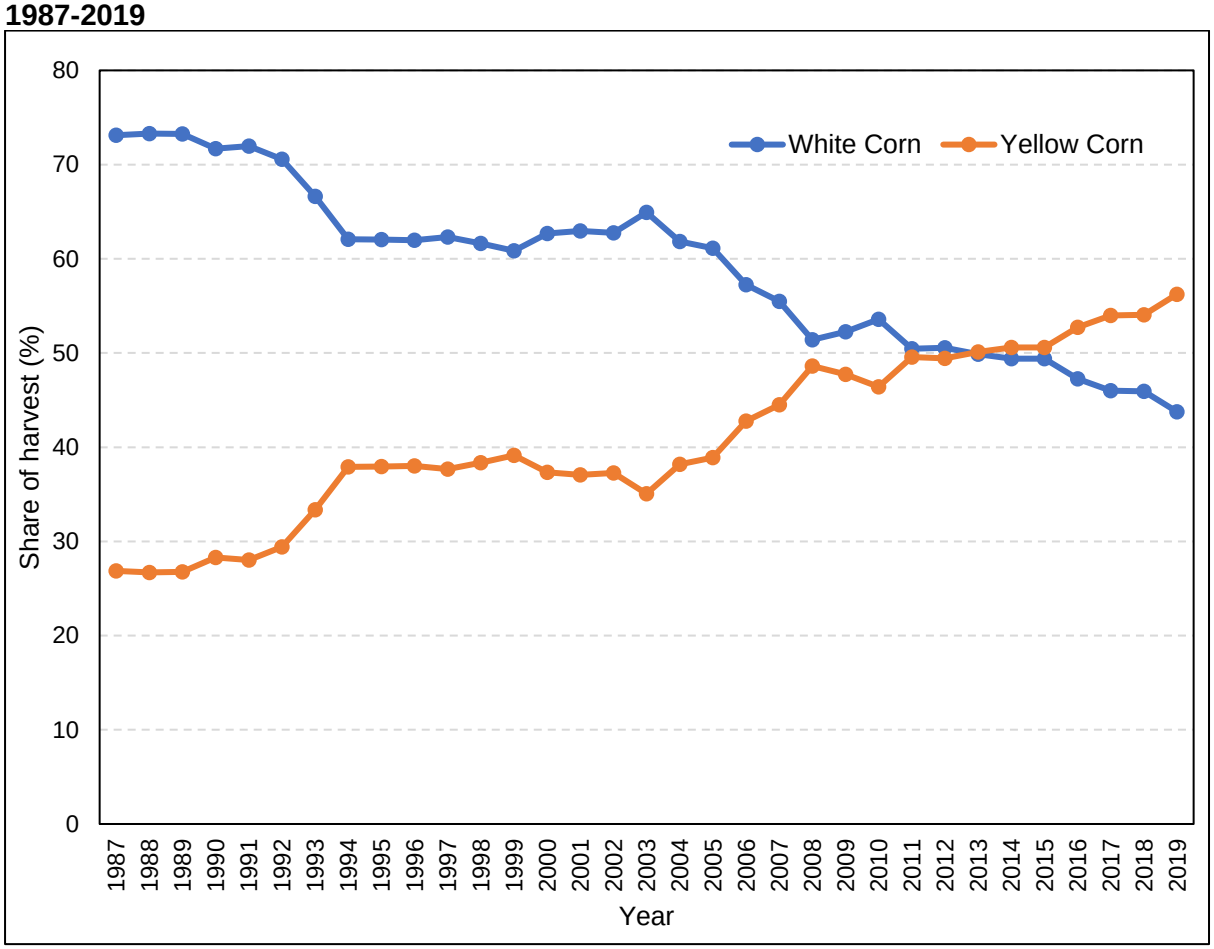
Table A1. Philippine corn area harvested, yield production, by type and period (pre-GM corn commercialization and post GM corn comer)

Item	Pre-GM commercialization 1987-2002	GM corn commercialization 2003-2019	Percent change between GM commercialization and pre-GM period
AREA HARVESTED			
White corn area harvested (in million ha)	2.03	1.33	-35%
Yellow corn area harvested (in million ha)	1.00	1.21	20%
Total corn area harvested (in million ha)	3.03	2.55	-16%
%share of white corn to total corn area harvested	66%	52%	-21%
%share of yellow corn to total corn area harvested	34%	47%	40%
YIELD			
White corn average yield (mt/ha)	1.13	1.65	46%
Yellow corn average yield (mt/ha)	2.17	3.76	73%

