PHILIPPINE VEGETABLE INDUSTRY ROADMAP 2021-2025

DEPARTMENT OF AGRICULTURE
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PHILIPPINE VEGETABLE INDUSTRY ROADMAP 2021-2025

Department of Agriculture

HIGH VALUE CROPS DEVELOPMENT PROGRAM

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PHILIPPINE VEGETABLE INDUSTRY ROADMAP DEVELOPMENT TEAM

Team Leader

Dr. Mary Ann P. Sayoc, East West Seed Philippines

Co-Team Leader

Dr. Rodel G. Maghirang, UPLB

Technical Consultants

Prof. Julieta A. delos Reyes, UPLB

Mr. Villamor A. Ladia, Jr., UPLB

Perlita C. Nuevo, UPLB

Technical Writers

Ms. Anna Gale C. Vallez

Ms. Donna Bae N. Malayang

Representative from the Private Sector

Mr. Julius Barcelona, Harbest Inc.

Ms. Augusta Balanoy, Highland Vegetables MPCI

Mr. Zaldy Tanega, Samahan sa Industriya ng Paggugulayan - CALABARZON

Mr. Gilbert Cumila, Nueva Vizcaya Agricultural Terminal, Inc.

Mr. Bong Cajes, Vegetable Industry Council of Southern Mindanao

Mr. Amado William, RAFC CAR

Representatives from the Department of Agriculture

Engr. Regine Patiño, DA-HVCRC

Leonel Limbauan, DA-HVCRC

Ms. Mary Ann B. Guerrero, BPI

Mr. Jerico Noynay, BPI

Mr. Bernardo P. Pascua, BSWM

Ms. Angelica L. Ecito, BSWM

Mr. Jomar Tabor, ATI

Mr. Rommermart Penamora, ATI

Dr. Ma. Cecilia R. Antolin, PhilMech

Ms. Maria Elizabeth V. Ramos, PhilMech

Engr. Cristy Cecilia Polido, BAFE

Engr. Emer Rose Asug, BAFE

Ms. Cristine D. Baldelomar, AMAS

Ms. Ma. Nelia R. Madamba, AMAS

Mr. Joseph C. Manicad, PMS

Mr. Mark Lester A. Bolotaolo, PMS

Ms. Sheena Mae Bagayao, PRS

Ms. Filipinas Gerardo, ACPC

Ms. Bernadette Balajadia, ACPC

Ms. Janielle Pelonio, PCAF

Ms. Charlene Mariquit, PCAF

Other Government Agencies

Mr. Joel Norman Panganiban, DOST-PCAARRD

Dr. Marivic Samson, DOH-NNC

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ACRONYMS AND ABBREVIATIONS

ACPC	Agricultural Credit Policy Council
AFFP	Agricultural and Fisheries and Financing Program
AFMA	Agriculture and Fisheries Modernization Act
AFMech	Agricultural and Fisheries Mechanization
AFMIS	Agriculture and Fisheries Market Information System
AMIA	Adaptation and Mitigation Initiative in Agriculture
AMP	Agro-Microfinance Program
ANI	AgriNurture Inc.
APCP	Agricultural Production Credit Program
APTC	Agri-Pinoy Trading Center Program
ARBO	Agrarian Reform Beneficiaries Organization
ARMM	Autonomous Region in Muslim Mindanao
ASEAN	Association of Southeast Asian Nations
AVRDC	Asian Vegetables Research and Development Center
BAFE	Bureau of Agricultural and Fisheries Engineering
BAFS	Bureau of Agricultural and Fisheries Standards
BAPTC	Benguet Agri-Pinoy Trading Center
BPI	Bureau of Plant Industry
BPI-CPMD	Crop Pest Management Division
BPRE	Bureau of Postharvest Research and Extension
BPTC	Bantay Presyo Technical Committee
BSU	Benguet State University
BSWM	Bureau of Soils and Water Management
Bt	Bacillus thuringiensis
BW	Bacterial wilt
CALABARZON	Cavite, Laguna, Batangas, Rizal, and Quezon

CAR	Cordillera Administrative Region
CARES	Cavite Agricultural Research and Experimentation Station
CavSU	Cavite State University
CCSTC	Candon City Slaughterhouse and Trading Center
CDA	Cooperative Development Authority
CLSU	Central Luzon State University
CNAPTC	Camarines Norte Agri-Pinoy Trading Center
DA	Department of Agriculture
DA-AMAS	Agribusiness and Marketing Assistance Services
DA-ATI	Agricultural Training Institute
DA-BAR	Bureau of Agricultural Research
DA-BNCRDC	BPI Baguio National Crop Research and Development Center
DA-DLLO	Department Legislative Liaison Officer
DA-DRRMC	Disaster Risk Reduction and Management Council
DA-HVCPD	DA-High Value Crops Development Program
DA-IAD	International Affairs Division
DAPTC	Dalaguete Agri-Pinoy Trading Center
DAR	Department of Agrarian Reform
DA-RCPC	Regional Crop Protection Center
DA-RFO	Regional Field Office
DepEd	Department of Education
DFTC	Davao Food Terminal Complex
DMPI	Del Monte Philippines, Inc.
DOH	Department of Health
DOST	Department of Science and Technology
DOST-FNRI	DOST - Food and Nutrition Research Institute
DTI	Department of Trade and Industry
ECCD	Early Childhood Care and Development
ECCD-F1KD	ECCD - First 1000 Days
ENNS	Expanded National Nutrition Survey
EPAHP	Enhanced Partnership Against Hunger and Poverty

FAO	Food and Agriculture Organization
FAOStat	Food and Agriculture Organization Corporate Statistical Database
FBS	Farm Business Schools
FCAs	Farmers' Cooperative and Associations
FEP	Farm Entrepreneurship Program
GAD	Gender and Development
GAP	Good Agricultural Practices
GDP	Gross Domestic Product
GFI	Government Financial Institution
GPP	Gulayan sa Paaralan Program
HVC	High Value Crops
IIRR	International Institute of Rural Reconstruction
IPB	Institute of Plant Breeding
IYCF	Infant and Young Child Feeding
JGF	Jollibee Group Foundation
JICA	Japan International Cooperation Agency
KADIWA	Kadiwa ni Ani at Kita program
KinGBiKS	Kinabuan, Ganao, Biruk, Kimbutan, Sanguit Farmers Marketing Cooperative
LBP	Land Bank of the Philippines
LOM	Livestock "Oksyon" Market
LTVTP	La Trinidad Vegetable Trading Post
MAO	Municipal Agriculturist's Offices
NCCA	National Commission for Culture and the Arts
NCR	National Capital Region
NDSP	National Dietary Supplementation Program
NEAPTC	Nueva Ecija Agri-Pinoy Trading Center
NELAPTC	Northeastern Leyte Agri-Pinoy Trading Center
NFA	National Food Authority
NFC	Northern Food Corporation
NFD	Net Food Disposable

NFSS	National Food Security Summit
NGF	National Guidelines for Filipinos
NiE	Nutrition in Emergencies
NNC	National Nutrition Council
NPGRL	National Plant Genetic Resources Laboratory
NPV	Nuclear Polyhedrosis Virus
NUPAP	National Urban and Peri-Urban Agriculture Program
NVAT	Nueva Vizcaya Agricultural Terminal, Inc.
OPA	Office of the Provincial Agriculturist
OPV	Open Pollinated Variety
PAPTC	Pangasinan Agri-Pinoy Trading Center
PCAARRD	Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development
PCAF	Philippine Council for Agriculture and Fisheries
PCFC	People's Credit and Finance Corporation
PCHM	Philippine Culinary Heritage Movement
PCIC	Philippine Crop Insurance Corporation
PCW	Philippine Commission on Women
PDDCP	Product Development and Design Center of the Philippines
PhilMech	Philippine Center for Postharvest Development and Mechanization
PHTRC	Postharvest Horticulture Training and Research Center
PITAHC	Philippine Institute of Traditional and Alternative Health Care
PLGU	Provincial Local Government Unit
MLGU	Municipal Local Government Unit
POPEA	Philippine Okra Producers and Exporters Association
PPAN	Philippine Plan of Action for Nutrition
PPSA	Philippine Partnerships for Sustainable Agriculture
PQS	Plant Quarantine Service
PRDP	Philippine Rural Development Project
PRS	Policy Research Service
PRSV	Papaya Ringspot virus

PSA	Philippine Statistics Authority
PSIA	Philippines Seed Industry Association
QAES	Quezon Agricultural Experiment Station
QUEDANCOR	Quedan and Rural Credit Guarantee Corporation
RDT	Roadmap Development Team
RSBSA	Registry System for Basic Sectors in Agriculture
SBFP	School-based Feeding Program
SEA	Southeast Asia
SEARCA	Southeast Asian Regional Center for Graduate Study and Research in Agriculture
SIAPTC	Siargao Islands Agri-Pinoy Trading Center
SIPAG	Samahan sa Industriya ng Paggugulayan
SLCV	Squash Leaf Curl Virus
SLPA	Sustainable Livelihood Associations
STIARC	Southern Tagalog Integrated Agricultural Research Laboratory
SUC	State Universities and College
TAMA	Traditional and Alternative Medicine Act
TMSTC	Tayug Municipal Slaughterhouse and Trading Center
TSK	Tanim sa Kinabukasan
TWG	Technical Working Group
UPLB	University of the Philippines Los Baños
USM	University of Southern Mindanao
VCA	Value Chain Analysis
VICSMIN	Vegetable Industry Council of Southern Mindanao, Inc.
VIEVA	Vegetable Importers, Exporters & Vendors Association
WHO	World Health Organization
ZYMV	Zucchini Yellow Mosaic Virus

MESSAGE

In the wake of unprecedented events and emerging crises, the Department of Agriculture (DA) launched the Plant, Plant, Plant Program to ensure that all Filipino families would have adequate supply of nutritious, healthy, accessible and affordable food to meet the demands of these challenging times.

As a testament of our firm resolve to triumph over this formidable foe, the DA was re-energized to act as one, but is committed at the same time to delivering results from various projects under the different major programs of the Department.

In light of this, I wish to congratulate all the principal actors who paved the way for the crafting and updating of High Value Crops Development Program (HVCDP) Roadmap. Through the completion and publication of this HVCDP Roadmap, we enshrine the spirit of excellence, collaboration, and resilience as inherent characteristics of our agricultural inheritance and legacy.

The progressive cross-cutting and continuing collaboration among all stakeholders in pursuit of attaining competitive advantage and relevant growth is an output designed into the pages of this roadmap.

I am proud and grateful that such a focused work on this commodity could be undertaken to ensure that a brighter future for the industry can reasonably be expected and attained because this blueprint already exists to assure it.

Marami pong salamat at Mabuhay!

WILLIAM D. DAR, Ph.D.
Secretary
Department of Agriculture

FOREWORD

The Covid-19 pandemic that ravaged life and livelihood in the country for almost 2 years now proved to be an existential threat to our way of life. On the positive side, it elicited generosity and a sense of community in all of us, and became a catalyst of change in many areas of our lives.

It is in these multi-faceted circumstances that the High Value Crops & Rural Credit (HVCRC) of the Department of Agriculture (DA), working collaboratively with various stakeholders and industry experts, undertook the needed updating of this industry roadmap as an integral part of the Secretary of the Department of Agriculture, Dr. William D. Dar's 18 transformative strategies, and formulated in alignment to his **One-DA to Transform Vision** of Philippine Agriculture, in order to achieve a Food Secure and Resilient Philippines, with empowered and prosperous farmers and fisher-folk. While this industry roadmap is the handiwork of many minds and multi-stakeholders, in its core it subscribes to the interdependent and inter-related approaches of **Industrialization, Farm Consolidation, Mechanization, and Professionalization** as pillars of its foundation.

This roadmap is envisioned to serve as a guide to all industry stakeholders for the realization of the targets set in it for 2021 – 2025. It is an embodiment of how the industry will achieve its goals of transformative growth through the value chain approach, as well as increase in quality and sustained yields and incomes. It is with pride and pleasure that I express my heartfelt gratitude to everyone both in the private sector and government, who unselfishly lent their time and talent for this timely and necessary endeavor. More than the lofty legacy and memorable milestone we shall leave behind because of this worthwhile work, it is more the comfort in the knowledge that the entire industry would have a clear pathway to follow in the years ahead to realize its vision that is truly more meaningful to remember us all by. Thank you.

EVELYN G. LAVIÑA
Undersecretary for High Value Crops and Rural Credit
Department of Agriculture

PREFACE

"The beautiful journey of today can only begin when we learn to let go of yesterday"
- Steve Maraboli, Bestselling author.

Crafting of the high value commodity industry roadmaps for vegetables, onion, mango and banana took a lot of time and effort. It started with revisiting existing roadmaps, validating industry statistics and reviewing the SWOT analysis. The multi-stakeholder commodity industry roadmap development teams spent countless hours in reading, giving feedback and discussing the draft industry roadmaps put together by dedicated technical writers which resulted in strategic plans that we can be proud of. I must say that these roadmaps are the "labor of love" of various stakeholders who believe that there is a bright future ahead for these industries.

It is time to let go of past strategies which did not work and focus on what can be achieved now in the light of new developments in the local and global scenes. The roadmaps are far from perfect but they are a good start and there will be opportunities to reassess, revisit and revise strategies and interventions as needed. As the saying goes "the devil is in the details". Let us continue to monitor the implementation of the roadmaps, watchful of the milestones, mindful of the pitfalls and raise the red flag when necessary.

On behalf of the Vegetable Roadmap Development Team and the PCAF Committee on Fruits and Vegetables, I would like to thank my co-chair and members of the Vegetable Industry Roadmap Development Team, my co-chair and members of the Committee on Fruits and Vegetables, Office of the DA Undersecretary for High Value Crops and the Philippine Council for Agriculture and Fisheries for sharing their invaluable time, effort and wisdom in crafting the high value industry roadmaps.

The best is yet to come for Philippine agriculture!

MARY ANN P. SAYOC, Ph.D., East West Seed Company, Inc. and Philippine Seed Industry Association
Team Leader
Vegetable Industry Roadmap Development Team

EXECUTIVE SUMMARY

The development of the Philippine Vegetable Industry Roadmap is one of the results or the way forward during the National Food Security Summit (NFSS) conducted in May 2021, which was attended by several stakeholders from the academe, government agencies, research institutions, private sector, and other key stakeholders of the vegetable industry.

The existing vegetable roadmap was drafted in 2014, however it was not signed and adopted, thus the need to update and revise. Separate roadmaps for the lowland and highland vegetables were developed, thus, in updating the roadmap, the team agreed to come up with one roadmap for the vegetable industry. The roadmap was crafted to: 1) engage wide range of stakeholders in the agriculture value chain and ensure that the stakeholders will have the ownership of the process and output; 2) Level up the vegetable sector through the identified 18 Key Strategies of the Department of Agriculture; and 3) Anchor in the food security framework – with the vision of a food secure and resilient Philippines with empowered and prosperous farmers and fisherfolk and pursue "OneDA" and "OneNation" approach.

This roadmap covers the following priority crops: lowland 'pinakbet' (ampalaya, tomato, squash, pole sitao, eggplant, okra); highland 'chopsuey' (cabbage, Chinese cabbage, carrot, snap beans, potato). In updating the roadmap, primary and secondary were gathered to update the vegetable industry roadmap. Several workshops and meetings were conducted by the roadmap development team (RDT) to get the stakeholders views and perceptions on the topics related to the vegetable industry.

This roadmap has eight sections. Section I highlights the need to update the roadmap and provides the objectives that the industry what to achieve and the methodologies used to gather and analyze the data. Section II provides an overview of the industry with focus on the importance of the vegetable industry in the Philippine agriculture, structure of the vegetable industry, and the performance of each of the priority crops using the production parameters such as volume of production, area planted/harvested, and the yield. It also presents data on consumption, trade, market channels/segments, and price analysis. Section III presents the analysis the vegetable industry in terms of the structural analysis of the vegetable value chain, SWOT, cost and return analysis, benchmark, and competitiveness analysis. Section IV deals with the market perspectives and prospects. Section V highlights the priority concerns and opportunities while Section VI presents the goals and targets. Section VII provides the recommendations for policies, strategies, and programs to improve the industry. Lastly, Section VIII presents the proposed industry cluster governance network

The lowland farmers usually plant two to three crops after rice as a hedge for low prices, so it is likely that there are about 80,000 lowland vegetable farming families. They also rotate the crops or change the mix every year depending on their anticipation of likely prices. Very few vegetable farmers are inclined to go into marketing contract with consolidators or commissaries, preferring instead accessible auction markets to sell their produce.

The highest yielding commodity for this vegetable group for the past five years is Eggplant with an annual average growth rate of 2.11% and yielding annually on the average with 22.61 metric tons per hectare of area planted followed by Tomato 1.41% AAGR equivalent to 15.25mt/ha and stringbeans at 0.94% or 3.64mt/ha. Two municipalities from Quezon Province, Buenavista and Sariaya, dominates the overall production with 120,120.96 and 27,390.00 metric tons respectively. Commodity wise, the municipality of Buenavista produced majority of the six vegetables. Squash, ampalaya and okra has declining yield for the past five years.

The main objective of the vegetable industry is to increase and sustain production of quality and safe vegetables, ensuring its availability of supply in the market at affordable price. These can be attained by the development of expansion and intensification

of production in existing areas that would generate more jobs for the unemployed; Establishment of production and irrigation facilities, upgrading of farm to market roads would increase the resiliency of the farmers to natural disasters such as typhoon, frost and drought while the establishment of postharvest facilities and processing equipment would lead to improvement of product quality, prolonging the shelf life and packaging technique would reduce postharvest loss.

Skillful balancing of complementary strategies from educating and motivating people to live a healthy lifestyle by eating more nutritious foods, to producing optimum mix of vegetable at the right time at affordable prices, and to creative ways of making available vegetable products to an increasingly urbanized population wherever they are in forms more convenient to cook and/or fun to consume.

In this roadmap, key strategies, specific activities, key performance indicator and the responsible agency for the short-term plans were also documented. The short-term strategies have the following objectives: 1) ensure year-round sufficiency levels of vegetables; 2) increase farmers' productivity and income by at least 5% per year; 3) reduce postharvest losses from 40% to 5% by 2025; 4) ensure food safety; 5) encourage more youth and women participation into vegetable farming; 6) enhance KADIWA and expand access to international market; 7); increase per capita vegetable consumption by 5% over a period of 5 years; 8) efficient communication and on time data monitoring; and 9) ease of doing business.

Based on the strategic recommendations, the programs and activities will focus on the top priorities. The identified medium to long term strategies for the input supply and production and post-harvest and processing include: a) post-harvest, processing, logistics and marketing support, food safety and regulations; b) farm mechanization and infrastructure investments; and c) technology and innovation including digital, while strategies addressing marketing, trade, and other related concerns will involve: i) diversification, postharvest, processing, logistics, and marketing support; ii) global trade, export development, and promotion; iii) education and training particularly agribusiness management; iv) climate change adaptation and mitigation measures; and v) credit support.

INTRODUCTION

Rationale

The development of the Philippine Vegetable Industry Roadmap is one of the results or the way forward during the National Food Security Summit (NFSS) conducted in May 2021, which was attended by several stakeholders from the academe, government agencies, research institutions, private sector, and other key stakeholders of the vegetable industry.

The existing vegetable roadmap was drafted in 2014, however it was not signed and adopted, thus the need to update and revise. Separate roadmaps for the lowland and highland vegetables were developed, thus, in updating the roadmap, the team agreed to come up with one roadmap for the vegetable industry. This roadmap covers the following priority crops: lowland 'pinakbet' (ampalaya, tomato, squash, pole sitao, eggplant, okra, asparagus); highland 'chopsuey' (cabbage, Chinese cabbage, carrot, snap beans, potato)

Objectives

The roadmap was crafted to achieve the following objectives:

- Engage wide range of stakeholders in the agriculture value chain and ensure that the stakeholders will have the ownership of the process and output.
- Level up the vegetable sector through the identified 18 Key Strategies of the Department of Agriculture
- Anchor in the food security framework – with the vision of a food secure and resilient Philippines with empowered and prosperous farmers and fisherfolk and pursue "OneDA" and "OneNation" approach

Methodology

Sources of data

Primary and secondary were gathered to update the vegetable industry roadmap. Several workshops and meetings were conducted by the roadmap development team (RDT) to get the stakeholders views and perceptions on the topics related to the vegetable industry. Some of the sources of primary data were the FNSS; consultations with the vegetable roadmap development team (RDT) composed of the members from the academe (UPLB), private sectors, i.e., East-West Seed Philippines, Harbest, government agencies and other farmer groups and organizations. On the other hand, secondary data were gathered from the following:

- PSA – trends 2011-2020 (production, area planted/harvested, yield, etc.)
- FAOStat – global/ASEAN trends 2010-2019 (production, area planted/harvested, yield, etc.)
- Government Agencies – prices (AMAS); cost and return (BPI, seed companies)
- PRDP – Value chain studies of certain vegetable crops
- Other documents - JICA, World Bank, etc.

Analytics

- Presentation and discussion of the global and domestic production trends
- Structural analysis of the vegetable industry (value chain approach)
- Value chain mapping
- SWOT Analysis
- Cost structure analysis and price analysis
- Market trends and opportunities
- Benchmarking and competitive analyses

INDUSTRY SITUATION AND OUTLOOK

Industry/Commodity Contribution to the Philippine Economy and Agriculture Sector

According to JICA's survey on issue analysis of food value chains (2019), the Philippine agricultural sector has experienced a decline in production and competitiveness, in general. Low productivity can be attributed to the inefficiencies in the agricultural value chain and the weaknesses of the current support system. On the other hand, a study conducted by the Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development (PCAARRD) in 2018 revealed that the weak performance of the agriculture sector is caused by narrow diversity and low productivity. Rice, corn, and coconut occupy more than half of the total harvestable area in the country and government interventions are focused mainly on these crops, especially rice. The World Bank (2020) has identified two important factors which drag down the performance of the agriculture sector. One of these is the low productivity of rice, despite the presence of policies, interventions, and resources given to it. Second is the failure to diversify into high value-adding products for local consumption and those with high potential for export, and to integrate farmers into the value chain. The share of high value crops (HVC) increased slightly from 19.6% in 2000 to 20.6% in 2018, and 22.9% in 2019.

Value of Agriculture and Fisheries Production in the Philippines

Crop production remains to be the highest contributor to the Philippine agriculture sector. In 2011, the value of production was PhP 783,539 million which increased to PhP 1,062,915 million in 2020. A generally increasing trend in value is seen during this period (Figure 1).

In 2020 alone, crops contributed 56% to the total value of agricultural production. The livestock sector shared 16% while both the poultry and fisheries sectors contributed 14% each (Figure 2).