Item	Pre-GM commercialization 1987-2002	GM corn commercialization 2003-2019	Percent change between GM commercialization and pre-GM period
PRODUCTION			
White corn production (in million mt)	2.28	2.19	-4%
Yellow corn production (in million mt)	2.16	4.53	110%
Total corn production (in million mt)	4.44	6.77	52%
%share of white corn to total corn production	51%	32%	-37%
%share of yellow corn to total corn production	49%	67%	37%

Note: Corn research team estimates based on PSA and DA-BPI data on GM corn adoption

Figure A1. Share of White Corn and Yellow Corn to Total Corn Area Harvested, 1987-2019



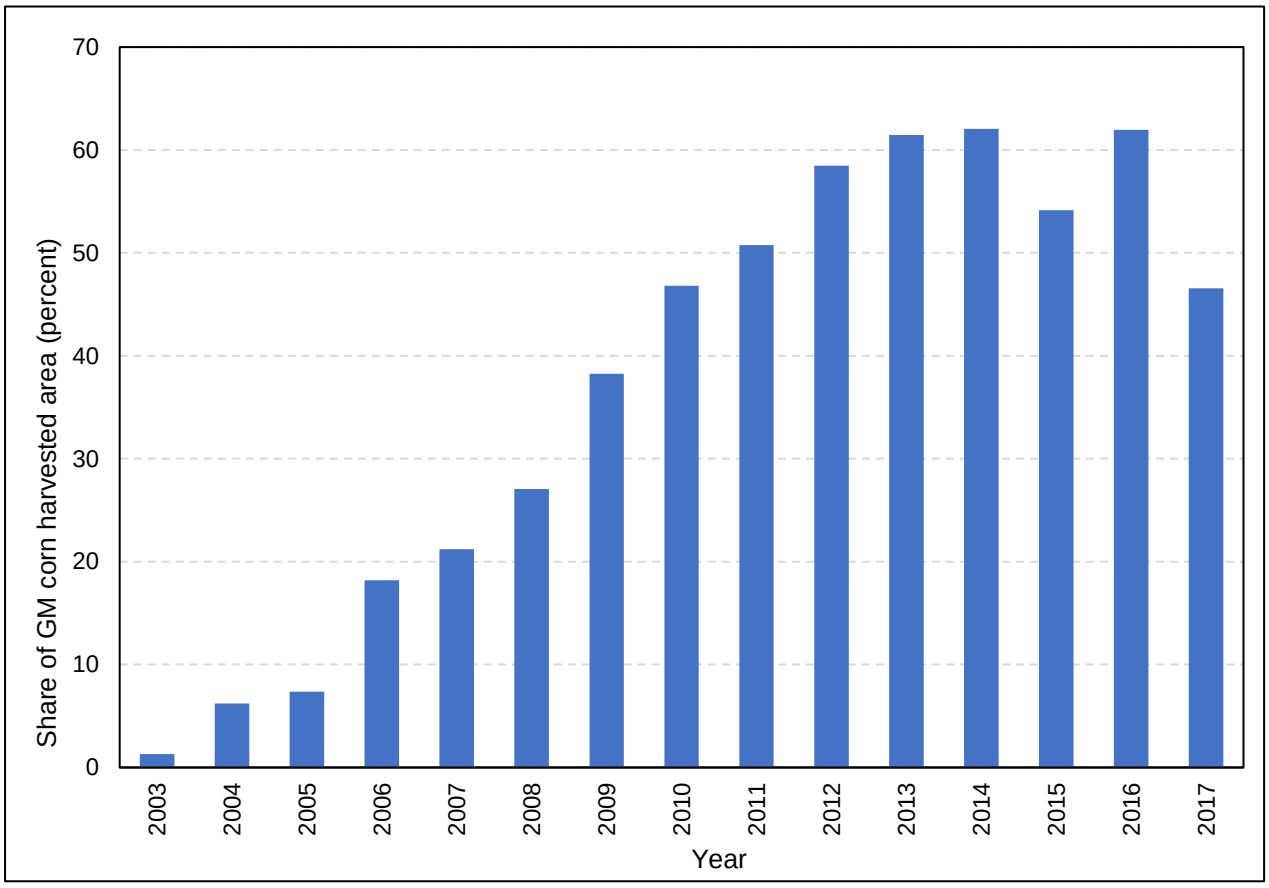
Note: Corn research team estimates based on PSA and DA-BPI data on GM corn adoption