FIGURE 1. VALUE OF PRODUCTION IN PHILIPPINE AGRICULTURE AND FISHERIES (MILLION PESOS, CURRENT PRICES), 2011-2020 (PSA).

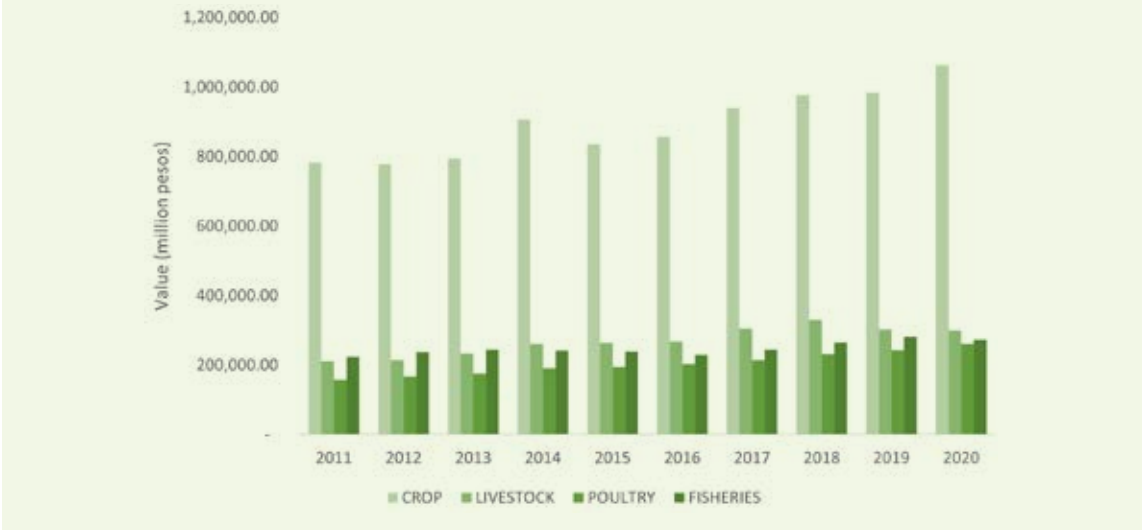
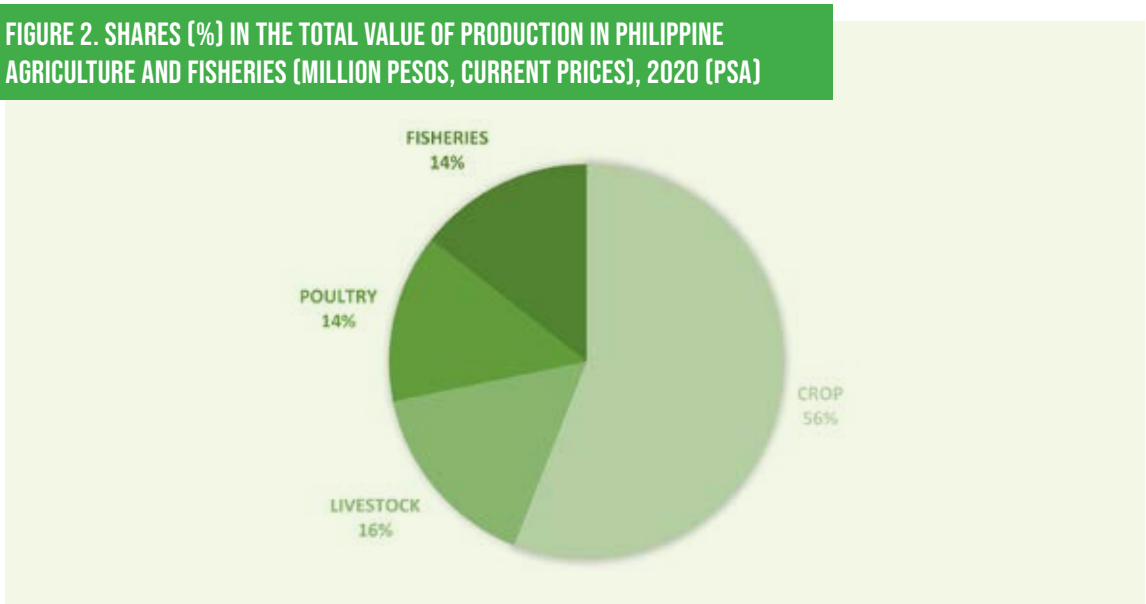


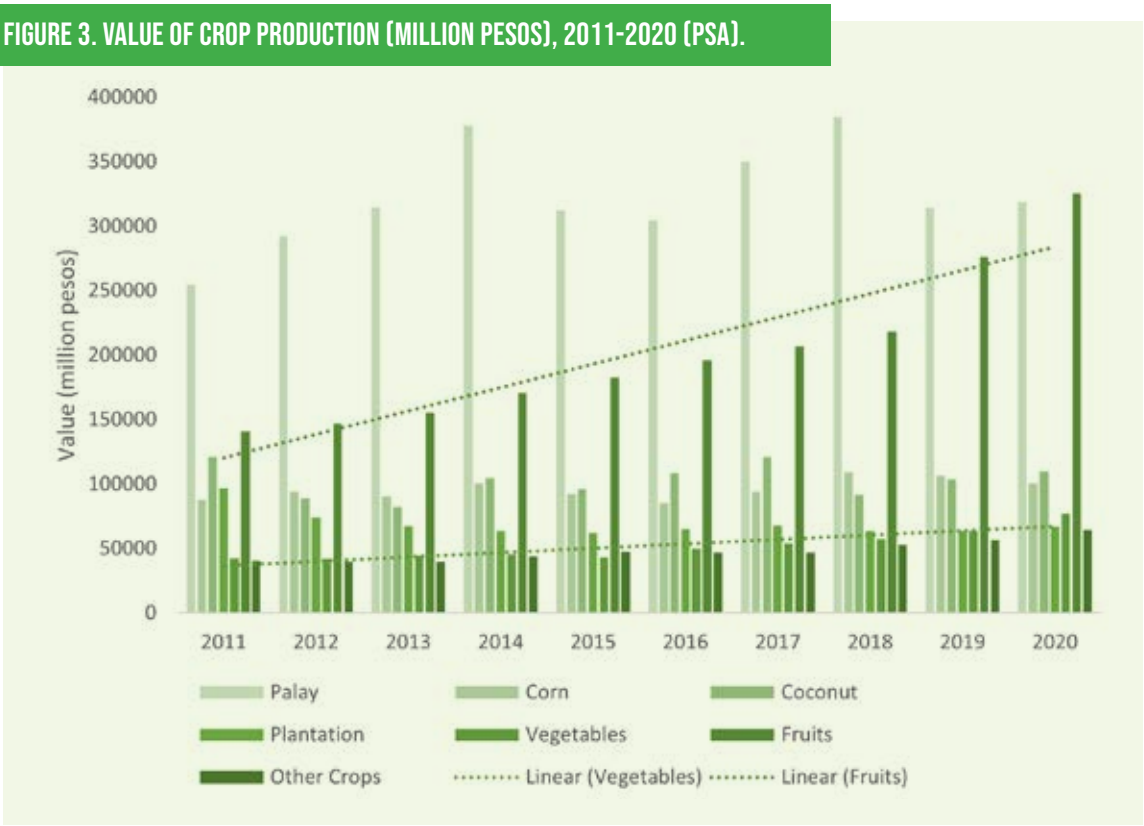
FIGURE 2. SHARES (%) IN THE TOTAL VALUE OF PRODUCTION IN PHILIPPINE AGRICULTURE AND FISHERIES (MILLION PESOS, CURRENT PRICES), 2020 (PSA)



Value of Crop Production in the Philippines

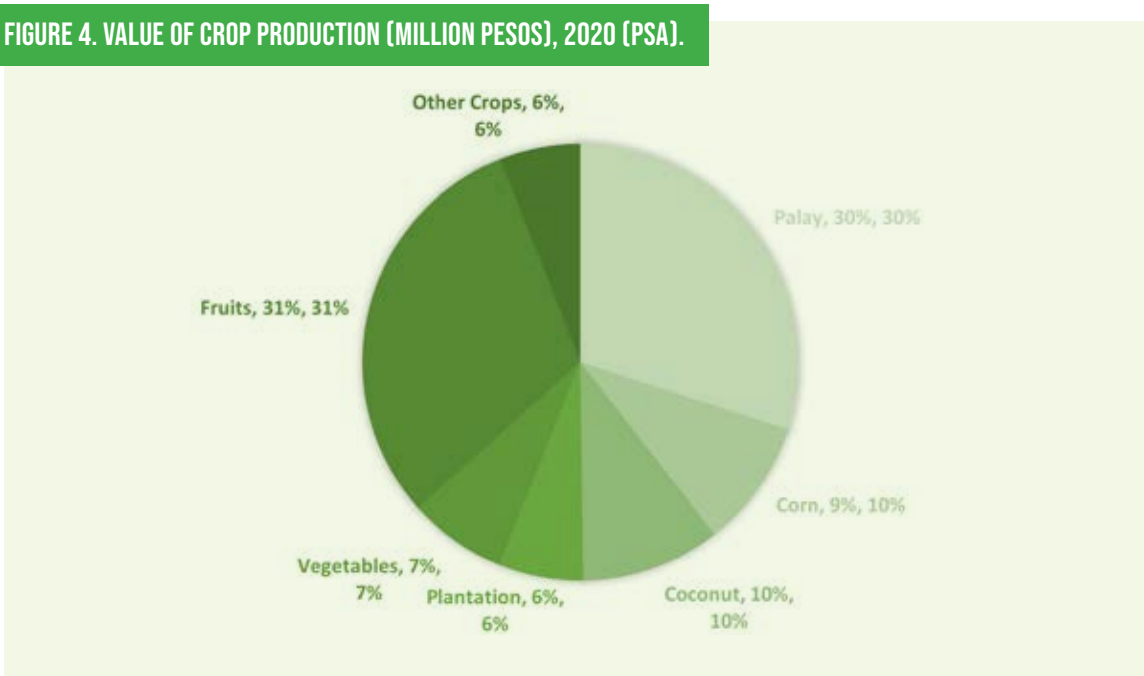
Palay contributes the highest in the total value of production, leading all other crops in the country from 2011-2020. The fruit industry significantly increased in terms of value from PhP 141,053 million in 2011 to PhP 325,502 million in 2020, finally overtaking palay with value of only PhP 318,756 million in 2020. Included in these fruits are banana, mango, pineapple, and calamansi, the first three of which are processed and exported to other countries. The coconut and corn industries have more or less constant production values during the period. On the other hand, the plantation crops (sugarcane, rubber, coffee, tobacco, abaca, and cacao) indicate a decreasing trend with a value of PhP 96,778 million in 2011 to only PhP 66,800 million in 2020. Lastly, the vegetable industry shows an increasing trend in value with PhP 42,324 million in 2011 which increased to PhP 77,132 million in 2020 (Figure 3).

FIGURE 3. VALUE OF CROP PRODUCTION (MILLION PESOS), 2011-2020 (PSA).



Having surpassed palay in terms of value of production, the fruit industry It contributed 31% to the total value of crops while palay contributed 30%, the highest shares recorded. Both corn and coconut industries shared 10% each while the vegetable industry shared 7% and both plantation and other crops shared 6% each (Figure 4).

FIGURE 4. VALUE OF CROP PRODUCTION (MILLION PESOS), 2020 (PSA).



Structure of the Vegetable Industry in the Philippines

The Philippine vegetable industry is subdivided into two major categories, usually based on the location of cultivation and other climatic requirements, namely highland and lowland. Table 1 shows the top ten vegetables produced in the country both in terms of volume and area planted/harvested in 2020. Cassava was excluded from the list because it has considered under the yellow corn roadmap.

Sweet potato had the highest volume and largest area contributing 18.48% and 22.58%, respectively. Among the priority crops included in the list with high volume of produce were eggplant (2nd place, 8.20%), tomato (4th place,7.50%), squash (5th place,6.55%), cabbage (7th place,4.39%), potato (8th place,3.84%), and string beans (9th place, 3.70%). In terms of area, eggplant ranked 4th with the largest area (5.88%), tomato at 6th place (4.44%), string beans at 9th place (3.75%), and squash at 10th place (3.50%).

TABLE 1. TOP 10 VEGETABLES IN TERMS OF VOLUME AND AREA (PSA,2020)

RANK	COMMODITY	VOLUME (mt)	%	COMMODITY	AREA (ha)	%
1	Sweet Potato	546,891.46	18.48%	Sweet Potato	83,694.39	22.58%
2	Eggplant	242,730.40	8.20%	Mungbean	41,852.81	11.29%
3	Onion, mature	229,539.24	7.76%	Peanut	23,957.29	6.46%
4	Tomato	222,002.24	7.50%	Eggplant	21,780.33	5.88%
5	Squash	193,814.22	6.55%	Onion, mature	18,391.37	4.96%
6	Onion, bermuda	190,974.88	6.45%	Tomato	16,448.19	4.44%
7	Cabbage	129,803.39	4.39%	Taro/Gabi	14,992.84	4.04%
8	Potato	113,562.36	3.84%	Onion, bermuda	14,453.40	3.90%
9	String beans	109,516.46	3.70%	String beans	13,911.50	3.75%
10	Taro/Gabi	107,422.18	3.63%	Squash	12,962.54	3.50%
TOTAL		2,086,256.83	70.51%		262,444.66	70.80%
TOTAL VEGETABLES		2,958,756.33	100%		370,667.32	100%

Highland Vegetable Production

Highland (semi-temperate) vegetables are generally grown in mid- and high- elevation areas as they require lower temperatures to achieve optimum growth. The major production areas include the provinces of Benguet (CAR), Bukidnon (Region X), and the highlands of Dalaguete, Cebu, Kanlaon, Negros, Kitanglad and Bukidnon in Northern Mindanao, and Buda of Davao City. In Benguet province, there is an observed decline in the production of cabbage, cauliflower, carrots, and potato. The major cause of this is the decrease in the area planted, lack of interest in farming of the younger generations, extreme weather events, pest and disease problems, and poor adoption of high-yielding varieties by farmers (JICA, 2019). In Negros Oriental, highland vegetables are grown year-round, but the production is observed to be lesser in 2016 from March to July due to El Niño. In Cebu, the production starts in July, just-in-time for the peak season from December to January (PRDP, 2016).

The production inputs (i.e., seeds and agrichemicals) for highland vegetables are sourced from agricultural dealers, retailers, and companies such as East West Seed, Allied Botanical Corporation, and Ramgo International Corporation, which are located mostly in La Trinidad, Benguet. The major production areas for the highland vegetables in CAR are in Buguias and Mankaya, which are about 86 km and 93 km away from La Trinidad, respectively. The distance of these production areas implies an increase in the prices of inputs due to transport cost. Some of the cultivation practices and associated inputs used in the production of highland vegetables will be discussed in the succeeding sections.

Table 2 shows the contribution of selected highland vegetable crops to the total volume produced and land area planted in the country.

TABLE 2. PERCENT CONTRIBUTION OF THE PRIORITY CROPS TO THE TOTAL VOLUME AND AREA PLANTED TO VEGETABLES IN 2020 (PSA)

COMMODITY	VOLUME (MT)	%	AREA (HA)	%
Cabbage	129,803.39	4.39%	8,020.31	2.16%
Carrots	63,527.02	2.15%	4,430.38	1.20%
Snap Beans	13,420.83	0.45%	2,974.44	0.80%
Chinese Cabbage	51,394.14	1.74%	3,571.84	0.96%
Potato	113,562.36	3.84%	7,212.61	1.95%
TOTAL	371,707.74	12.56%	26,209.58	7.07%

Lowland Vegetable Production

The production areas of lowland vegetables are more widely dispersed than the highland vegetables, but the majority is concentrated in Luzon. The major producing areas from Northern Luzon are the provinces of Pangasinan, Tarlac, Nueva Ecija, Nueva Vizcaya, La Union, and Ilocos Sur. Meanwhile, the major producers in Southern Luzon are Cavite, Laguna, Batangas, and Quezon Province. Metro Manila, in general, depends on the production from these provinces (JICA, 2019).

Table 3 shows the contribution of selected lowland vegetable crops to the total volume produced and land area planted in the country.

TABLE 3. PERCENT CONTRIBUTION OF THE PRIORITY CROPS TO THE TOTAL VOLUME AND AREA PLANTED TO VEGETABLES IN 2020 (PSA)

COMMODITY	VOLUME (MT)	%	AREA (HA)	%
Ampalaya	87,804.27	2.97%	10,687.78	2.88%
Eggplant	242,730.40	8.20%	21,780.33	5.88%
Squash	193,814.22	6.55%	12,962.54	3.50%
String beans	109,516.46	3.70%	13,911.50	3.75%
Tomato	222,002.24	7.50%	16,448.19	4.44%
TOTAL	855,867.59	28.93%	75,790.34	20.45%

Product Forms

Most of the vegetables produced in the Philippines are consumed fresh and/or undergo primary food processing such as pickling, fermentation, and other preservation techniques. Among the priority crops in this roadmap, tomato is being processed commercially as sauce, paste, juice, and puree. Most of the tomatoes used for processing are produced in the Ilocos Region. Similarly, the main market potential of ampalaya lies in it being processed into ampalaya tablet, capsule, or tea. These products can be used as food supplements and hot beverages and promoted as aid in maintaining normal blood sugar levels. Also, ampalaya products can be used to stop coughs and to treat sterility in women and alleviate liver problems. Appendix 1 shows how the vegetables are utilized and some of its most common (processed) product forms.

Industry Performance

Global and Regional (SEA) Production of Vegetable Crops

In 2019, the global production of fresh vegetables is 311.82M tons with an area of 21.94M ha and an average yield of 14.21 tons/ha. The Southeast Asian (SEA) region contributed 10% (2.29M ha) to the area planted to and 9% (29.15M ha) to the total production of fresh vegetables with a yield of 12.75 tons/ha. From 2011-2020, both the area and production of fresh vegetables at the global scale increased at an average rate of 2.09% and 2.08%, respectively. The same trend was observed at the SEA region at an average rate of 3.74% and 5.48%, respectively. The rate of increase in the SEA region is relatively higher as compared to the global scale (Table 4).

TABLE 4. FRESH VEGETABLES: AREA PLANTED, PRODUCTION, AND YIELD, BY COUNTRY, 2019

Region/ Country	Area (ha)	Ave % Growth	Production (t)	Ave % Growth	Yield (t/ha)	Ave % Growth
World	21.94M	2.09	311.82M	2.08	14.21	-0.004
SE Asia	2.29M	3.74	29.15M	5.48	12.75	1.565
Vietnam	873,532.00	11.53	15.34M	12.55	17.56	1.028
Timor-Leste	8,721.00	0.85	27,154.00	2.40	3.11	1.528
Thailand	91,090.00	-3.49	1.10M	0.20	12.04	4.046
Singapore	1,277.00	3.16	23,446.00	2.39	18.36	-0.495
Philippines	**675,426.00**	**2.20**	**5.58M**	**2.13**	**8.26**	**-0.062**
Myanmar	291,708.00	1.74	3.86M	1.44	13.22	-0.301
Malaysia	30,740.00	2.29	702,215.00	5.82	22.84	3.322
Lao PDR	174,892.00	3.99	1.53M	7.35	8.73	2.550
Indonesia	31,980.00	-6.50	322,740.00	-6.37	10.09	0.139
Cambodia	105,768.00	2.47	678,526.00	2.54	6.42	0.047
Brunei	523.00	-19.21	430.00	-19.15	0.82	0.068

Source: FAOStat, *2010-2019

Vietnam, Philippines, and Myanmar together contributed about 81% of the total land area and 85% of the total production of fresh vegetables in SEA. Vietnam is the top producer with an area of 873,532 ha (38%) and production of 15.34M tons (53%). The Philippines ranked second in terms of area (675,426 ha or 30%) and production (5.58M tons of 19%) while Myanmar ranked third with an area of 291,708 ha (13%) and production of 3.86M tons (13%) (Figures 5 and 6).

It can be noted, however, that despite the Philippines having a large contribution to the area and production of fresh vegetables in SEA, the yield (8.26 t/ha) is generally lower as compared to Vietnam (17.56 t/ha), Myanmar (13.22 t/ha), and other countries with small contributions such as Singapore (18.36 t/ha) and Malaysia (22.84 t/ha), which has the highest yield among the SEA countries. This implies a need to improve on the production technologies to maximize the area and increase the yield.

FIGURE 5. CONTRIBUTION OF SEA COUNTRIES TO THE AREA PLANTED TO FRESH VEGETABLES, 2019 (FAOSTAT).

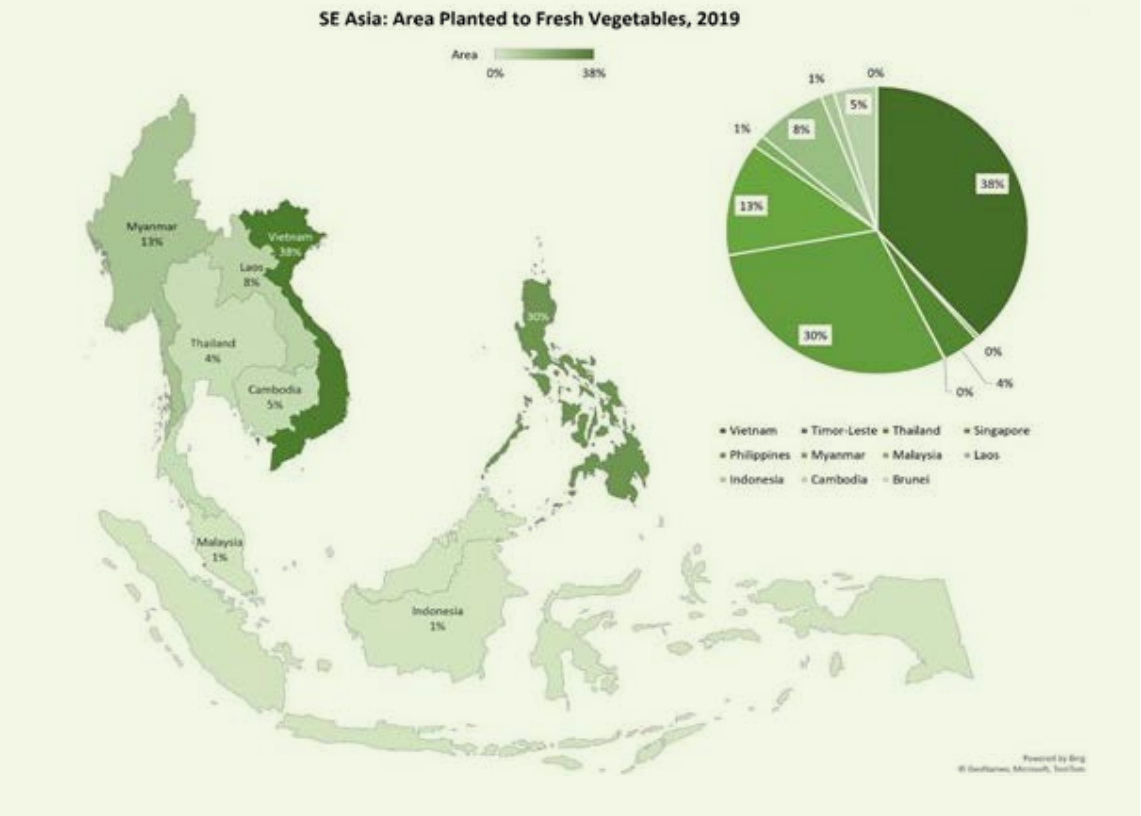
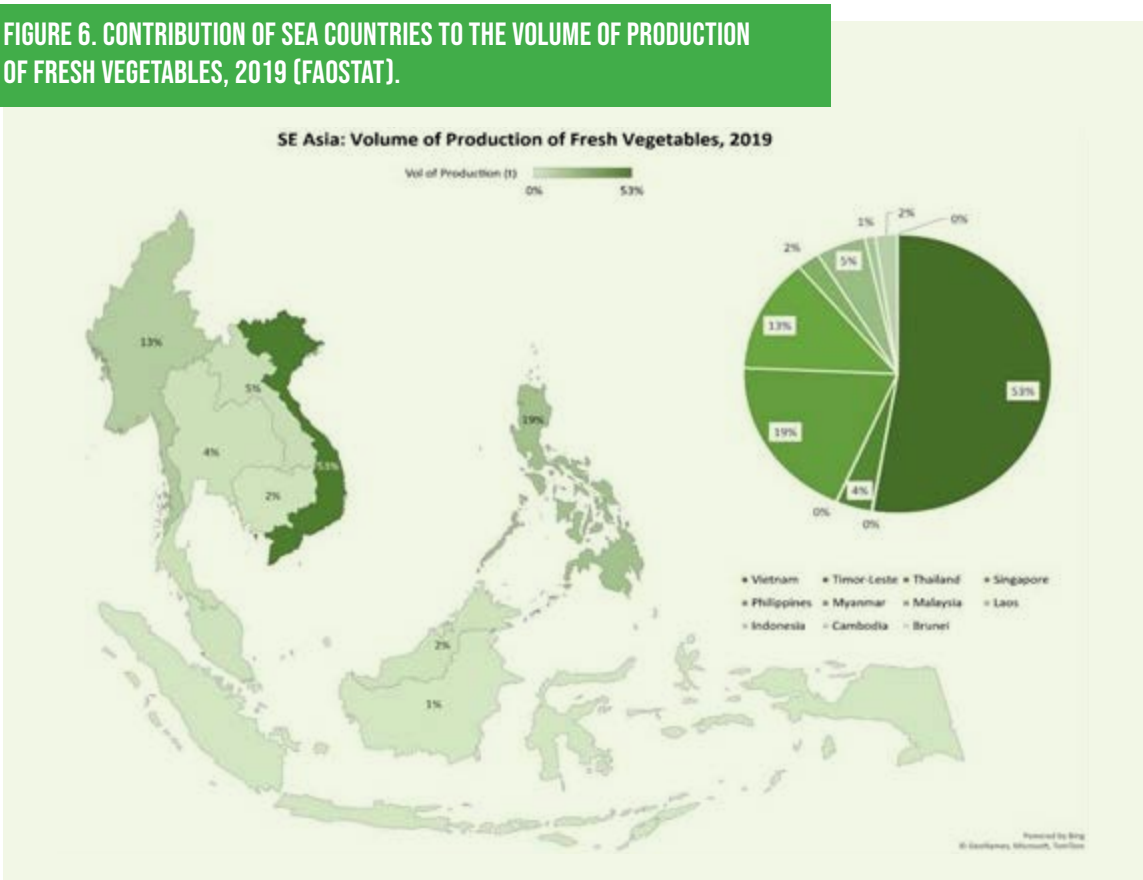


FIGURE 6. CONTRIBUTION OF SEA COUNTRIES TO THE VOLUME OF PRODUCTION OF FRESH VEGETABLES, 2019 (FAOSTAT).



Domestic Production of Lowland Vegetable Crops

Ampalaya. In 2020, the Philippines has a total land area of 10,687.78 ha planted to ampalaya with a total production of 87,804.27 mt and yield of 8.22 mt/ha as compared to the area of 10,877.10 ha, total production of 86,599.32 mt, and yield of 7.96 mt/ha in 2011. It should be noted that the potential yields of the varieties grown in the country is 2-3 times as much. There has been an observed decline in terms of area at an average rate of 0.19% while the average increase in growth rates were observed in the production and the yield at 0.17% and 0.37%, respectively (Table 5).

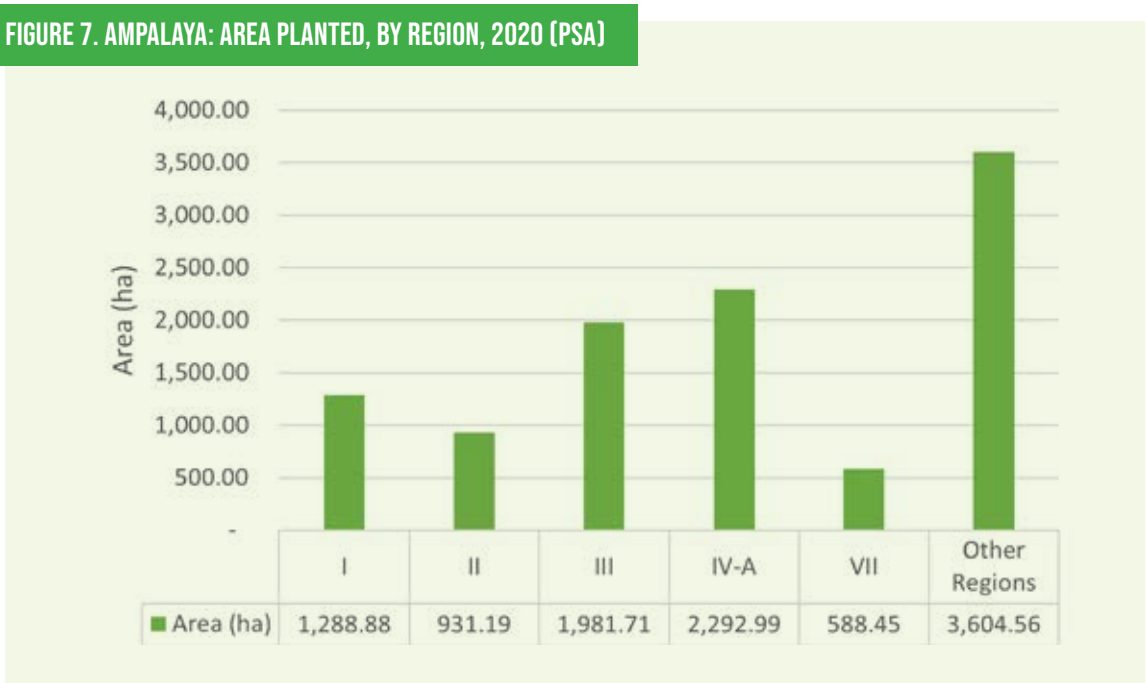
TABLE 5. AMPALAYA: AREA PLANTED, PRODUCTION, AND YIELD, BY REGION, 2020

Region	Area (ha)	Ave % Growth*	Production (mt)	Ave % Growth*	Yield (mt/ha)	Ave % Growth*
PHILIPPINES	**10,687.78**	**-0.19**	**87,804.27**	**0.17**	**8.22**	**0.37**
CAR	104.60	0.16	425.20	-0.66	4.07	-0.82
I	1,288.88	0.49	10,521.17	1.01	8.16	0.53
II	931.19	-2.26	5,173.60	-2.58	5.56	-0.31
III	1,981.71	0.20	25,550.32	0.26	12.89	0.07
IV-A	2,292.99	-0.36	19,507.55	-2.24	8.51	-1.89
IV-B	331.93	3.35	1,511.76	12.74	4.55	9.01
V	421.26	0.11	2,932.81	0.61	6.96	0.50
VI	421.68	1.20	3,260.65	2.10	7.73	0.94
VII	588.45	-1.88	3,335.01	1.14	5.67	3.14
VIII	263.99	-0.75	1,041.86	-1.32	3.95	-0.54
IX	578.91	-1.98	5,322.73	9.06	9.19	11.62
X	571.88	1.38	3,164.25	2.01	5.53	0.61
XI	428.68	1.05	2,951.18	1.77	6.88	0.74
XII	205.92	-1.72	1,164.35	-2.91	5.65	-1.17
XIII	208.39	5.20	1,592.56	10.98	7.64	5.58
ARMM	67.32	-1.11	349.27	2.21	5.19	3.62

Source: PSA, *2011-2020

Looking at the regional level, Region IV-A (2,292.99 ha or 21%), Region III (1,981.71 ha or 19%), Region I (1,288.88 ha or 12%), Region II (931.19 ha or 9%), and Region VII (588.45 ha or 6%) are the top five regions with the highest area planted to ampalaya. These five regions accounted for 66% of the total area devoted to ampalaya production (Figure 7). Although Region IV-A maintains the lead in terms of area, an average decline of 0.36% was observed from 2011-2020 while Regions III and I continue to expand at an average rate of 0.20% and 0.49%, respectively. Regions II and VII were also observed to have a decline of 2.26% and 1.88%, respectively. Region XIII has the highest increase in land expansion at a rate of 5.20% while Region II recorded the highest rate of decline in area among the regions.

FIGURE 7. AMPALAYA: AREA PLANTED, BY REGION, 2020 (PSA)



In terms of production, Region III holds the record of being the highest producer with 25,550.32 mt or 29% of the national production. Region IV-A (19,507.55 mt or 22%), Region I (10,512.17 mt or 12%), Region IX (5,322.73 mt or 6%), and Region II (5,173.60 mt or 6%) also contributed significantly to the production. The remaining regions accounted for 25% of the national production (Figure 8).

FIGURE 8. AMPALAYA: VOLUME OF PRODUCTION, BY REGION, 2020 (PSA)

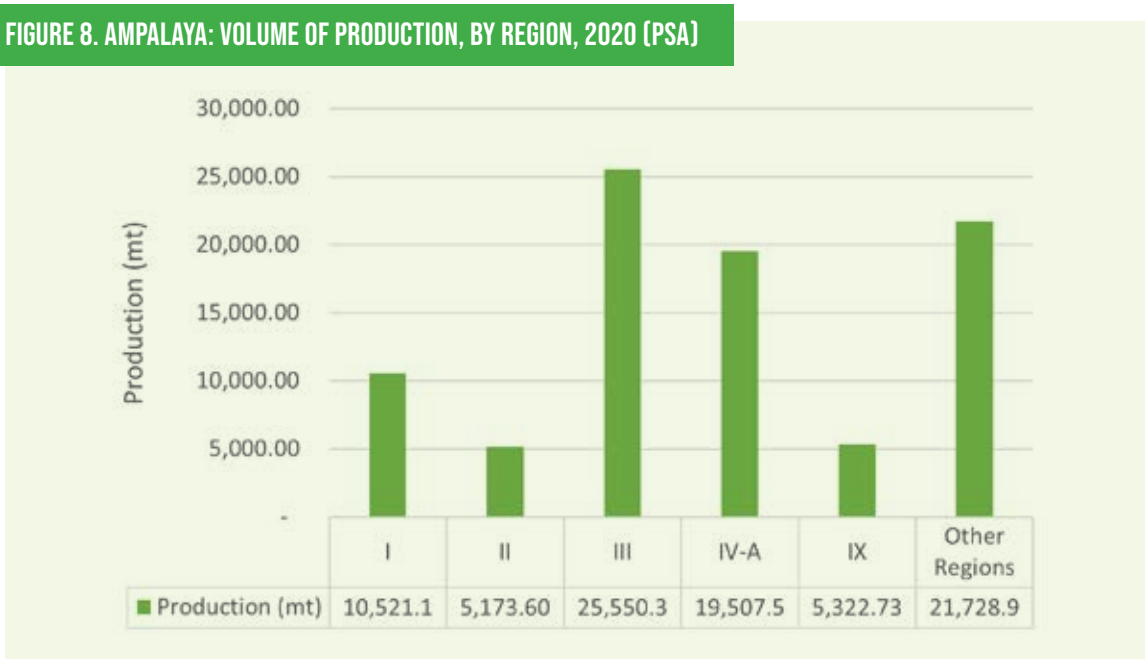


Figure 9 shows the yield of ampalaya per region. The yield in Region III (12.89 mt/ha) is generally higher than the national yield (8.22 mt/ha) with a difference of 4.68 mt/ha. It is interesting to note the high contribution of Region IX in terms of production and yield with an average growth rate of 9.06% and 11.62%, respectively, despite the decline in area of 1.98%. The farmers in Region III and IV-A use the high-yielding hybrid variety, Galaxy.

FIGURE 9. AMPALAYA: YIELD, BY REGION, 2020 (PSA)

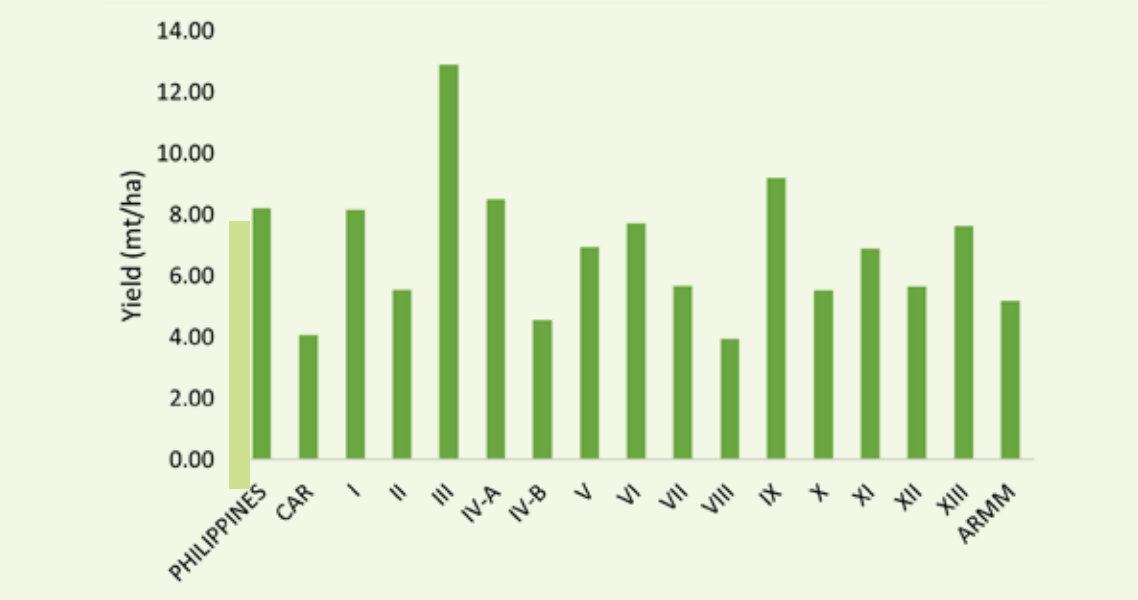


Table 6 below shows the top five provinces with highest contributions in terms of volume of production of ampalaya. Nueva Ecija is the top producer, contributing 12% to the national production, followed by Pampanga (10%), Batangas (6%), Bulacan (5%), and Zamboanga City (5%), These provinces contributed a total of 38% to the national ampalaya production.

TABLE 6. TOP FIVE PROVINCES WITH HIGHEST VOLUME OF AMPALAYA PRODUCTION, 2020 (PSA)

Province	Volume of Production (mt)	% Contribution to the National Production
Nueva Ecija	10,212.01	12
Pampanga	9,077.58	10
Batangas	5,304.91	6
Bulacan	4,218.60	5
Zamboanga City	4,076.16	5

Eggplant. In 2020, the Philippines has a total land area of 21,780.33 ha planted to eggplant with a total production of 242,750.40 mt and yield of 11.14 mt/ha as compared to the area of 21,377.20 ha, total production of 207,994.01 mt, and yield of 9.73 mt/ha in 2011. There has been an observed increase in the average growth rates in terms of area, volume of production, and yield at 0.21%, 1.75%, and 1.54%, respectively (Table 7).

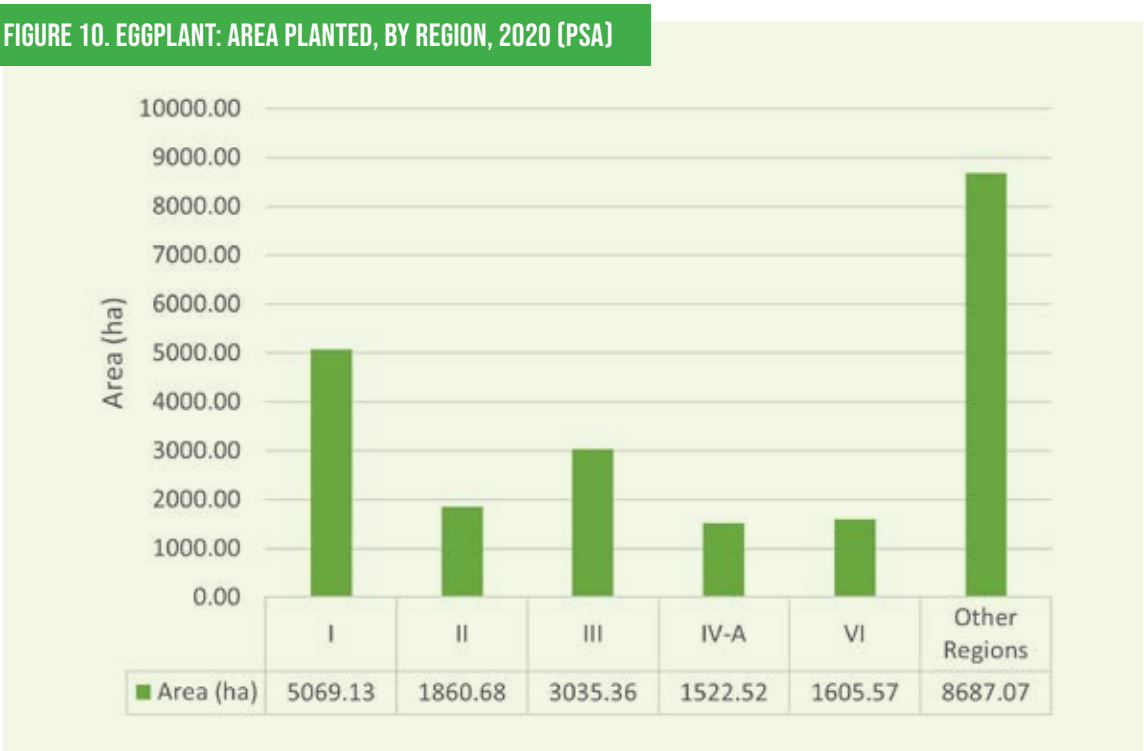
TABLE 7. EGGPLANT: AREA PLANTED, PRODUCTION, AND YIELD, BY REGION, 2020

Region	Area (ha)	Ave % Growth*	Production (mt)	Ave % Growth*	Yield (mt/ha)	Ave % Growth*
PHILIPPINES	**21780.33**	**0.21**	**242730.40**	**1.75**	**11.14**	**1.54**
CAR	174.21	3.08	1061.52	3.19	6.09	0.13
I	5069.13	0.47	95443.66	2.70	18.83	2.20
II	1860.68	-0.06	18272.32	-0.41	9.82	-0.35
III	3035.36	0.51	28850.36	4.97	9.50	4.48
IV-A	1522.52	-2.19	26259.75	-3.38	17.25	-0.85
IV-B	1213.46	2.42	5315.37	8.66	4.38	6.12
V	1362.37	0.07	7030.16	0.28	5.16	0.22
VI	1605.57	0.81	17115.70	1.49	10.66	0.68
VII	1393.50	-1.69	8165.43	1.56	5.86	3.70
VIII	287.22	-2.15	2015.90	-1.08	7.02	1.14
IX	481.27	-2.23	4667.78	13.31	9.70	16.50
X	957.32	2.10	5541.21	3.42	5.79	1.30
XI	1136.48	-0.34	6935.81	0.86	6.10	1.19
XII	570.23	-1.05	6953.38	-0.14	12.19	1.00
XIII	884.55	7.59	8281.18	12.86	9.36	4.55
ARMM	226.46	0.44	820.87	3.35	3.62	2.99

Source: PSA, *2011-2020

Region I (5,069.13 ha or 23%), Region III (3,035.36 ha or 14%), Region II (1,860.68 ha or 9%), Region VI (1,605.57 ha or 7%), and Region IV-A (1,522.52 ha or 7%) are the top five regions with the highest area planted to eggplant. These five regions contributed 60% to the total area devoted to eggplant production (Figure 10). Regions I, III, and VI have an average growth rate of 0.47%, 0.51%, and 0.81%, respectively while Regions II and IV-A have a noticeable decline of 0.06% and 2.19%, respectively, from 2011-2020. Region XIII has the highest rate of expansion at a rate of 7.59% while Region IX has the highest rate of decline in area at 2.23%.

FIGURE 10. EGGPLANT: AREA PLANTED, BY REGION, 2020 (PSA)



In terms of production, Region I had the highest volume of production with 95,443.66 mt or 39% of the national production. Region III (28,850.36 mt or 12%), Region IV-A (26,259.75 mt or 11%), Region II (18,272.32 mt or 8%), and Region VI (17,115.70 mt or 7%) also contributed significantly to the production. The remaining regions contributed 23% to the national production (Figure 11).