GM yellow corn seed commercialization in the country

Estimates by ISAAA show that GM corn adoption had increased from 2002 (1 percent of total area harvested to yellow corn) to about 62 percent of total area harvested to yellow corn in 2014. It has declined in 2015 (54 percent adoption rate) and 2017 (47 percent adoption rate). **Figure A2** shows the trend of GM corn area harvested as a share of total

yellow corn area harvested based on ISAAA estimates. Industry players cite the proliferation of counterfeit seeds in the decline of GM corn adoption (ISAAA, 2017). These counterfeit seeds are still GM but are of inferior quality, no biosafety permits, and are potentially an environmental risk if it is used (ISAAA, 2017). Based on ISAAA's report that cite industry players, counterfeit seeds are about 10 percent of the total market for GM seeds (ISAAA, 2017).

Figure A2. Share of GM corn area harvested to total yellow corn area harvested, 2003-2017



Source: ISAAA estimates, compiled from 2015 to 2017 briefing reports

Table A2 show the GM corn adoption by region based on DA-BPI data. The top adopter is Cagayan Valley (Region II) with 51 percent of the total GM crop hectarage in the Philippines. It is followed by Northern Mindanao (Region X) and SOCCKSARGEN (Region XII) with 10 percent and 8 percent of total GM corn area harvested in the country. These three regions comprise about 70 percent of total GM corn area harvested hectarage in the Philippines. They are also the top three yellow-corn producing regions. It is therefore safe to say that these three regions would also be the major markets for GM corn related technologies (seeds and herbicides).

Table A2. GM corn adoption by region, March 2019-July 2019 (wet season)

Region	Region Name	Herbicide Tolerant, hectare	Insect Resistant + Herbicide Tolerant, hectare	Total, hectare	Percent share to total hectarage of GM corn adoption
II	Cagayan Valley	950	190,892.65	191,842.65	51.2
X	Northern Mindanao	0	38,396.00	38,396.00	10.2
XII	SOCCSKSARGEN	1,700	29,095.00	30,795.00	8.2
VI	Western Visayas	500	29,089.75	29,589.75	7.9
CAR	Cordillera Autonomous Region	1,700	23,058.00	24,758.00	6.6
I	Ilocos Region	350	12,899.00	13,249.00	3.5
ARMM	Autonomous Region in Muslim Mindanao	500	10,216.00	10,716.00	2.9
V	Bicol	400	8,386.55	8,786.55	2.3
XIII	Caraga	0	6,683.50	6,683.50	1.8
III	Central Luzon	0	5,920.45	5,920.45	1.6
IV-B	MIMAROPA	0	4,478.00	4,478.00	1.2
XI	Davao	0	4,267.00	4,267.00	1.1
IX	Zamboanga Peninsula	0	3,058.00	3,058.00	0.8
IV-A	CALABARZON	0	2,389.81	2,389.81	0.6
Total		**6,100**	**368,829.71**	**374,929.71**	**100.0**

Source: DA Bureau of Plant Industry-Biotechnology Division

Annex B: Export Competitiveness of Philippine Corn

This section of the issues paper assessed the competitive state of Philippine corn production to tap the export market. The analysis is limited to export price competitiveness. From the viewpoint of corn producers, there are two possible product destinations. One option is to sell in the local market, and the other is selling in the international market via export. The decision which market to choose is dictated by the output price offered in the two markets. Producers would rationally choose the market that can offer the higher price. This method is called simple price comparison.

An important step in simple price comparison is the selection of the relevant place of comparison. It was revealed during the KII with an industry representative that in Luzon, the commonly quoted wholesale price is Bulacan, since most of the corn coming from Northern Luzon end up in Bulacan. It is in Bulacan where most of the feedmills are located. In the absence of time-series wholesale price of corn quoted in Bulacan, Manila is the next logical choice because of its proximity.