FIGURE 11. EGGPLANT: VOLUME OF PRODUCTION, BY REGION, 2020 (PSA)

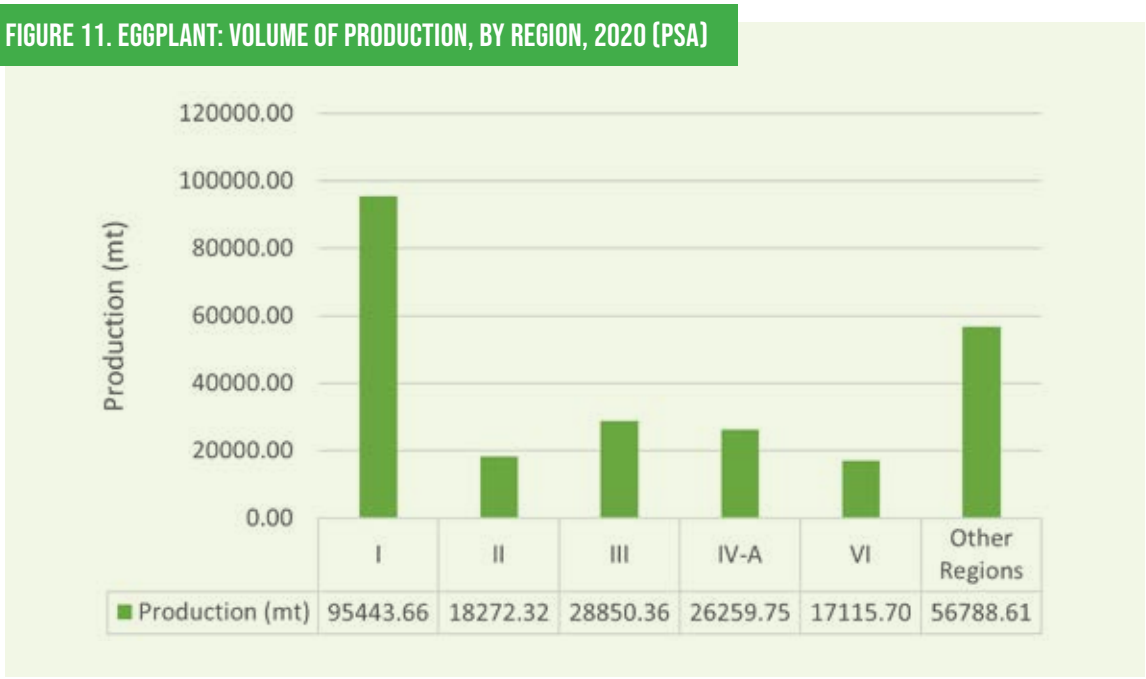
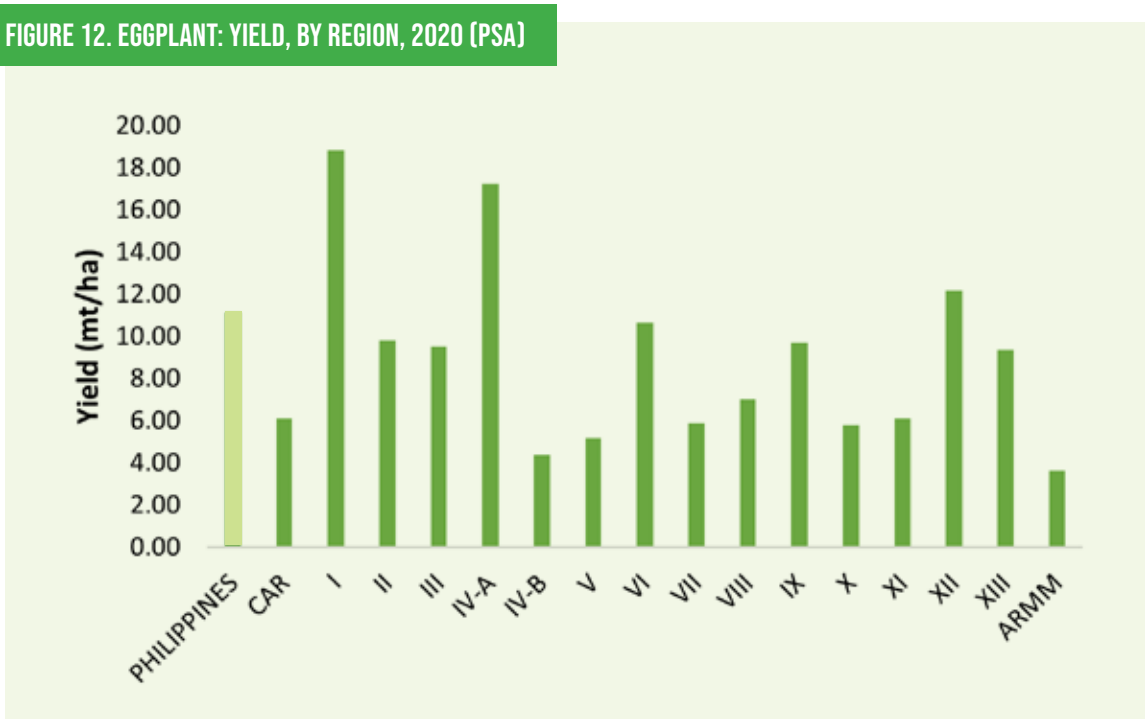


Figure 12 shows the yield of eggplant per region. On the average, the Philippines has a yield of 11.14 mt/ha. Region I has the highest yield of 18.83 mt/ha. Region IV-A (17.25 mt/ha), Region XII (12.19 mt/ha), Region VI (10.66 mt/ha), and Region II (9.82 mt/ha) are the next highest yielding regions for eggplant.

FIGURE 12. EGGPLANT: YIELD, BY REGION, 2020 (PSA)



In terms of provincial contributions, Pangasinan has the highest volume produced in 2020 amounting to 78,201.18 mt or 32% of the national production. Next to it are the following provinces: Quezon (8%), Iloilo (5%), Tarlac (5%), and Nueva Ecija (4%). These provinces contributed 54% of the national production (Table 8).

TABLE 8. TOP FIVE PROVINCES WITH HIGHEST VOLUME OF EGGPLANT PRODUCTION, 2020 (PSA)

Province	Volume of Production (mt)	% Contribution to the National Production
Pangasinan	78,201.18	32
Quezon	20,128.31	8
Iloilo	11,941.2	5
Tarlac	11,207.28	5
Nueva Ecija	9,590.17	4

Squash. The nationwide production of squash in 2020 was 193,814.22M tons, planted to 12,962.54 ha with a yield of 14.95 mt/ha. There has been a slight increase in the average growth rate in terms of area planted (0.08) from 12,877.27 ha in 2011. However, an observed decline in both production and yield were noticeable from 2011 to 2020 with average rates at 1.58% and 1.64%, respectively (Table 9).

TABLE 9. SQUASH: AREA PLANTED, PRODUCTION, AND YIELD, BY REGION, 2020

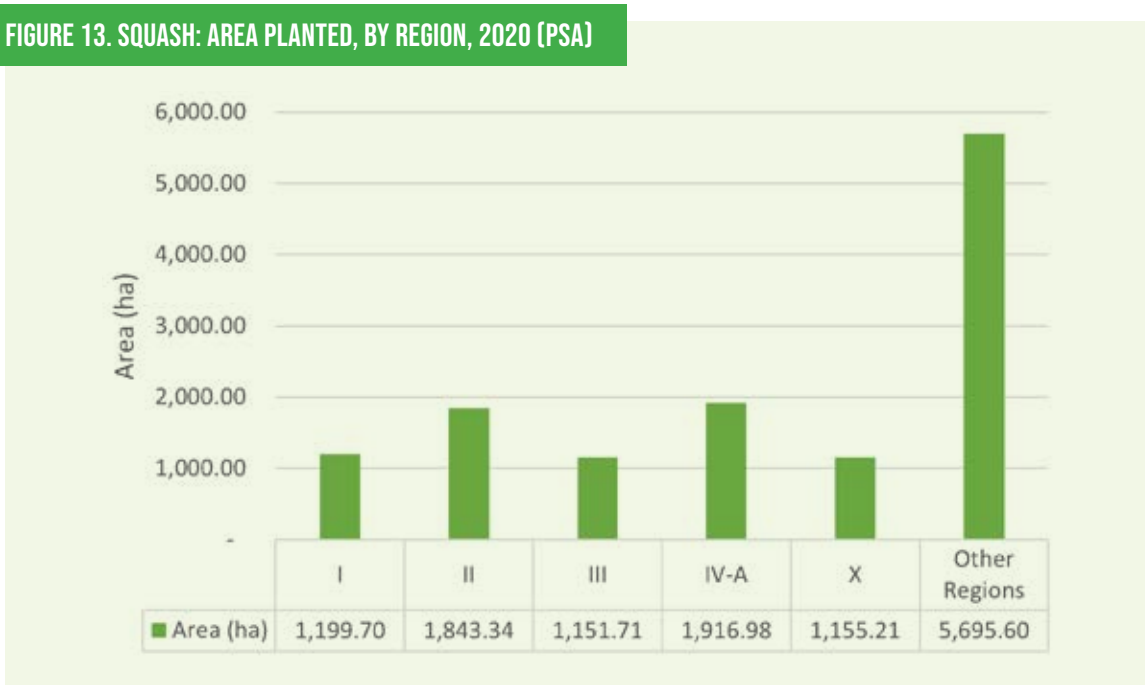
Region	Area (ha)	Ave % Growth*	Production (mt)	Ave % Growth*	Yield (mt/ha)	Ave % Growth*
PHILIPPINES	**12,962.54**	**0.08**	**193,814.22**	**-1.58**	**14.95**	**-1.64**
CAR	268.87	1.46	5,045.42	-2.12	18.77	-3.58
I	1,199.70	-0.23	17,316.71	0.43	14.43	0.66
II	1,843.34	-2.47	26,425.19	-4.15	14.34	-1.70
III	1,151.71	0.87	21,075.71	-1.49	18.30	-2.48
IV-A	1,916.98	-0.50	30,963.50	-2.86	16.15	-2.35
IV-B	383.80	7.84	2,927.96	7.87	7.63	-0.02
V	1,003.33	-0.82	25,285.29	-2.17	25.20	-1.42
VI	916.82	0.19	13,847.61	-0.84	15.10	-1.00
VII	817.71	0.32	7,146.94	-5.93	8.74	-6.26
VIII	323.05	-1.75	1,987.54	-1.09	6.15	0.71
IX	543.37	0.16	6,224.58	1.60	11.46	1.40
X	1,155.21	0.88	17,345.70	1.03	15.02	0.17

Region	Area (ha)	Ave % Growth*	Production (mt)	Ave % Growth*	Yield (mt/ha)	Ave % Growth*
XI	576.46	0.84	6,921.53	1.32	12.01	0.49
XII	294.40	3.92	3,045.38	3.23	10.34	-0.55
XIII	428.30	12.56	6,625.03	14.21	15.47	1.74
ARMM	139.49	-0.20	1,630.14	1.05	11.69	1.36

Source: PSA, *2011-2020

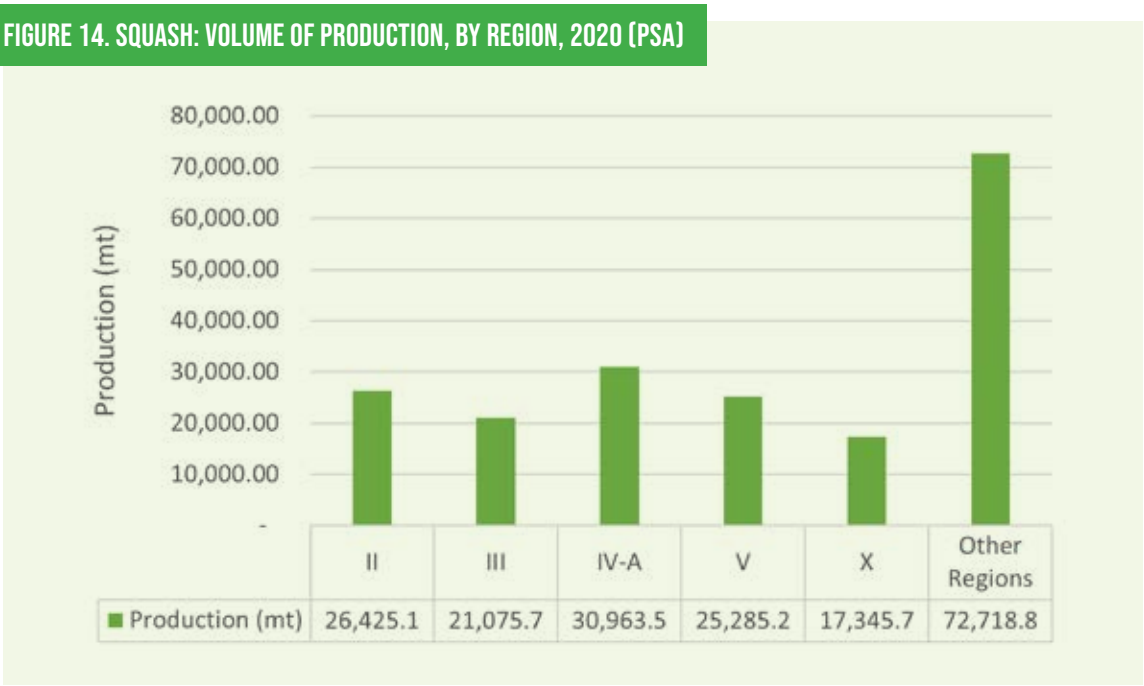
Region IV-A has the largest area planted to squash with an area of 1,916.98 ha (15%). Region II ranks second with an area of 1,843.34 ha (14%) followed by Region I (1,199.70 ha or 9%), Region X (1,155.21 ha or 9%), and Region III (1,151.71 ha or 9%), which all tied at the third place. These five regions account for 56% of the total area planted to squash in the country (Figure 13).

FIGURE 13. SQUASH: AREA PLANTED, BY REGION, 2020 (PSA)



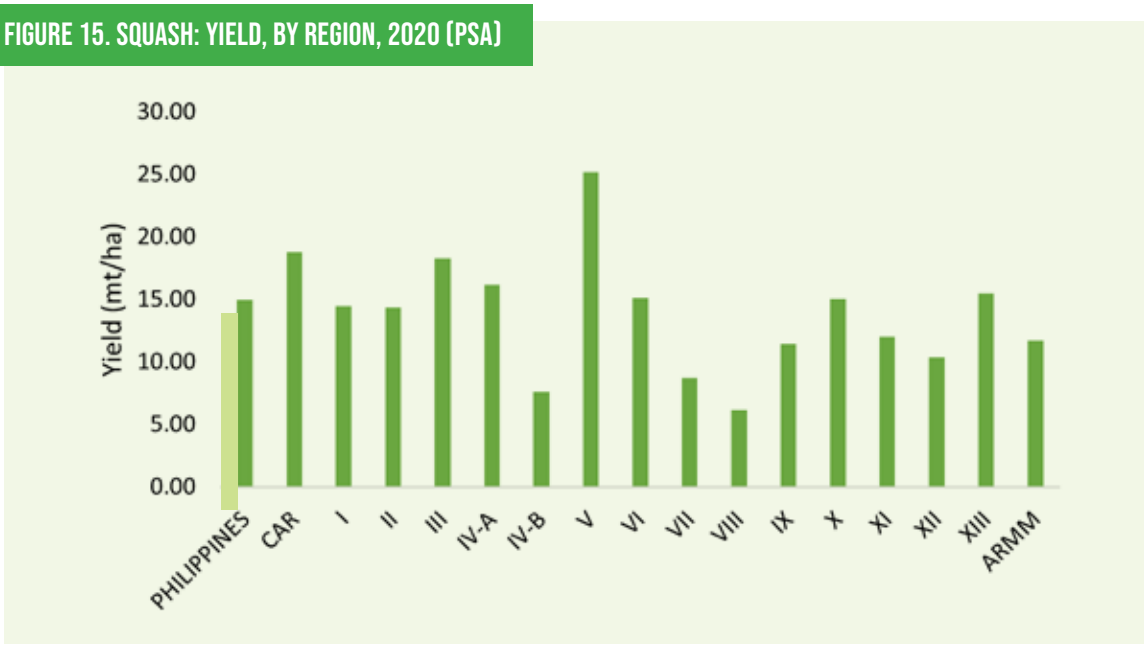
The top five producers of squash in the country in 2020 are Regions IV-A, II, V, III, and X. Region IV-A contributed 30,963.50 mt or 16% to the national production while Region II has a share of 26,425.19 mt (14%), Region V with 25,285.29 mt (13%), Region III with 21,075.71 mt (11%), and Region X with 17,345.70 mt (9%). These regions contributed a total of 62% to the country's production (Figure 14).

FIGURE 14. SQUASH: VOLUME OF PRODUCTION, BY REGION, 2020 (PSA)



On the average, the Philippines has a squash yield of 14.95 mt/ha. Seven (7) out of the 15 regions in the country have surpassed the national average yield with Region V having the highest yield of 25.20 mt/ha. CAR has the second highest yield at 18.77 mt/ha despite the small area and low volume of production. Region III has recorded a yield of 18.30 mt/ha while Region IV-A has 16.15 mt/ha, and Region XIII has 15.47 mt/ha (Figure 15).

FIGURE 15. SQUASH: YIELD, BY REGION, 2020 (PSA)



In 2020, Albay was the top producer of squash among the provinces in the country. Squash production in Albay amounted to 20,017.99 mt (10%), which almost tied up with Quezon at 19,938.39 mt (10%). They were followed by Nueva Vizcaya (9%), Nueva Ecija (8%), and Bukidnon (6%).

TABLE 10. TOP FIVE PROVINCES WITH HIGHEST VOLUME OF SQUASH PRODUCTION, 2020 (PSA)

Province	Volume of Production (mt)	% Contribution to the National Production
Albay	20,017.99	10
Quezon	19,938.39	10
Nueva Vizcaya	16,882.79	9
Nueva Ecija	15,732.5	8
Bukidnon	12,095	6

Tomato. The Philippines has a total harvestable area of 16,449.19 ha for tomato in 2020 as compared to 17,556 ha in 2011, registering an average decline of 0.71% during the period. Despite the observed decline, the production slightly increased from 203,581.71 mt in 2011 to 222,002 mt in 2020. Among the regions, only Regions IV-B, VI, XI, and XIII have an increase in average growth rates in terms of area while the rest declined. For the volume of production, in general, it was observed to have increased except for five regions (CAR, IV-A, VIII, X, and ARMM) (Table 11).

TABLE 11. TOMATO: AREA PLANTED, PRODUCTION, AND YIELD, BY REGION, 2020

Region	Area (ha)	Ave % Growth*	Production (mt)	Ave % Growth*	Yield (mt/ha)	Ave % Growth*
PHILIPPINES	**16,448.19**	**-0.71**	**222,002.24**	**0.98**	**13.50**	**1.73**
CAR	302.69	-1.85	3,077.39	-2.41	10.17	-0.56
I	3,651.68	-0.22	73,435.34	0.80	20.11	1.03
II	864.52	-0.13	11,505.94	1.30	13.31	1.58
III	3,302.35	-0.19	31,802.44	4.53	9.63	4.81
IV-A	1,187.95	-1.71	13,902.02	-2.81	11.70	-0.82
IV-B	451.94	5.61	3,488.25	12.95	7.72	6.71
V	549.14	-0.29	3,755.87	1.08	6.84	1.37
VI	915.10	1.74	11,813.34	3.31	12.91	1.52
VII	596.11	-7.21	4,668.87	2.84	7.83	15.70
VIII	98.89	-0.68	603.84	-1.41	6.11	-0.78
IX	397.59	-2.81	5,950.84	18.16	14.97	22.48
X	2,620.17	-0.51	47,205.57	-0.86	18.02	-0.35
XI	672.74	0.62	4,594.46	0.81	6.83	0.20
XII	649.35	-0.27	5,253.02	0.25	8.09	0.49
XIII	107.25	8.79	561.31	15.63	5.23	6.28
ARMM	80.72	-3.45	383.73	-0.52	4.75	5.35

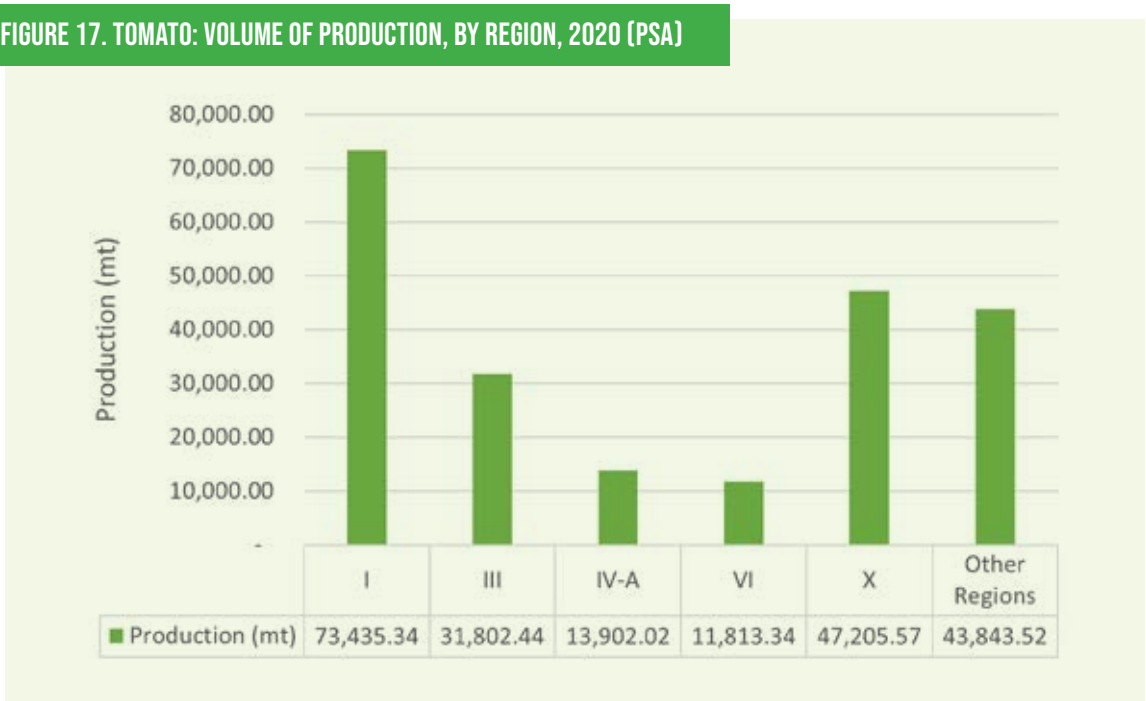
Source: PSA, *2011-2020

In 2020, Region I had the largest area planted to tomato with 3,651.68 ha which contributed 22% to the total tomato area in the country. Region III ranks with 3,302.35 ha (20%), followed by Region X (2,620.17 ha or 16%), Region IV-A (1,187.95 ha or 7%), and Region VI (915.10 ha or 6%). These five regions contributed a total of 71% to the national scale (Figure 16).

FIGURE 16. TOMATO: AREA PLANTED, BY REGION, 2020 (PSA)

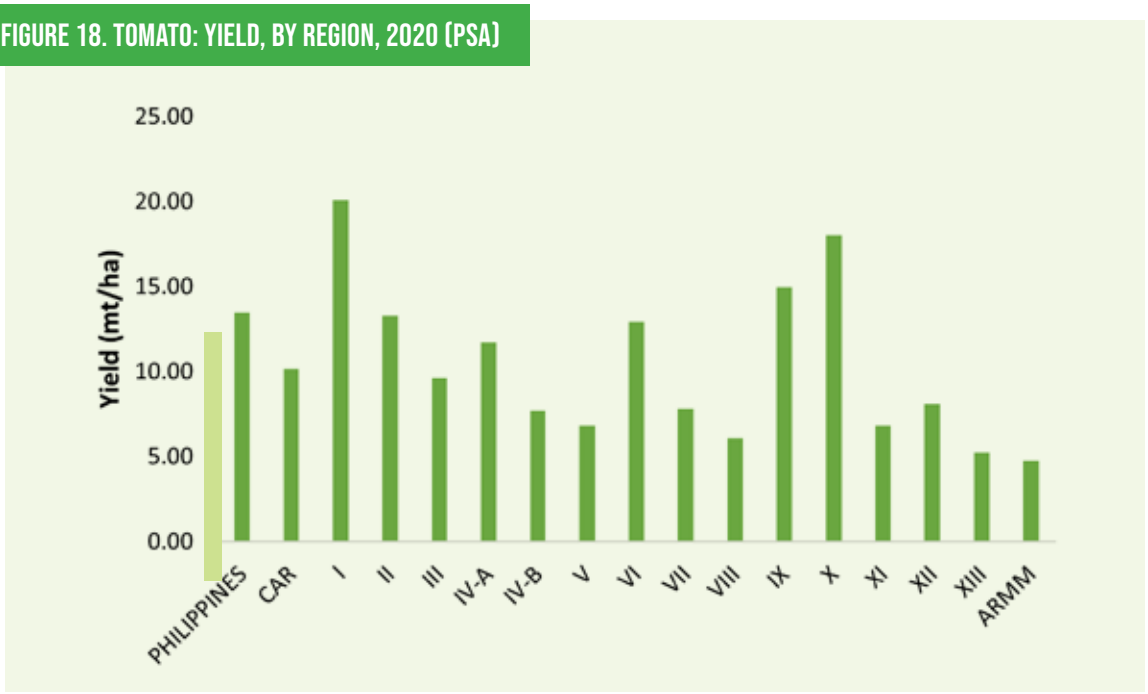
The top five producers of tomato in terms of volume are Regions I (73,435.34 mt or 33%), X (47,205.57 mt or 21%), III (31,802.44 mt or 14%), IV-A (13,902 mt or 6%), and VI (11,813.34 mt or 5%). Eighty percent (80%) of the national production are covered by these five regions while the remaining 20% are covered by other regions (Figure 17).

FIGURE 17. TOMATO: VOLUME OF PRODUCTION, BY REGION, 2020 (PSA)



The Philippines has an average yield of 13.5 mt/ha. Figure 18 shows that the yield of tomato in the following regions are higher than the national yield: Regions I (20.11 mt/ha), Region X (18.02 mt/ha), and Region IX (14.97 mt/ha). Regions II and VI belong to the top five regions with highest yields. ARMM (4.75 mt/ha), Region XIII (5.23 mt/ha), and Region VIII (6.11 mt/ha) have recorded the lowest yields.

FIGURE 18. TOMATO: YIELD, BY REGION, 2020 (PSA)



Tomato production was highest in Bukidnon with 40,268.61 mt or 18% of the national production in 2020. Ilocos Norte and Ilocos Sur ranked second and third with 12% and 11% contributions to the national production, respectively, while Pangasinan and Nueva Ecija shared 8% each (Table 12).

TABLE 12. TOP FIVE PROVINCES WITH HIGHEST VOLUME OF TOMATO PRODUCTION, 2020 (PSA)

Province	Volume of Production (mt)	% Contribution to the National Production
Bukidnon	40,268.61	18
Ilocos Norte	27,456.47	12
Ilocos Sur	24,841.67	11
Pangasinan	18,764.91	8
Nueva Ecija	18,391.87	8

Pole Sitao. There is a slight decrease in terms of area planted to pole sitao from 2011 (14,298.06 ha) to 2020 (13,911.50 ha) at an average rate of 0.30%. The volume of production also has an average decline of 0.65% from 116,302.47 mt in 2011 to only 109,516.46 mt in 2020. For 8 out of the 16 regions area planted has been fluctuating. On the other hand, in terms of volume of production, only five regions experienced decline in production and these are: Region II (-2.44%), Region III (-2.33%), Region V (-1.87%), Region VI (-0.68%), and Region VIII (-1.77%). On the other hand, Region XIII was observed to have the highest AAGR at 10.03% (Table 13).

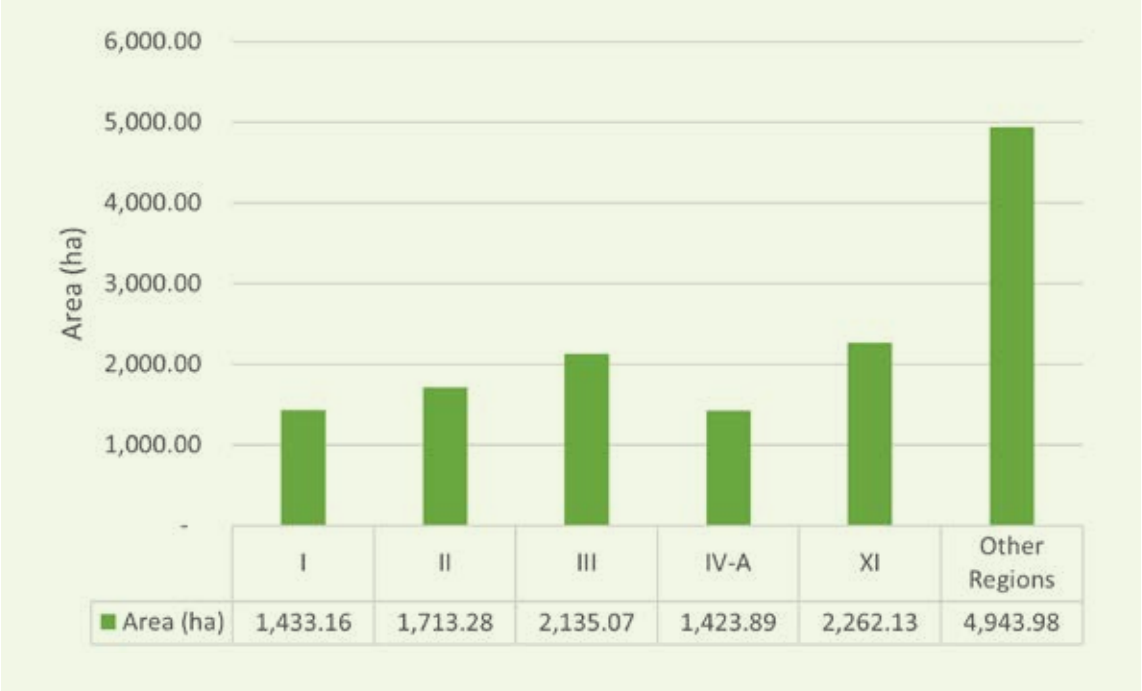
TABLE 13. POLE SITAO: AREA PLANTED, PRODUCTION, AND YIELD, BY REGION, 2020

Region	Area (ha)	Ave % Growth*	Production (mt)	Ave % Growth*	Yield (mt/ha)	Ave % Growth*
PHILIPPINES	**13,911.50**	**-0.30**	**109,516.46**	**-0.65**	**7.87**	**-0.34**
CAR	151.91	-1.29	482.31	0.61	3.17	1.91
I	1,433.16	0.77	12,761.14	1.25	8.90	0.48
II	1,713.28	0.13	13,913.90	-2.44	8.12	-2.55
III	2,135.07	1.16	30,175.99	-2.33	14.13	-3.42
IV-A	1,423.89	-0.56	5,758.59	2.18	4.04	2.74
IV-B	445.35	3.69	2,313.90	6.56	5.20	2.69
V	1,299.73	-0.11	9,441.52	-1.87	7.26	-1.76
VI	858.16	-0.06	9,120.74	-0.68	10.63	-0.60
VII	413.16	-7.54	2,673.30	1.01	6.47	16.37
VIII	332.69	-1.57	1,593.29	-1.77	4.79	-0.17
IX	492.65	-2.08	2,732.10	5.98	5.55	8.33
X	499.91	1.78	3,293.60	3.33	6.59	1.53
XI	2,262.13	-0.27	12,405.45	0.41	5.48	0.68
XII	220.76	0.73	1,010.31	3.55	4.58	2.77
XIII	153.61	3.07	1,378.76	10.03	8.98	7.08
ARMM	76.05	0.89	461.57	0.81	6.07	-0.06

Source: PSA, *2011-2020

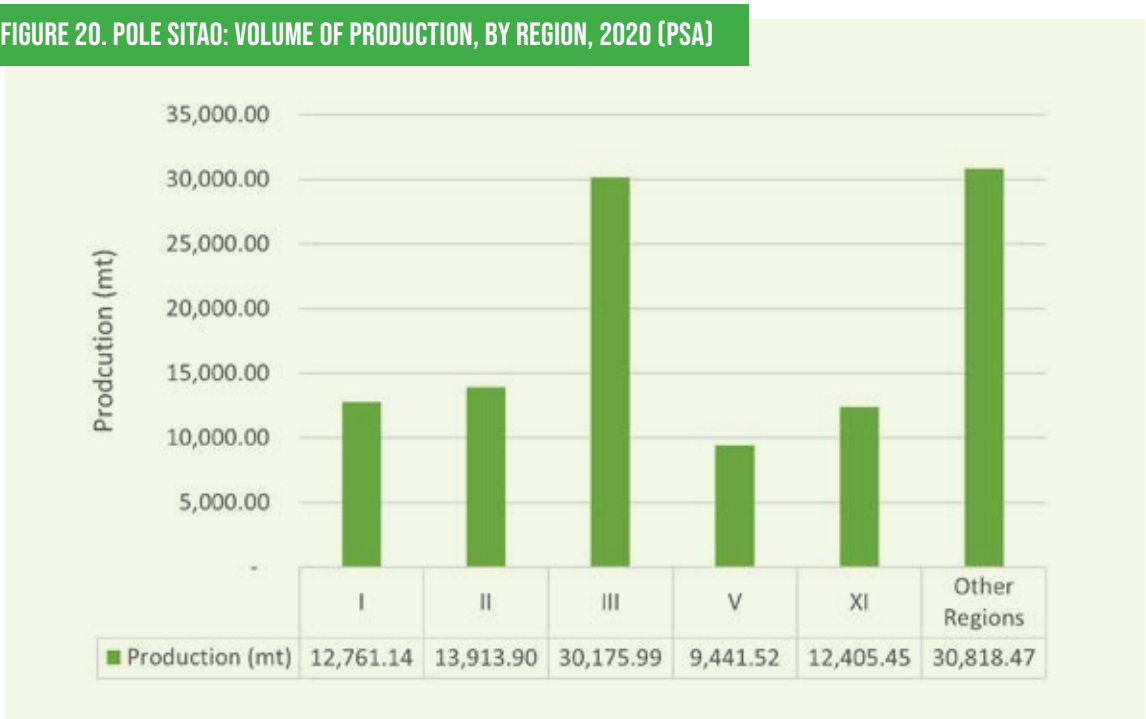
Region XI planted the largest area in 2020 with 2,262.13 ha or 165 percent of the total national area planted to pole sitao. Region III ranks second with an area of 2,135.07 ha (15%). It is followed by Region II (1,713.28 ha or 12%) while Regions IV-A and I tied with 1,433 ha or 12%. Overall, these five regions contributed 64% to the total area planted to pole sitao in the country (Figure 19).

FIGURE 19. POLE SITAO: AREA PLANTED, BY REGION, 2020 (PSA)



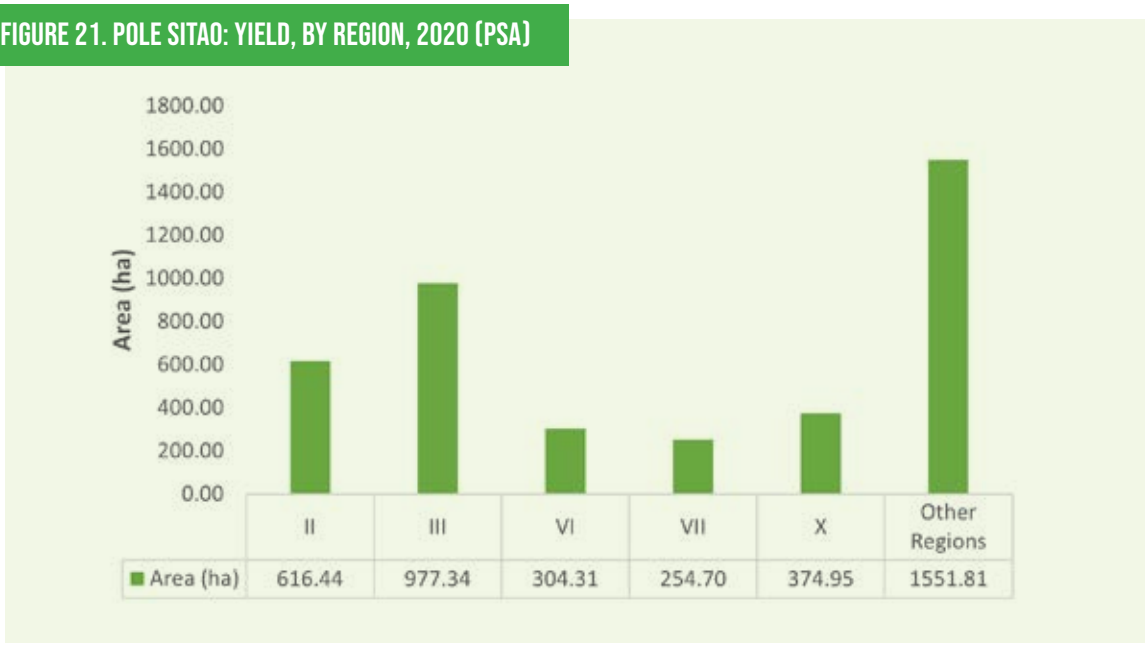
Region III recorded the highest volume of production in 2020 with 30,175.99 mt or 28% of the national production. Joining Region III at the top are Region II (13,913.90 mt or 13%), Region I (12,761.14 mt or 12%), Region XI (12,405.45 mt or 11%), and Region V (9,441.52 ha or 9%). The production of the remaining 11 regions is just equivalent to Region III's production at 28% (Figure 20).

FIGURE 20. POLE SITAO: VOLUME OF PRODUCTION, BY REGION, 2020 (PSA)



The country's average yield for pole sitao is 7.87 mt/ha. The five regions which surpassed the national average are Region III, being the highest, with 14.13 mt/ha, Region VI (10.63 mt/ha), Region XIII (8.98 mt/ha), Region I (8.90 mt/ha), and Region II (8.12 mt/ha). The remaining regions fall relatively lower than the national yield, to which CAR is the lowest at 3.17 mt/ha (Figure 21).

FIGURE 21. POLE SITAO: YIELD, BY REGION, 2020 (PSA)



Bulacan is the top producer of pole sitao among the provinces in 2020 with a total volume of 15,734.02 mt or 14% of the national production. Nueva Ecija ranked second to Bulacan with 10,168.61 mt or 9%, making Region III the top-producing region. Aside from these, two other provinces in Region II – Cagayan and Nueva Vizcaya – were also included in the top five with 5% and 4% contributions to the national production, respectively (Table 14).

TABLE 14. TOP FIVE PROVINCES WITH HIGHEST VOLUME OF POLE SITAO PRODUCTION, 2020 (PSA)

Province	Volume of Production (mt)	% Contribution to the National Production
Bulacan	15,734.02	14
Nueva Ecija	10,168.61	9
Davao City	5,587.93	5
Cagayan	4,949.61	5
Nueva Vizcaya	4,250.12	4

Okra. Both the area planted and production of okra have slightly increased at an average rate of 1.73% and 1.28%, respectively, from 2011 to 2020. Among the regions, Regions II, VIII, and IX had a decrease in terms of area planted/harvested to okra while the others had expanded their land area. In terms of volume of production, only Regions IV-A and VIII recorded a decrease at an average rate of 1.70% and 1.55%, respectively. The country average for yield has also decreased at an average rate of 0.44% during the same period (Table 15).

TABLE 15. OKRA: AREA PLANTED, PRODUCTION, AND YIELD, BY REGION, 2020

Region	Area (ha)	Ave % Growth*	Production (mt)	Ave % Growth*	Yield (mt/ha)	Ave % Growth*
PHILIPPINES	**4,079.55**	**1.73**	**32,632.12**	**1.28**	**8.00**	**-0.44**
CAR	19.23	2.79	47.96	4.46	2.49	1.65
I	218.65	2.57	2027.04	2.49	9.27	-0.06
II	616.44	-0.66	5451.35	0.05	8.84	0.73
III	977.34	3.50	11866.72	1.01	12.14	-2.36
IV-A	186.38	1.18	1443.94	-1.70	7.75	-2.86
IV-B	171.30	5.89	455.82	10.14	2.66	4.09
V	168.72	-0.19	1778.48	0.07	10.54	0.24

Region	Area (ha)	Ave % Growth*	Production (mt)	Ave % Growth*	Yield (mt/ ha)	Ave % Growth*
VI	304.31	2.47	2250.83	4.18	7.40	1.72
VII	254.70	2.32	1501.18	0.92	5.89	-1.39
VIII	143.20	-0.84	821.17	-1.55	5.73	-0.74
IX	120.06	-2.03	868.98	9.60	7.24	12.66
X	374.95	2.20	2010.03	2.37	5.36	0.16
XI	248.07	3.47	744.81	3.70	3.00	0.30
XII	113.04	0.23	586.55	1.45	5.19	1.24
XIII	139.64	3.37	722.13	6.85	5.17	3.82
ARMM	23.52	0.76	55.12	5.72	2.34	5.28

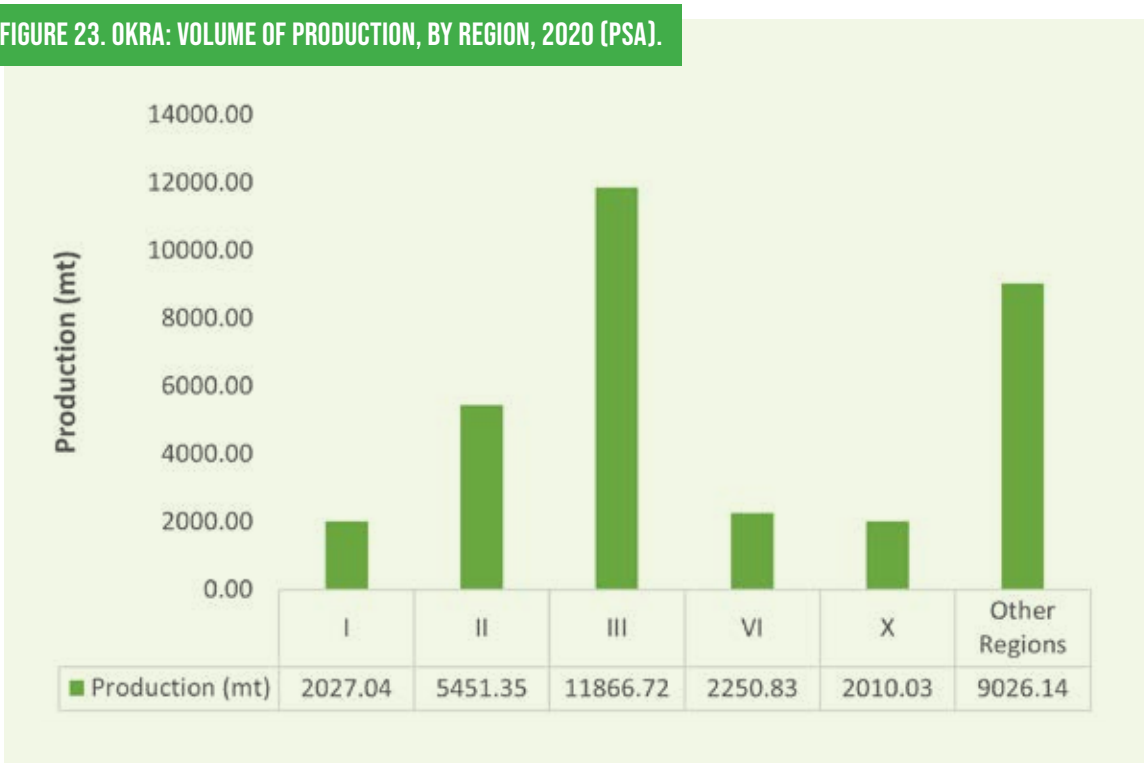
Source: PSA, *2011-2020

Figure 22 shows that Region III had the largest area planted to okra in 2020 with 977.34 ha or 24%. Region I ranked second with 616.44 ha or 15%. Regions VI (7%), VII (6%), and X (9%) are among the top five regions in the country. Together, these covered 62% of the total area planted to okra.

FIGURE 22. OKRA: AREA PLANTED, BY REGION, 2020 (PSA)

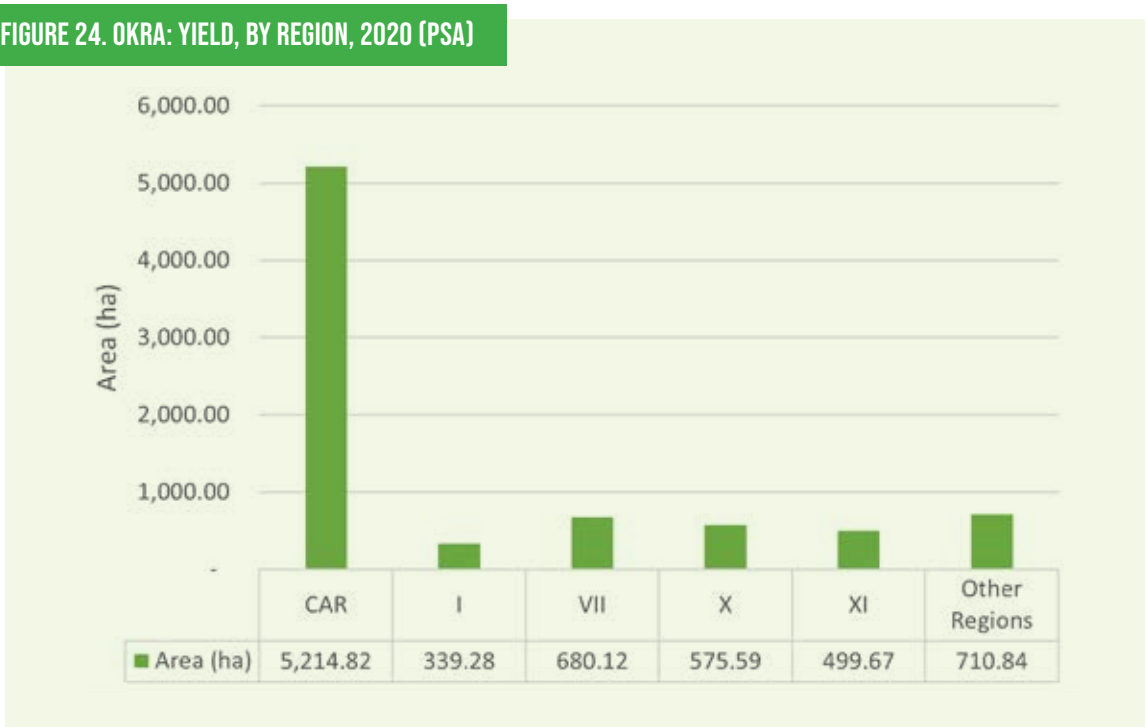
In terms of volume of production, Region III shared a total of 11,866.72 mt or 36% to the national production of okra in 2020. Region II ranked second with 5,451.35 mt or 17%. Regions VI, X, and also contributed significantly to the volume of okra production in the country. In total, these regions contributed 72% of the national production (Figure 23).