The Philippines, just like any other country, is a price taker in the international trade of corn. This means that if the Philippines will export corn, its quoted price should be taken from the leading exporter. The main exporter of corn has traditionally been the US. The value of corn export of US has been increasing steadily. However, its market share in the world market has declined over the years. Brazil and Argentina are the emerging major exporters of corn in recent years (**Table B1**).

If the Philippines will decide to export corn, the potential destinations are Japan, South Korea, Vietnam and China. These four countries are in the top ten major importers of corn in recent years. Proximity should also be considered in order to save on transportation cost (e.g. ocean freight) and insurance. Japan and South Korea are consistent importers of corn, registering a market share ranging from 5.4 to 20.2 percent of global corn import (**Table B2**).

Table B1. Top exporters of corn, 1990, 2000, 2010 and 2017

1990			2000			2010			2017		
Country	Corn exports (USD Billion)	Percent Share	Country	Corn exports (USD Billion)	Percent Share	Country	Corn exports (USD Billion)	Percent Share	Country	Corn exports (USD Billion)	Percent Share
US	6.21	63.3	US	4.68	53.3	US	10.11	44.2	US	9.56	32.1
France	1.85	18.9	France	1.20	13.6	Argentina	3.15	13.8	Brazil	4.63	15.6
China	0.40	4.1	China	1.05	12.0	Brazil	2.21	9.7	Argentina	3.88	13.1
Argentina	0.33	3.4	Argentina	1.02	11.6	France	1.84	8.0	Ukraine	2.99	10.1
South Africa	0.23	2.4	Hungary	0.14	1.6	Hungary	0.88	3.9	France	1.45	4.9
Thailand	0.16	1.7	Germany	0.09	1.0	India	0.53	2.3	Hungary	0.89	3.0
Zimbabwe	0.11	1.1	South Africa	0.07	0.8	Romania	0.51	2.2	Russia	0.89	3.0
Germany	0.07	0.7	Chile	0.07	0.8	Ukraine	0.51	2.2	Romania	0.83	2.8
Hungary	0.05	0.5	Canada	0.04	0.4	Serbia	0.33	1.5	Mexico	0.49	1.6
Spain	0.04	0.4	Italy	0.04	0.4	South Africa	0.30	1.3	South Africa	0.47	1.6
World	9.80	100.0	World	8.78	100.0	World	22.87	100.0	World	29.74	100.0

Source: FAOSTAT, 2020

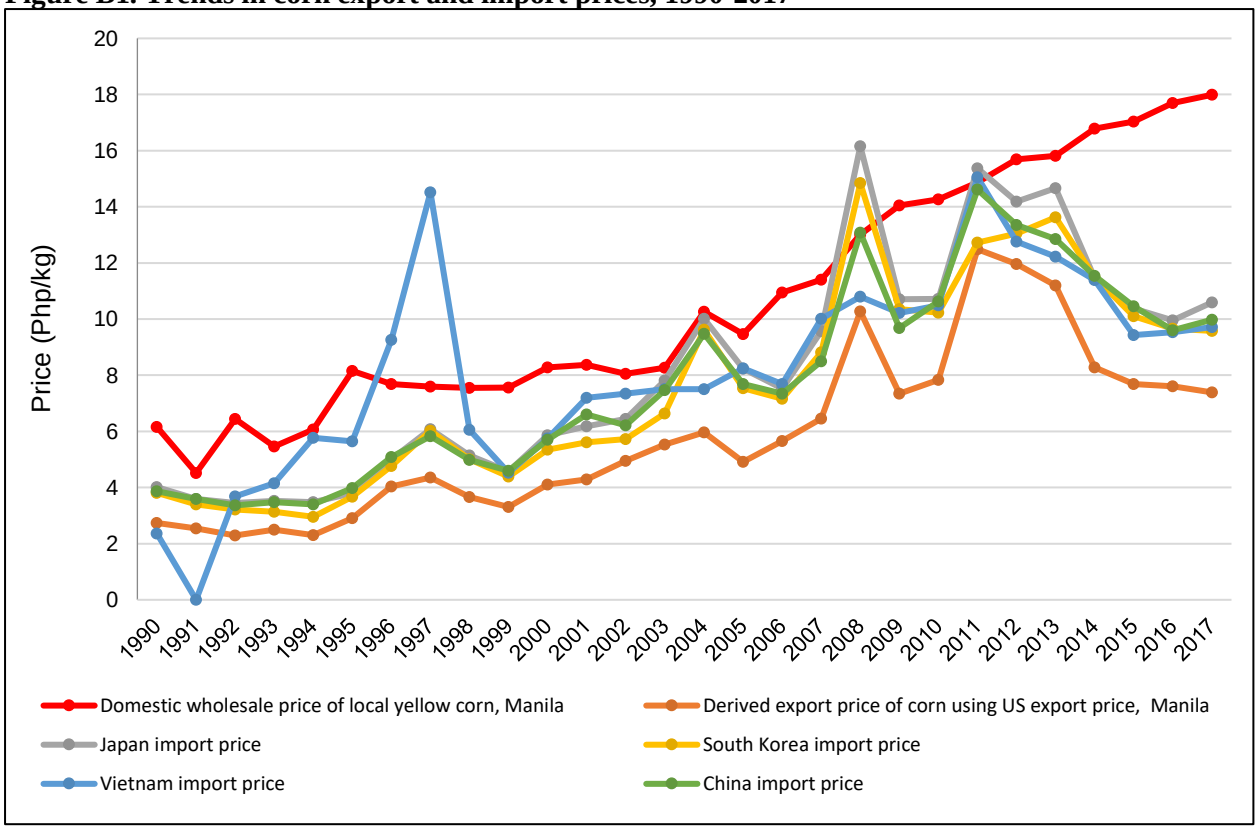
Table B2. Top importers of corn, 1990, 2000, 2010 and 2017