FIGURE 23. OKRA: VOLUME OF PRODUCTION, BY REGION, 2020 (PSA).



The national average yield of okra is at 8.0 mt/ha in 2020. The top five regions with high yields are Region III (12.24 mt/ha), Region V (10.54 mt/ha), Region I (9.27 mt/ha), Region II (8.84 mt/ha), and Region IV-A (7.75 mt/ha). Among these, the top four regions have yields which are higher than the national average (Figure 24).

FIGURE 24. OKRA: YIELD, BY REGION, 2020 (PSA)



The top-producing province of okra in 2020 was Nueva Ecija with 7,152.95 mt or 22% of the national production. The provinces of Isabela, Bulacan, Cagayan, and Tarlac are also among the top producers of okra in the country (Table 16).

TABLE 16. TOP FIVE PROVINCES WITH HIGHEST VOLUME OF OKRA PRODUCTION, 2020 (PSA)

Province	Volume of Production (mt)	% Contribution to the National Production
Nueva Ecija	7,152.95	22
Isabela	2,566.71	8
Bulacan	2,426.71	7
Cagayan	2,200.32	7
Tarlac	1,634.24	5

Domestic Production of Highland Vegetable Crops

Cabbage. The area planted to cabbage has decreased from 8,549.63 ha in 2011 to 8,020.31 ha in 2020 at an average rate of -0.70%. Despite the observed decline in area, the volume of production and yield increased from 2011 to 2020 at 0.42% and 1.13%, respectively (Table 17).

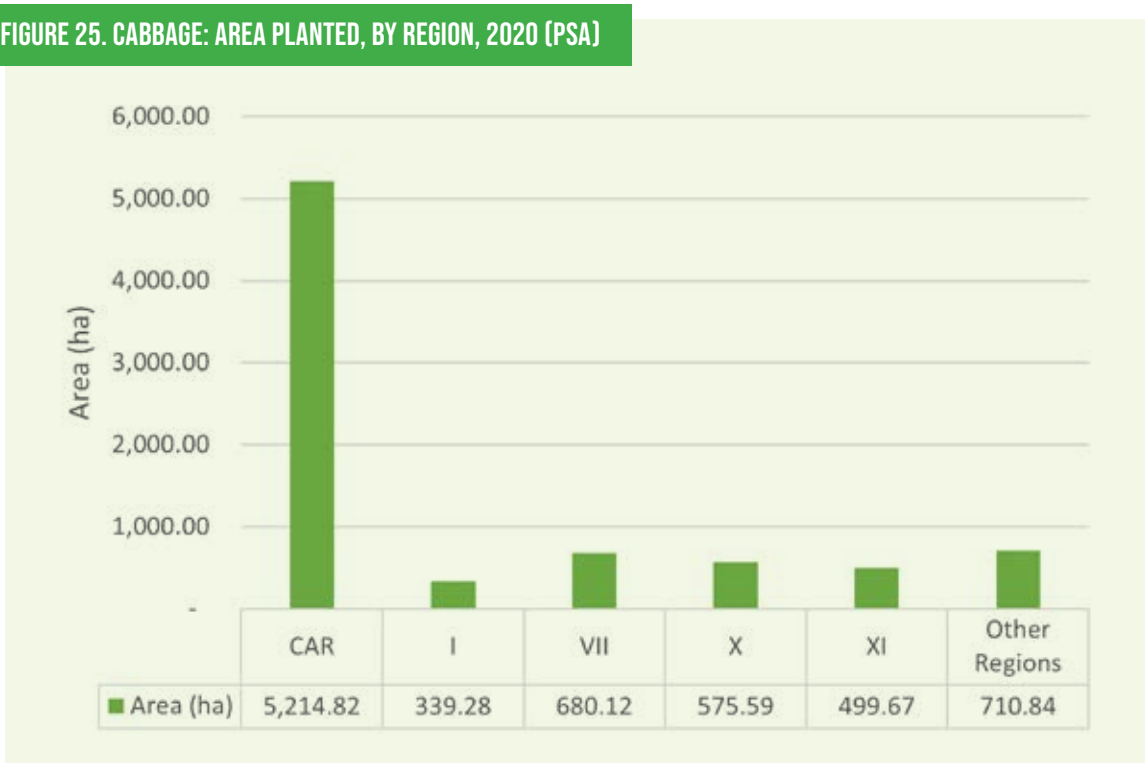
Most of the cabbages in the Philippines are grown in CAR with contributions to land area of 5,214. 82 ha or 65% and production of 101,124.37 mt or 78%. The yield in CAR (19.39 mt/ha) is also higher than the national average (16.18 mt/ha). Other cabbage-producing regions include Regions I, VII, X, and XI. These, together with CAR, contributed a total of 91% to the land area and 96% to the national production. In terms of yield, Region V ranks next to CAR with 15.58 mt/ha in 2020. Following Region V are Region X (13.43 mt/ha), Region VII (11.85 mt/ha), and Region IX (11.34 mt/ha) (Figures 25, 26, and 27).

TABLE 17. CABBAGE: AREA PLANTED, PRODUCTION, AND YIELD, BY REGION, 2020

Region	Area (ha)	Ave % Growth*	Production (mt)	Ave % Growth*	Yield (mt/ha)	Ave % Growth*
PHILIPPINES	**8020.31**	**-0.70**	**129803.39**	**0.42**	**16.18**	**1.13**
CAR	5214.82	-0.47	101124.37	0.28	19.39	0.75
I	339.28	-0.86	3279.46	1.03	9.67	1.90
II	205.03	0.85	1373.22	1.44	6.70	0.75
III	0.00	0.00	0.00	-	-	-
IV-A	106.46	-2.31	516.21	-4.99	4.85	-2.84
IV-B	12.00	-4.65	25.29	-0.64	2.11	5.33
V	5.75	-13.93	89.60	-10.36	15.58	6.03
VI	70.50	0.62	481.33	0.15	6.83	-0.54
VII	680.12	-1.16	8057.89	0.19	11.85	1.50
VIII	18.05	-1.56	105.88	-4.32	5.87	5.37
IX	68.19	-5.22	773.18	12.41	11.34	20.18
X	575.59	1.85	7727.32	3.40	13.43	1.52
XI	499.67	-1.92	4813.55	1.53	9.63	3.70
XII	164.64	-3.20	1194.70	-2.86	7.26	0.44
XIII	4.10	9.83	3.52	-10.69	0.86	-13.58
ARMM	56.12	-2.99	237.88	-6.69	4.24	-3.92

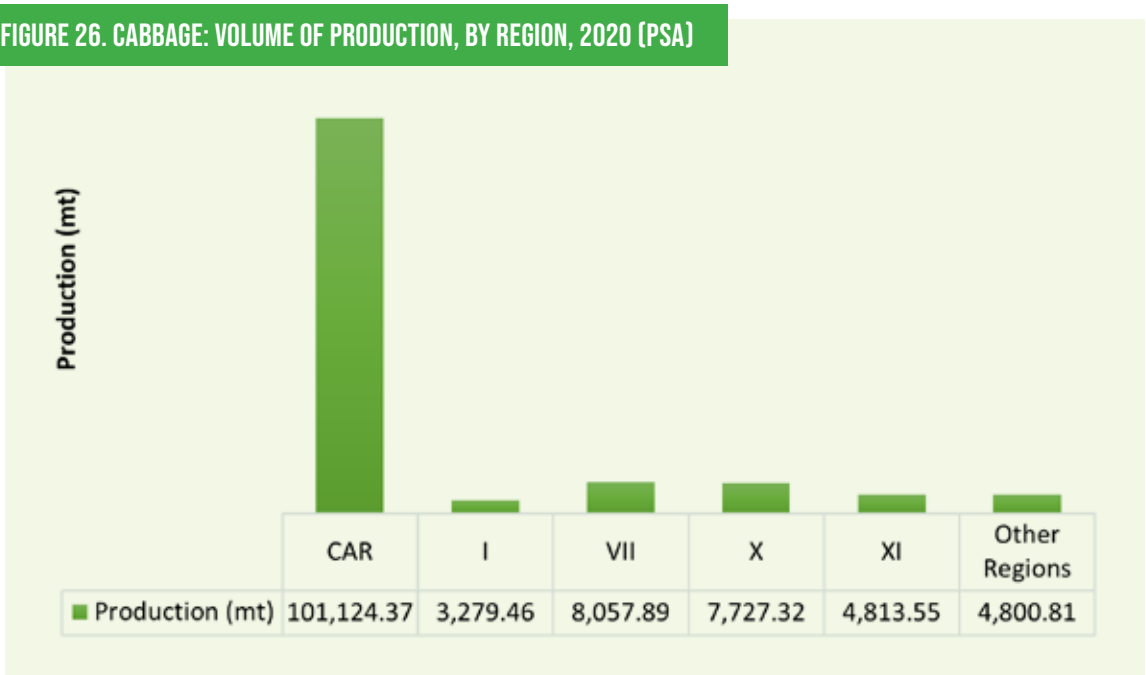
Source: PSA, *2011-2020

FIGURE 25. CABBAGE: AREA PLANTED, BY REGION, 2020 (PSA)



	CAR	I	VII	X	XI	Other Regions
Area (ha)	5,214.82	339.28	680.12	575.59	499.67	710.84

FIGURE 26. CABBAGE: VOLUME OF PRODUCTION, BY REGION, 2020 (PSA)



	CAR	I	VII	X	XI	Other Regions
Production (mt)	101,124.37	3,279.46	8,057.89	7,727.32	4,813.55	4,800.81

FIGURE 27. CABBAGE: YIELD, BY REGION, 2020 (PSA)

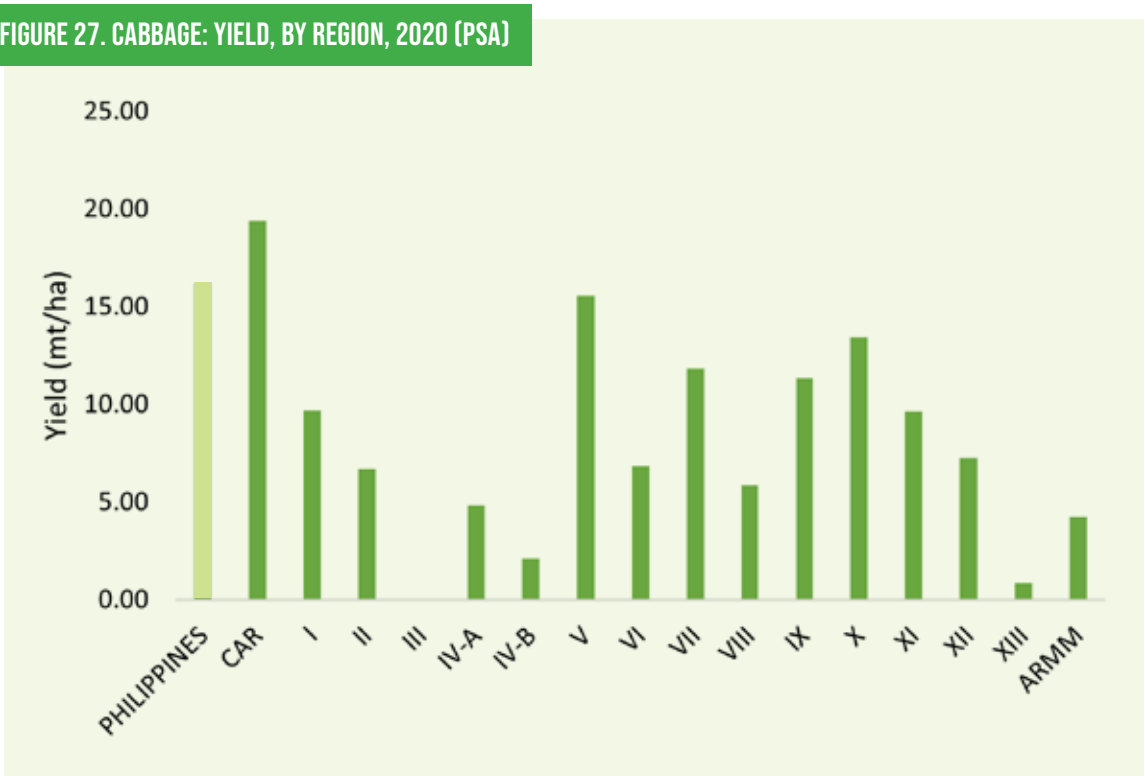


Table 18 shows the major producers of cabbage in the country in 2020. The list included Benguet (67%), Mountain Province (11%), Bukidnon (5%), Cebu (4%), and Davao del Sur (3%).

TABLE 18. TOP FIVE PROVINCES WITH HIGHEST VOLUME OF CABBAGE PRODUCTION, 2020 (PSA)

Province	Volume of Production (mt)	% Contribution the National Production
Benguet	86,820.67	67
Mountain Province	13,756.1	11
Bukidnon	6,483.5	5
Cebu	5,464.74	4
Davao del Sur	3,357.54	3

Chinese Cabbage. The trend in production of Chinese cabbage in the Philippines has been almost constant from 2011 to 2020. Although there is a slight decrease in terms of area from 3,742. 37 ha in 2011 to 3,57184 ha in 2020 at an average rate of 0.51, the average rate of production has increased by 0.19% from 50,581.21 mt in 2011 to 51,394 mt in 2020. The yield is also observed to increase at an average of 0.71% (Table 19).

TABLE 19. CHINESE CABBAGE: AREA PLANTED, PRODUCTION, AND YIELD, BY REGION, 2020

Region	Area (ha)	Ave % Growth*	Production (mt)	Ave % Growth*	Yield (mt/ha)	Ave % Growth*
PHILIPPINES	**3571.84**	**-0.51**	**51394.14**	**0.19**	**14.39**	**0.71**
CAR	2688.86	-0.41	44329.73	0.00	16.49	0.41
II	36.45	4.89	193.38	1.73	5.31	-2.38
III	5.31	-	10.87	-	2.05	-
IV-A	27.70	-2.15	137.16	-1.63	4.95	0.52
VII	357.18	-3.34	3466.59	0.76	9.71	4.80
VIII	0.50	-6.22	12.30	64.04	24.60	87.52
IX	10.50	0.66	70.86	-0.95	6.75	-1.36
X	284.33	2.62	2299.28	3.01	8.09	0.48
XI	100.70	0.51	529.50	3.07	5.26	2.57
XII	60.01	0.38	344.32	0.89	5.74	0.47

Source: PSA, *2011-2020

Not all regions produce Chinese cabbage because of its climatic requirements and adaptability to the area. Just like cabbage, most of the Chinese cabbages are grown in CAR with a contribution of 75% (2,688.86 ha) to the area planted and 44,329.73 mt (86%) in 2020. Other than CAR, the regions with significant contributions to area and production are Regions VII, X, XI, and XII, totaling 98% and 99%, respectively in 2020 (Figures 28 and 29).

FIGURE 28. CHINESE CABBAGE: AREA PLANTED, BY REGION, 2020 (PSA)

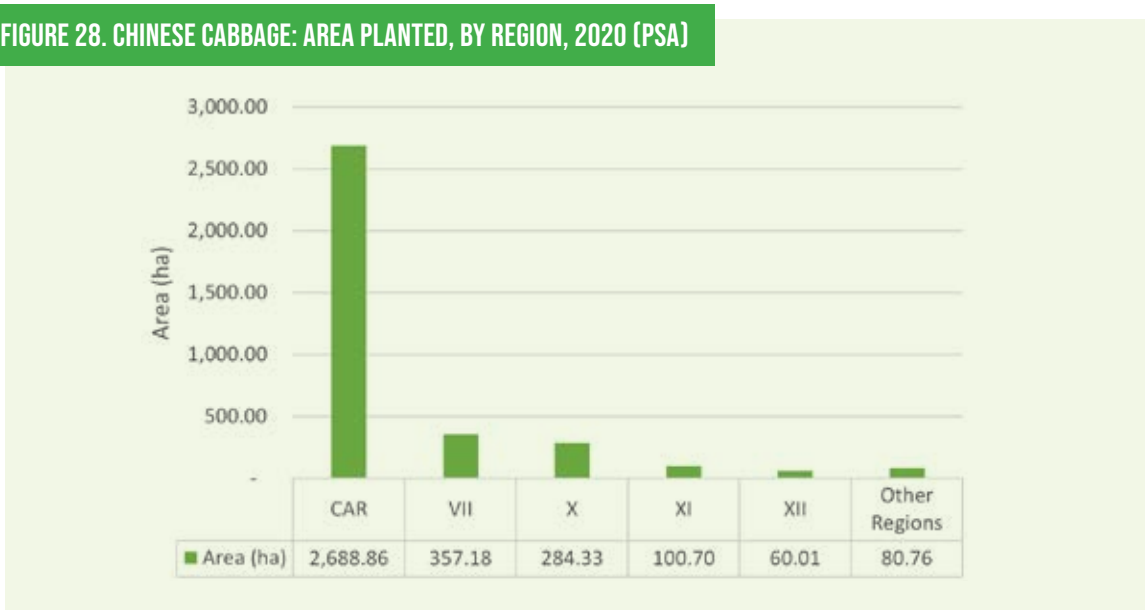
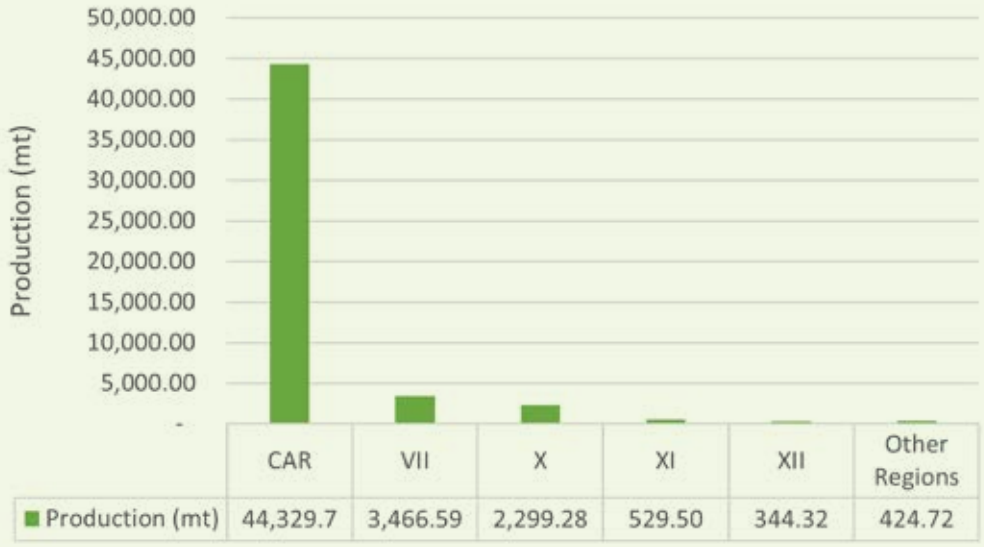
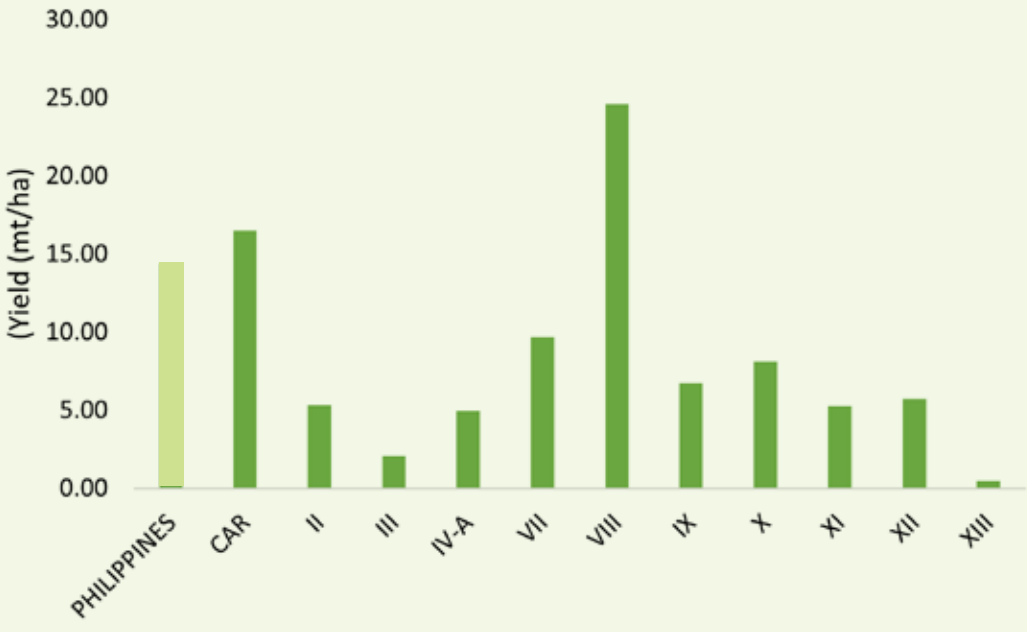


FIGURE 29. CHINESE CABBAGE: VOLUME OF PRODUCTION, BY REGION, 2020 (PSA)



In terms of yield, the national average yield of Chinese cabbage is 14.39 mt/ha in 2020. Region VIII recorded a yield of 24.60 mt/ha while CAR has 16.49 mt/ha, both which are higher than the national average. All the others are below the national average (Figure 30).

FIGURE 30. CHINESE CABBAGE: YIELD, BY REGION, 2020 (PSA)



The top five provinces which produced most of the Chinese cabbage in 2020 were Benguet (81%), Cebu (6%), Mountain Province (5%), Bukidnon (4%), and Davao del Sur (1%) (Table 20).

TABLE 20. TOP FIVE PROVINCES WITH HIGHEST VOLUME OF CHINESE CABBAGE PRODUCTION, 2020 (PSA)

Province	Volume of Production (mt)	% Contribution to the National Production
Benguet	41681.31	81
Cebu	3275.88	6
Mountain Province	2647.34	5
Bukidnon	2000.9	4
Davao del Sur	461.73	1

Carrots. The area and volume of production of carrots in the Philippines decreased from 2011 to 2020 at an average rate of 1.21% and 0.61%, respectively. The area planted to carrots went down from 4946.69 ha in 2011 to 4430.38 ha in 2020 while the level of production dropped from 67,161.65 mt in 2011 to 63,527.02 mt in 2020. Despite these decreases the average yield increased at a rate of 0.61% during the same period. The largest decline in terms of area and volume of production is observed in Region VII with an average of 9.42% and 14.56%, respectively. In terms of yield, Region IX has an average increase of 17.71% (Table 21).

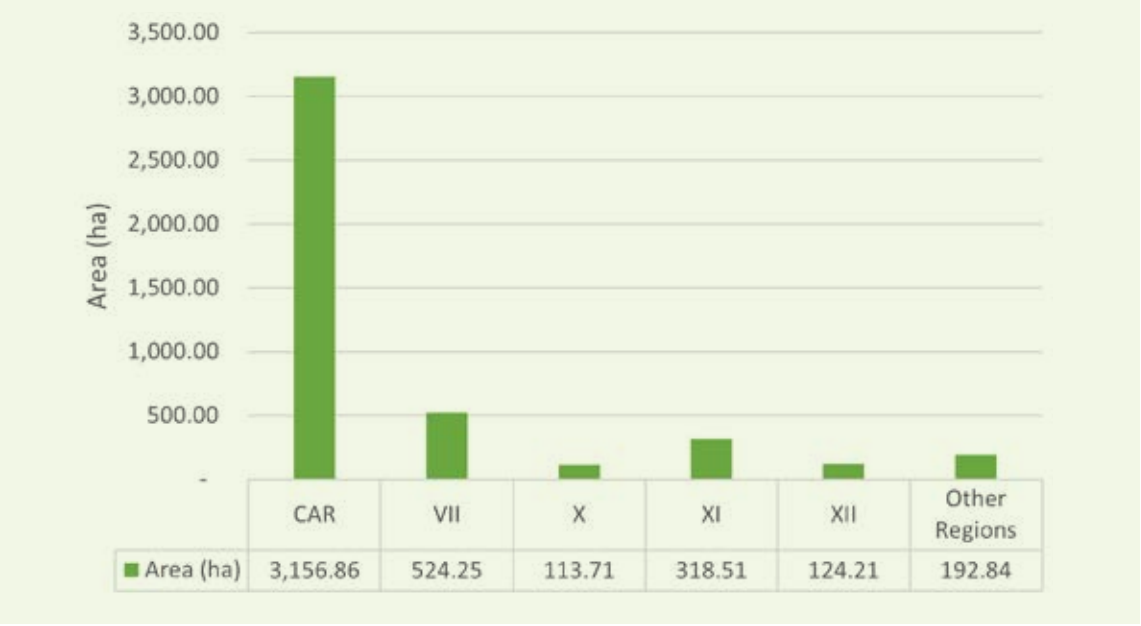
TABLE 21. CARROTS: AREA PLANTED, PRODUCTION, AND YIELD, BY REGION, 2020

Region	Area (ha)	Ave % Growth*	Production (mt)	Ave % Growth*	Yield (mt/ha)	Ave % Growth*
PHILIPPINES	**4430.38**	**-1.21**	**63527.02**	**-0.61**	**14.34**	**0.61**
CAR	3156.86	-0.68	56770.43	-0.37	17.98	0.31
II	92.49	-1.15	638.64	-1.05	6.90	0.04
IV-A	9.00	2.14	25.79	-5.75	2.87	-6.40
V	3.75	-2.78	5.03	-11.83	1.34	-10.18
VI	23.75	-0.15	153.53	0.43	6.46	0.60
VII	524.25	-3.05	2435.81	-5.64	4.65	-2.57
VIII	1.40	-9.42	1.40	-14.56	1.00	-5.64
IX	61.80	-4.47	322.06	12.09	5.21	17.71
X	113.71	-1.98	1291.44	0.29	11.36	2.34
XI	318.51	-1.40	1373.66	-0.29	4.31	1.17
XII	124.21	-1.73	507.08	0.99	4.08	2.91

Source: PSA, *2011-2020

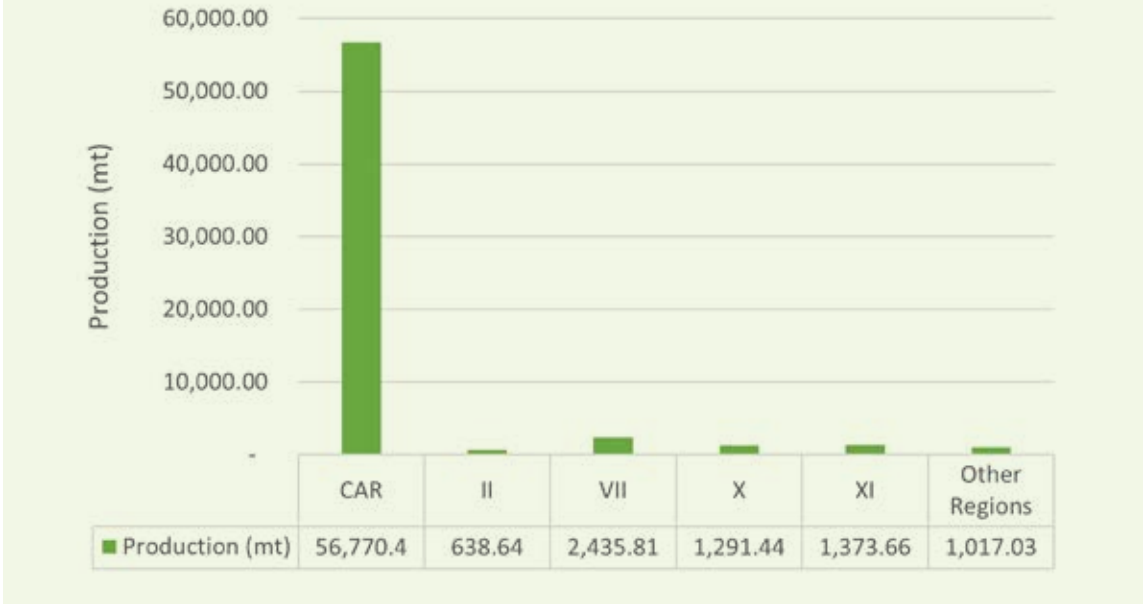
CAR has the largest contribution in terms of area planted to carrot and production in 2020 covering 3,156.86 ha (71%) while its production contributed 89% (56,770.43 mt) to the national total. Region VII ranks second to CAR with an area of 524.25 ha (12%) and production of 2,435.81 mt (4%). Other regions that produce carrots are Regions II, X, and XI. These five regions contributed 98% to the national production (Figure 31 and 32).

FIGURE 31. CARROTS: AREA PLANTED, BY REGION, 2020 (PSA)



	CAR	VII	X	XI	XII	Other Regions
Area (ha)	3,156.86	524.25	113.71	318.51	124.21	192.84

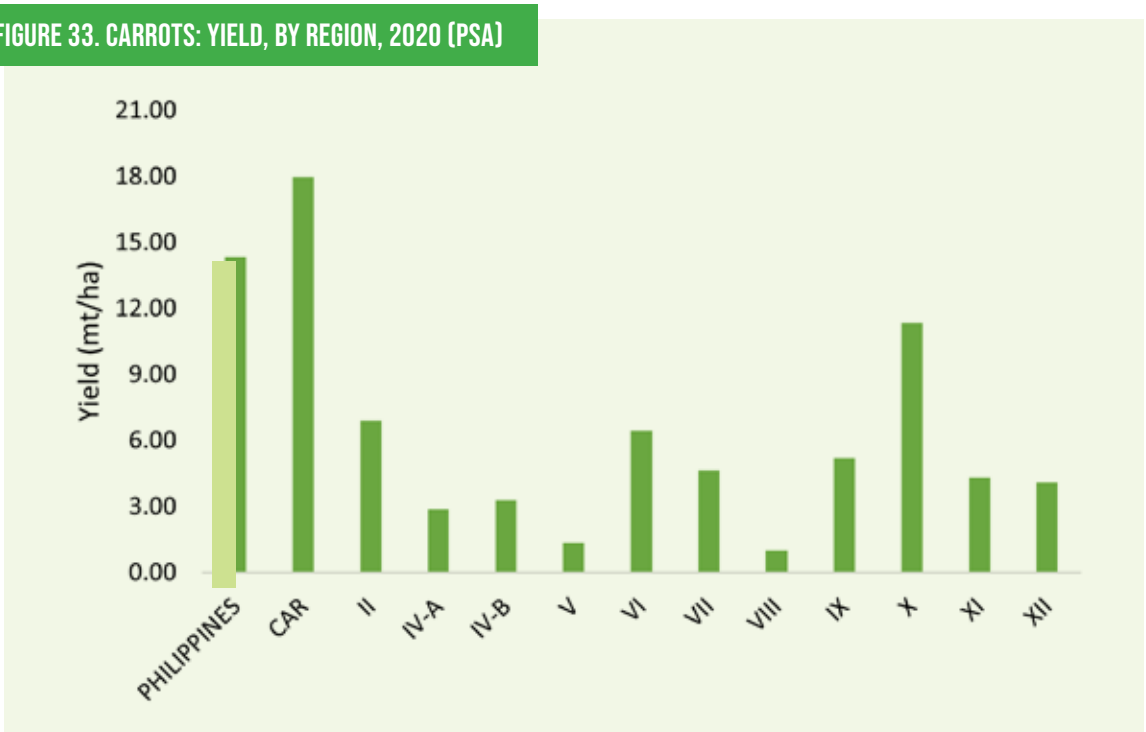
FIGURE 32. CARROTS: VOLUME OF PRODUCTION, BY REGION, 2020 (PSA)



	CAR	II	VII	X	XI	Other Regions
Production (mt)	56,770.4	638.64	2,435.81	1,291.44	1,373.66	1,017.03

The yield of carrots in CAR is 17.98 m/ha, which is higher than the national average of 14.34 mt/ha. Next to CAR with high yields are Region X (11.36 mt/ha), Region II (6.90 mt/ha), Region VI (6.46 mt/ha), and Region IX (5.21 mt/ha) (Figure 33).

FIGURE 33. CARROTS: YIELD, BY REGION, 2020 (PSA)



Benguet and Mountain Province contributed a total of 89% to the national production of carrots in 2020. Aside from these two, Negros Oriental, Davao del Sur, and Bukidnon, are among the top contributors in the country in 2020 (Table 22).

TABLE 22. TOP FIVE PROVINCES WITH HIGHEST VOLUME OF CARROT PRODUCTION, 2020 (PSA)

Province	Volume of Production (mt)	% Contribution to the National Production
Benguet	53,484.73	84
Mountain Province	2,888.33	5
Negros Oriental	1,252.35	2
Davao del Sur	1,240.33	2
Bukidnon	1,199.69	2

Snap beans. The area planted to snap beans decreased at an average rate of 2.18% from 3,631.98 ha in 2011 to 2,974.44 ha in 2020. The volume of production also decreased by an average of 1.52% from 15,425.93 mt in 2011 to 13,420.83 mt in 2020. While these are on a national scale, other regions have recorded an increase in terms of area and volume of production as well. The largest increase in area is recorded in Region IV-A at an average rate of 6.03% while the highest increase in production is recorded in Region IX at an average rate 17.51%. In terms of yield, ARMM has recorded an average increase of 18.46 during the same period (Table 23).

TABLE 23. SNAP BEANS: AREA PLANTED, PRODUCTION, AND YIELD, BY REGION, 2020

Region	Area (ha)	Ave % Growth*	Production (mt)	Ave % Growth*	Yield (mt/ha)	Ave % Growth*
PHILIPPINES	**2974.44**	**-2.18**	**13420.83**	**-1.52**	**4.51**	**0.68**
CAR	967.59	-3.11	6712.08	-1.83	6.94	1.35
I	144.75	-1.79	371.29	1.67	2.57	3.80
II	542.49	-2.67	2156.68	-4.98	3.98	-2.25
III	14.50	-7.08	43.95	-0.67	3.03	7.56
IV-A	114.11	6.03	326.06	8.26	2.86	2.10
IV-B	0.81	-	3.41	-	4.21	-
V	238.05	0.85	667.63	-1.70	2.80	-2.61
VI	38.74	2.19	155.31	1.74	4.01	-0.47
VII	442.46	-2.79	1432.03	4.56	3.24	7.98
VIII	73.50	-7.55	247.75	-6.80	3.37	1.50
IX	35.10	-7.39	192.69	17.51	5.49	32.35
X	108.12	1.83	656.99	1.31	6.08	-0.48
XI	153.92	1.97	182.71	3.52	1.19	1.72
XII	77.00	2.93	223.39	0.12	2.90	-2.72
XIII	22.29	1.75	43.80	9.45	1.97	6.97
ARMM	1.00	-11.99	5.05	0.44	5.05	18.46

Source: PSA, *2011-2020

The top five regions with largest areas planted to snap beans in 2020 are CAR with 967.59 ha (33%), Region II with 542.49 ha (18%), Region VII with 442.46 ha (15%), Region V with 238.05 ha (8%), and Region XI with 153.92 ha (5%). These contributed a total of 79% to the total area in the country (Figure 34). In terms of production, CAR also has the highest volume of production with 6,712.08 mt or 50%. It is then followed by Region II (2,156.68 mt or 16%), Region VII (1,432.03 mt or 11%), Region V (667.63 mt or 5%), and Region X (656.99 mt or 5%). These regions contributed a total of 87% to the national production in 2020 (Figure 35).

FIGURE 34. SNAP BEANS: AREA PLANTED, BY REGION, 2020 (PSA)

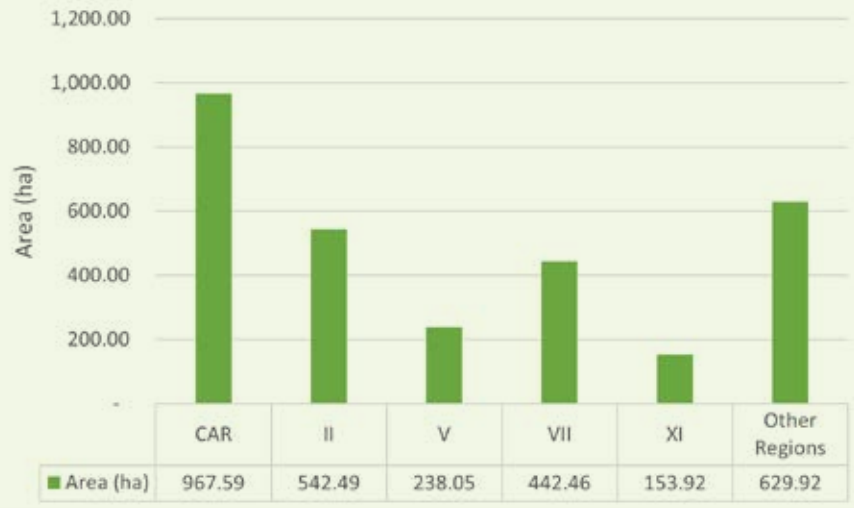
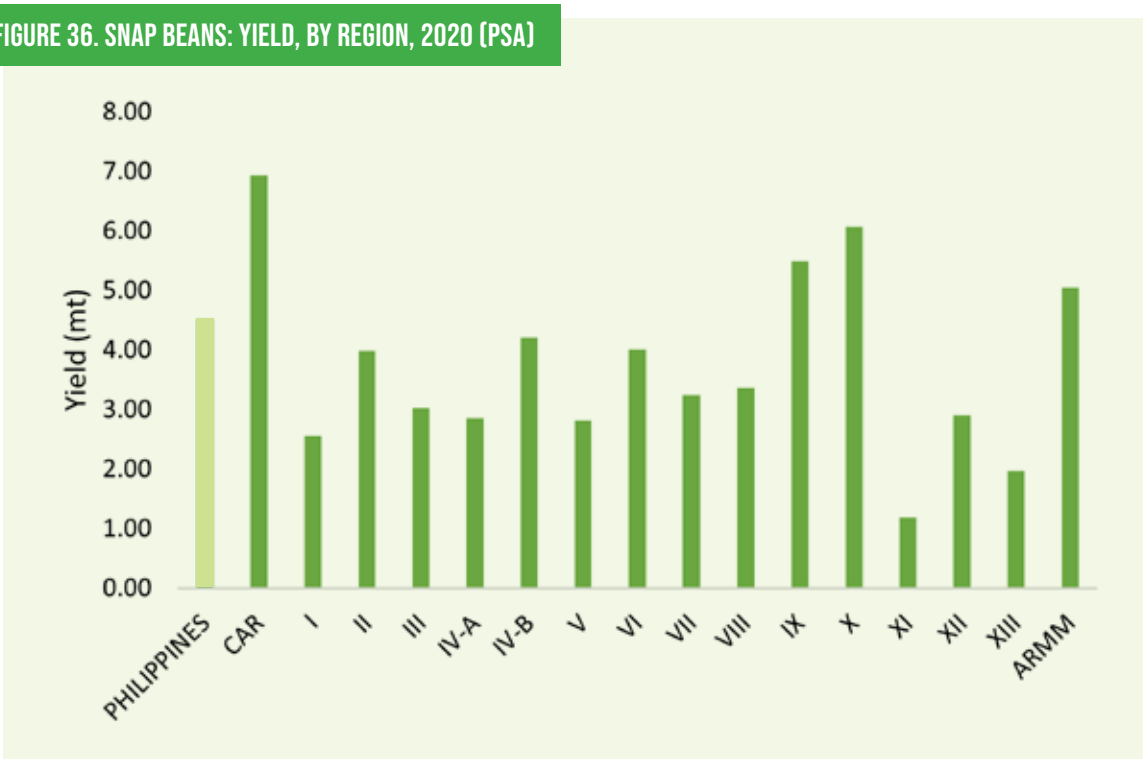


FIGURE 35. SNAP BEANS: VOLUME OF PRODUCTION, BY REGION, 2020 (PSA)

The yield of snap beans in CAR (6.94 mt/ha) in 2020 was higher than the national average yield of 4.51 mt/ha. Other regions which have higher yields than the national average are Region X (6.08 mt/ha), Region IX (5.49 mt/ha) and ARMM (5.05 mt/ha) (Figure 36).

FIGURE 36. SNAP BEANS: YIELD, BY REGION, 2020 (PSA)



Benguet is the top producer of snap beans in 2020 with 2,982 mt or 22% of the national production. Nueva Vizcaya ranked second with 2,047.74 mt or 15% while the least was Mountain Province (3%) (Table 24).

TABLE 24. TOP FIVE PROVINCES WITH HIGHEST VOLUME OF SNAP BEANS PRODUCTION, 2020 (PSA)

Province	Volume of Production (mt)	% Contribution to the National Production
Benguet	2982	22
Nueva Vizcaya	2047.74	15
Cebu	1137.06	8
Ifugao	921.87	7
Mountain Province	394.61	3

Potato. Potatoes are grown in at least six regions in the country namely, CAR, Regions II, VII, X, XI, and XII. From 2011 to 2020, the area planted to potato decreased at an average rate of 1.37% (from 8,170.95 ha to 7,212.61 ha) while the volume of production also decreased at an average rate of 0.66% (from 120,573.73 mt to 113,562.36 mt). Region VII recorded the largest drop in area and production with an average rate of 14.14% and 11.98%, respectively (Table 25).

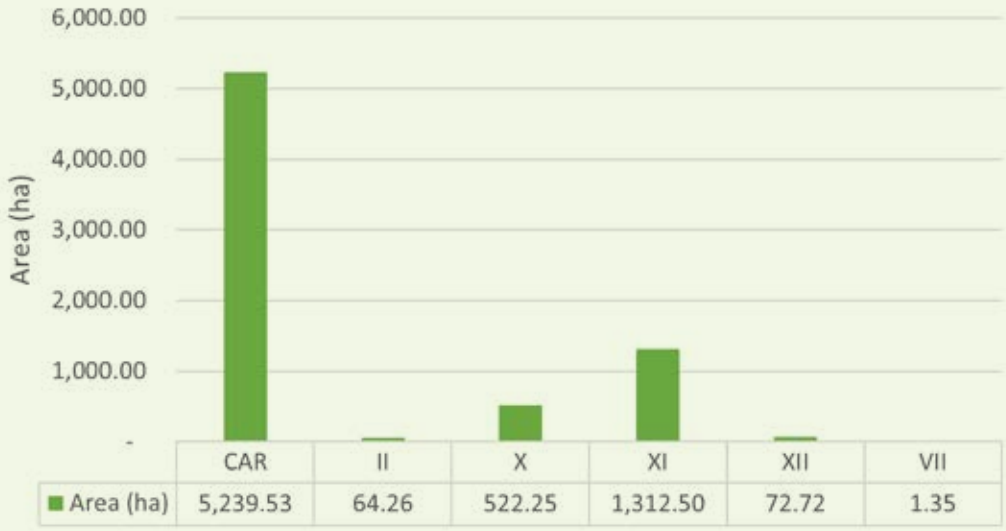
TABLE 25. POTATO: AREA PLANTED, PRODUCTION, AND YIELD, BY REGION, 2020

Region	Area (ha)	Ave % Growth*	Production (mt)	Ave % Growth*	Yield (mt/ha)	Ave % Growth*
PHILIPPINES	**7212.61**	**-1.37**	**113562.36**	**-0.66**	**15.74**	**0.73**
CAR	5239.53	-1.68	94380.54	-0.97	18.01	0.74
II	64.26	-0.72	467.78	0.70	7.28	1.43
VII	1.35	-14.14	1.37	-11.98	1.01	-6.15
X	522.25	-0.73	6278.45	-0.76	12.02	-0.01
XI	1312.50	-0.14	11793.66	2.35	8.99	2.50
XII	72.72	-0.18	640.55	1.04	8.81	1.23

Source: PSA, *2011-2020

CAR contributed a total land area of 5,239.53 (73%) and volume of 94,380.54 mt (83%) to the national data in 2020. The yield in CAR was also higher than the national average at 18.01 mt/ha and 15.74 mt/ha. Following CAR is Region XI with land area of 1,312.50 ha (18%) and volume of 11,793.66 mt (10%). Minimal contributions in area planted and volume of production were noted for other (Figures 37 - 39).