1990			2000			2010			2017		
Country	Corn imports (USD Billion)	Percent Share	Country	Corn imports (USD Billion)	Percent Share	Country	Corn imports (USD Billion)	Percent Share	Country	Corn imports (USD Billion)	Percent Share
Japan	2.30	20.2	Japan	1.89	18.5	Japan	3.96	15.1	Japan	3.08	9.2
USSR	1.69	14.9	South Korea	0.93	9.1	South Korea	1.99	7.6	Mexico	2.85	8.5
South Korea	0.84	7.4	China	0.57	5.5	China	1.60	6.1	South Korea	1.97	5.4
China	0.76	6.7	Taiwan	0.56	5.5	Mexico	1.58	6.0	Egypt	1.72	5.2
Taiwan	0.70	6.2	Mexico	0.55	5.4	Iran	1.35	5.2	Iran	1.64	4.9
Mexico	0.55	4.9	Egypt	0.54	5.3	Egypt	1.27	4.8	Vietnam	1.50	4.5
Netherlands	0.54	4.7	Spain	0.45	4.4	Taiwan	1.23	4.7	Spain	1.48	4.4
Germany	0.49	4.3	Malaysia	0.26	2.5	Spain	0.97	3.7	China	1.46	4.4
United Kingdom	0.40	3.5	United Kingdom	0.22	2.2	Colombia	0.81	3.1	Netherlands	1.13	3.4
Italy	0.36	3.2	Brazil	0.20	2.0	Malaysia	0.77	2.9	Italy	1.10	3.3
World	11.35	100.0	World	10.23	100.0	World	26.22	100.0	World	33.43	100.0

Source: FAOSTAT, 2020

The results of the export competitiveness analysis using simple price comparison are shown in **Figure B1**. Using Manila as a reference point of comparison for both locally sold and exported corn, the analysis shows that the local market can offer the higher price (red line) compared to the price offered in the international market (orange line). Since the US is the leading exporter of corn, the Philippines takes the US price as given. The buying price of top corn importing countries is above the price of US primarily because of the logistic costs (i.e. ocean freight and insurance) of bringing corn from the US to their respective countries. However, since these are all annualized data, the effects of seasonality and substitution of cheaper alternatives (*e.g.* feed wheat) are not represented. When domestic corn prices are depressed in certain months of the year, producers should be able to allow to tap the export market if the quoted price are higher.

Figure B1. Trends in corn export and import prices, 1990-2017



Source: World Bank Commodity Pink Sheet, 2019 and FAOSTAT, 2020

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