FIGURE 37. POTATO: AREA PLANTED, BY REGION, 2020 (PSA)

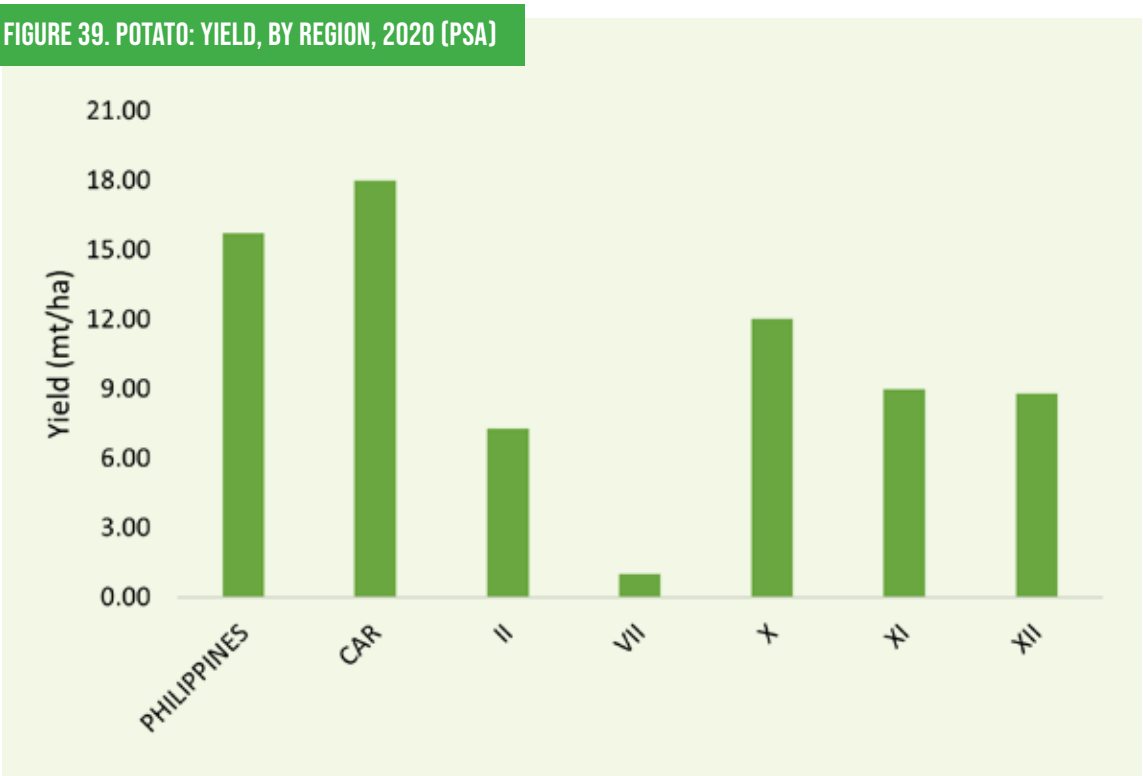


	CAR	II	X	XI	XII	VII
Area (ha)	5,239.53	64.26	522.25	1,312.50	72.72	1.35

FIGURE 38. POTATO: VOLUME OF PRODUCTION, BY REGION, 2020 (PSA)

	CAR	II	X	XI	XII	VII
Production (mt)	94,380.5	467.78	6,278.45	11,792.6	640.55	1.37

FIGURE 39. POTATO: YIELD, BY REGION, 2020 (PSA)



Most of the potato produced in the country in 2020 came from Benguet with 84,997.87 mt (75%). Davao del Sur produced 11,779.06 mt or 10%. Mountain Province produced 93,447.98 mt (8%) while Bukidnon produced 6,278.45 mt or 6% of the total (Table 26).

TABLE 26. TOP FIVE PROVINCES WITH HIGHEST VOLUME OF POTATO PRODUCTION, 2020 (PSA)

Province	Volume of Production (mt)	% Contribution to the National Production
Benguet	84997.87	75
Davao del Sur	11779.06	10
Mountain Province	9347.98	8
Bukidnon	6278.45	6
Nueva Vizcaya	463.88	<1

Domestic Consumption (Per Capita Consumption) of Vegetables

Status of Vegetable Consumption in the Philippines

For three years, the mean per capita intake of vegetables did not significantly improve from 123 grams in 2015 to 126 grams in 2018, as revealed by the 2018-2019 Expanded National Nutrition Survey (ENNS) of the Department of Science and Technology – Food and Nutrition Research Institute (DOST-FNRI). At the household level, consumption of vegetables declined from 496 grams in 2015 to 468 grams in 2018-2019. The 2018 ENNS showed that food-insecure households had higher consumption of vegetables at 470.7 grams or 15.3% of the total food intake, while those food-secure consumed 434.2 grams, equivalent to 14.4% of total food intake.

In another study conducted by Digal in 2005, as cited by JICA, 2019, the per capita consumption of vegetables among Filipinos (107 g/capita/day) increased at an annual rate of 1.6% per year from 2005 to 2013 (177g/capita/day). The increase, according to JICA (2019), can be attributed to the improving economic conditions, rapid urbanization and increasing consciousness of healthy food consumption among Filipinos. But these values still fall short of the World Health Organization (WHO) recommendation of 200 g/capita/day.

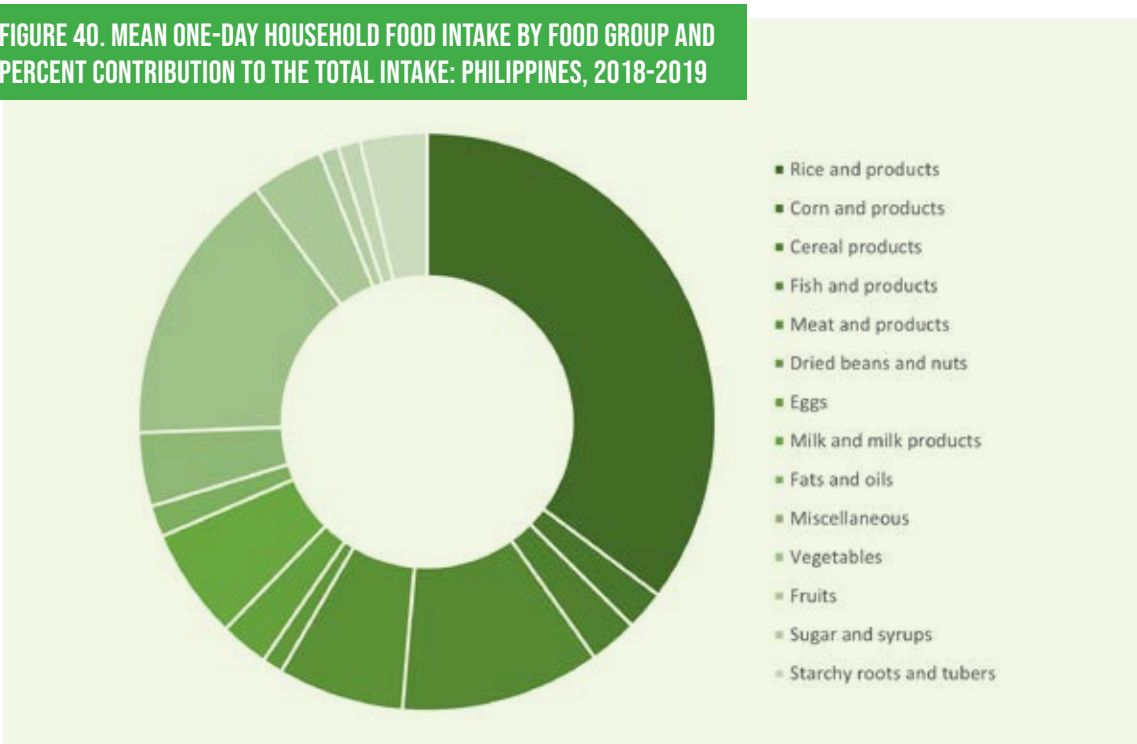
According to the food consumption survey at the household level as part of the Expanded National Nutrition Survey (ENSS) in 2019, the mean one-day household food intake of a person was at 3,021 g. Table 27 and Figure 40 show the breakdown of food intake, disaggregated by food group. This revealed that more than one-third (35.2%) of the food intake came from the rice and other rice products food group. Vegetable consumption is at 468 g/day or 15.5% of the total food intake, although the list of vegetables which belonged to this group were not mentioned. Rice, vegetables, fish (11.2%), meat (7.1%), and milk (6.2%) were the most consumed food groups in 2019.

TABLE 27. MEAN ONE-DAY HOUSEHOLD FOOD INTAKE BY FOOD GROUP AND PERCENT CONTRIBUTION TO THE TOTAL INTAKE: PHILIPPINES, 2018-2019

FOOD GROUP	FOOD INTAKE (g)	% CONTRIBUTION TO TOTAL INTAKE
Rice and products	1064	35.2
Corn and products	67	2.2
Cereal products	82	2.7
Fish and products	339	11.2
Meat and products	213	7.1
Dried beans and nuts	35	1.2
Eggs	82	2.7
Milk and milk products	188	6.2
Fats and oils	53	1.8
Miscellaneous	125	4.1
Vegetables	468	15.5
Fruits	122	4.0
Sugar and syrups	32	1.1
Starchy roots and tubers	38	1.3
Poultry	113	3.7
TOTAL	**3021**	**100**

Source: DOST-FNRI, 2021

FIGURE 40. MEAN ONE-DAY HOUSEHOLD FOOD INTAKE BY FOOD GROUP AND PERCENT CONTRIBUTION TO THE TOTAL INTAKE: PHILIPPINES, 2018-2019



Pinggang Pinoy Recommendations

Pinggang Pinoy is a tool developed by the DOST-FNRI to assess how the Filipinos consume healthy meals on a daily basis. The FNRI recommends that each healthy meal should be composed of 33% rice, 33% vegetables, 17% meat, and 17% fruit. In a 2019 ENNS, the average daily food intake is composed of 35.2% rice, 15.5% vegetables, 22% meat, and 4.0% fruits. These figures show that the Filipinos consumed the right amounts of calories, which they get mainly from rice. They also get the right amounts of protein from meat including fish and poultry. However, there is a deficit in the actual consumption of fruits and vegetables at a rate of 17.5% and 13% (Table 28). This shows the need to further promotion activities on vegetable consumption among the Filipino households.

TABLE 28. THE PINGGANG PINOY RECOMMENDATIONS AND THE MEAN DAILY INTAKE, BY FOOD GROUP, 2019

FOOD GROUP	PINGGANG PINOY RECOMMENDATION (%)	ACTUAL FOOD INTAKE (%)	DIFFERENCE (Actual – Recommended) (%)
Rice	33	35.2	2.2
Vegetables	33	15.5	-17.5
Meat	17	22% *	5
Fruits	17	4.0	-13

*including fish and poultry

A JICA study in 2013 forecasted that vegetable consumption in the Philippines will increase from 63.7 kg/capita (data from FAO) to 85 kg/capita by 2040. Table 29 shows the results of the study which also shows that the demand for vegetables and vegetable consumption is positively correlated to the increase in population over time.

TABLE 29. FORECAST OF POPULATION, VEGETABLE CONSUMPTION, AND DEMAND IN THE PHILIPPINES, 2013-2040

YEAR	POPULATION	ESTIMATED VEGETABLE CONSUMPTION PER CAPITA (kg/year)	ANNUAL DEMAND (ton)
2013	98,481,032	63.7	6,270,287
2014	100,102,249	64.5	6,455,186
2015	101,716,359	65.3	6,642,267
2016	103,320,222	66.1	6,831,303
2017	104,918,090	66.9	7,022,556
2020	109,947,900	69.4	7,628,348
2025	117,959,400	73.5	8,665,429
2030	125,337,500	77.5	9,718,763
2035	131,903,900	81.6	10,766,045
2040	137,532,200	85.7	11,786,510

Source: FAO, JICA, World Bank, PSA, PwC analysis

Consumption Pattern

The demand for vegetables is positively correlated with the increasing population and economic growth. Among the Philippine regions, the National Capital Region (NCR), Region III, and Region IV-A are the most populated and most economically progressive. The country's gross domestic product (GDP) per capita in December 2017 was PhP82,592.00 as compared to that of Region IV-A, Region III, and NCR with GDP per capita of PhP99,328.00, PhP83,044.00, and PhP244,453.00, respectively, all of which are higher than the national average. This has driven the establishment of more fast-food restaurants and supermarkets, thus, increasing the demand for vegetables (JICA, 2019).

The consumption of vegetables can be disaggregated by type and location. Table 30 shows the most consumed vegetables by location (PSA, 2017). The table shows a demographic pattern of consumption rather than economic. For instance, some regions also have preference for certain types of vegetables, i.e., lowland 'pinakbet' vegetables are more preferred in Region I while the highland 'chopsuey' vegetables are more preferred in NCR and CALABARZON (JICA, 2019).

The 2015 NNS and 2018 ENNS showed that household vegetable consumption was higher in rural dwellers than in urban dwellers. The amount of vegetables consumed among rural residents was 574 grams in 2015, 16.9% of the total food consumption, and 513 grams in 2018, 16.7% of the total food consumption. The amount of vegetables consumed in 2015 among urban residents is 406 grams or 11.9% of total consumption, and in 2018 this group consumed 378 grams or 12.3% of the total food consumed.

TABLE 30. VEGETABLE CONSUMPTION BY LOCATION, 2017

LOCATION	TYPE	CONSUMPTION (kg/year)
NCR	Eggplant	>3 kg
	Tomato	
	Ampalaya	2.07–2.77
	Chayote	
	Cabbage	
	Onion	
Eastern Manila District	Chayote	4.13
	Squash	2.26
	Carrots	1.48
Northern Manila District	Ampalaya	3.32
	Cabbage	2.97
	Tomato	4.19
Southern Manila District	Gourd	1.32
	Snap beans	0.36
	Mungbean	1.39
CAR	Chayote	5.76
	Eggplant	4.50
	Tomato	4.18
Region I	Eggplant	5.96
	Tomato	6.00

Source: Adapted from JICA, 2019

Promotion of Vegetable Consumption in the Philippines

Increasing evidence shows that consuming fruits and vegetables prevents weight gain and reduces the incidence of Type 2 diabetes and the risk of cancer, certain eye diseases, dementia, and osteoporosis. Thus, in many of the advocacy campaigns for vegetable consumption in the nutrition and health sector, the focus is to prevent NCDs and excessive weight gain. The NNC, together with its member agencies such as the DOH, DOST, and DepEd, are active in promoting Guideline No. 3 of the 2012 Nutritional Guidelines for Filipinos using various platforms indicated in the next part of this paper. More so, as NGF was dubbed into Filipino language as 10 Kumainments, the No. 3 guideline is "Kumain ng gulay at prutas araw araw."

The concept of "food security" is defined as including physical and economic access to food that meets people's dietary needs, as well as their food preferences. Even then, still, economic drivers typically reduce the diversity of food available for Filipinos, especially the poor, who are also nutritionally vulnerable. Thus, more and more Filipinos are suffering from hidden hunger on top of physical hunger. The need for micronutrients that can be sourced from vegetables can address hidden hunger and, ultimately, malnutrition.

Vegetable production and consumption can create employment and generate income, especially among the poor, while at the same time providing the much-needed micronutrients for the body and antioxidants and phytochemicals that may protect people against non-communicable diseases. Nevertheless, the consumption of vegetables at the national level remains below the expected minimum of 2 to 3 cups of vegetables equivalent to an estimated amount of 300 to 400 grams per day, with the urban population and the poor population lagging.

Trade (Import and Export)

Table 31 shows the amount and value of imports and exports of selected vegetables in the Philippines from 2015-2020. Among the vegetables, carrots, potatoes, and cabbages were imported. Most of the carrots were imported from China, USA, and France; potatoes were imported from Belgium, USA, and the Netherlands; and cabbages were imported from China. On the other hand, okra, squash, potatoes, and eggplant were exported. Potatoes were exported to UAE and Myanmar; okra to Japan, Hongkong, and Singapore; eggplant to Sweden, Bahrain, and Qatar; and squash to Hongkong and UAE.

TABLE 31. AMOUNT AND VALUE OF IMPORTS AND EXPORTS OF SELECTED VEGETABLES IN THE PHILIPPINES, 2015-2020 (PSA)

IMPORTS				EXPORTS			
Commodity	Year	Gross Weight (kg)	Value (USD)	Commodity	Year	Gross Weight (kg)	Value (USD)
Carrots	2015	76,875.38	144,700.00	Potatoes	2015	336.00	479.00
	2016	319,444.59	647,014.00		2017	2,194.00	4,174.00
	2017	359,055.48	605,118.00		2019	26,971.00	34,558.00
	2018	463,295.63	7,367.00	Okra	2016	5,060,827.00	13,250,690.00
	2019	453,005.40	787,367.00		2017	4,943,758.00	13,419,574.00
	2020	379,502.04	761,154.00		2018	5,753,869.00	15,921,068.00
Potatoes	2015	85,245,711.33	64,012,729.00		2019	6,758,283.80	18,730,435.00
	2016	105,516,075.78	84,335,348.00		2020	5,054,009.49	14,706,528.00
	2017	144,275,478.92	121,578,664.00	Eggplant	2019	290.05	779.00
	2018	147,379,034.84	129,283,074.00		2020	11.20	26.00
	2019	162,754,479.29	145,938,603.00	Squash	2017	16,574.21	48,807.00
	2020	127,520,159.85	102,293,838.00		2018	39,666.00	44,674.00
Cabbage	2015	21,660.00	72,123.00		2019	47,026.89	62,702.00
	2016	96,260.00	262,458.00		2020	42,655.56	48,841.00
	2017	80,544.50	662,753.00				
	2018	92,111.20	1,113,875.00				
	2019	43,653.60	417,206.00				
	2020	95,957.69	1,406,198.00				

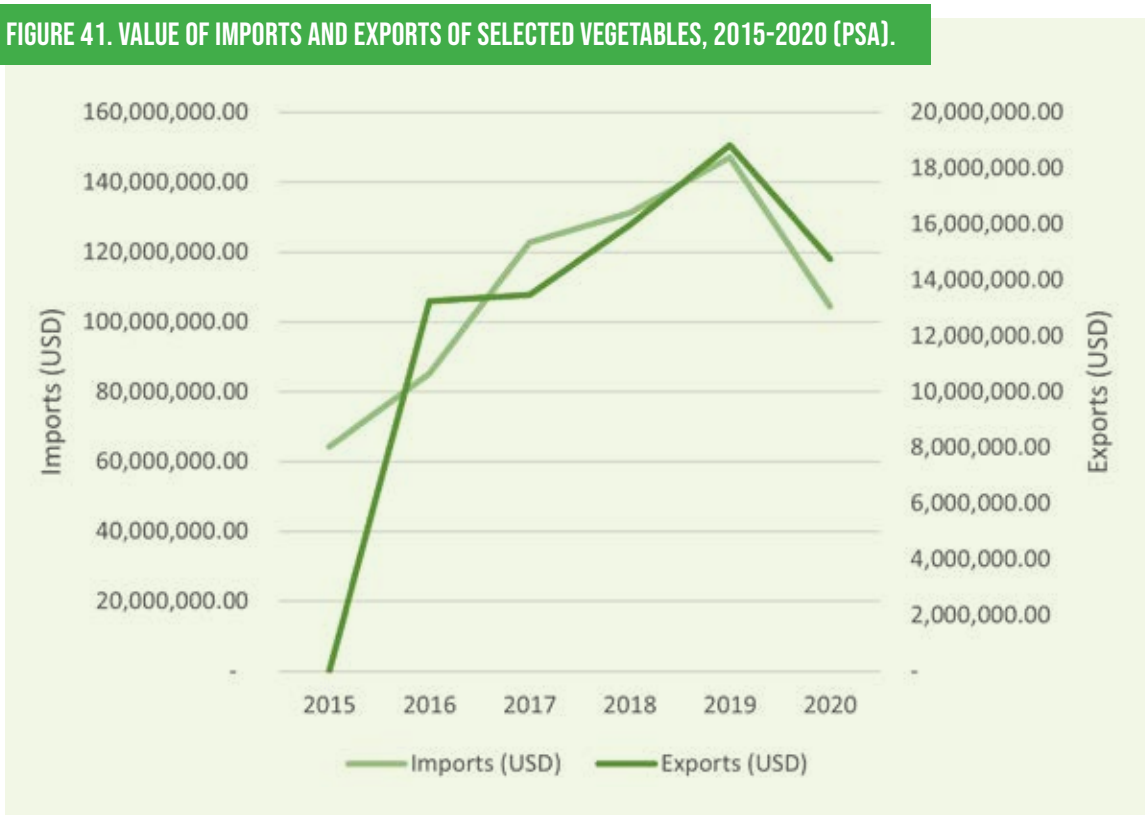
Table 32 and Figure 41 show the value of exports and imports of selected vegetables. This indicates a widening gap between the demand and supply of vegetables produced locally. Sharp fluctuations in the trend in exports are also observed during the period which implies a need to strengthen vegetable exportation.

TABLE 32. VALUE OF SELECTED VEGETABLE EXPORTS AND IMPORTS, 2015-2020 (PSA)

Year	Exports* (USD)	Imports** (USD)
2015	479.00	64,229,552.00
2016	13,250,690.00	85,244,820.00
2017	13,472,555.00	122,846,535.00
2018	15,965,742.00	131,184,316.00
2019	18,828,474.00	147,143,176.00
2020	14,755,395.00	104,461,190.00

*Exported vegetables: potato, okra, eggplant, pumpkins, squash, and gourds
** Imported vegetables: carrots, potato, cabbage

FIGURE 41. VALUE OF IMPORTS AND EXPORTS OF SELECTED VEGETABLES, 2015-2020 (PSA).



Market Segments and Channels

The marketing of lowland and highland vegetables is composed of several channels, from the input supplier to the farm (producer) to the final consumer. Before the produce reaches the final consumer, the vegetables are transported several times and undergo some processes such as sorting, cleaning, processing, packing, storage, and distribution before reaching the supermarkets, institutional buyers, and other wholesalers, retailers, and traders. The same case is also applicable to highland vegetables, only the location differs.

Prices

Figure 42 shows the average monthly wholesale prices of vegetables. All vegetables reflect almost constant prices from January to August which started to increase from September to December. However, the average monthly prevailing retail prices do not follow the same trend. Retail prices were highly fluctuating all throughout the year (Figure 43). According to the Nueva Vizcaya Agricultural Terminal (NVAT), the prices were affected by the law of supply and demand, with the following conditions:

- If the supply is low and the demand is high, the price is high.
- If the supply is high and the demand is low, the price is low.
- If the supply is high and the demand is high, the price is average.
- If the supply is low and the demand is low, the price is average.

Other factors that contribute to price differences are bad weather condition, overproduction, poor postharvest handling, old stock/sleep (or products which were not sold within 24 hours), few buyers coming in, and traffic in the national highway. On the other hand, the factors that determine the daily prices in the terminal (NVAT) are the price from the previous day's sale, supply and demand, quality of vegetables (e.g., texture, size, packaging, sorting), and that the fact that big buyers usually start to buy at a lower price then increase their buying price later just to complete their intended load.

FIGURE 42. MONTHLY WHOLESALE PRICE OF SELECTED VEGETABLES, 5-YEAR AVERAGE (PSA)

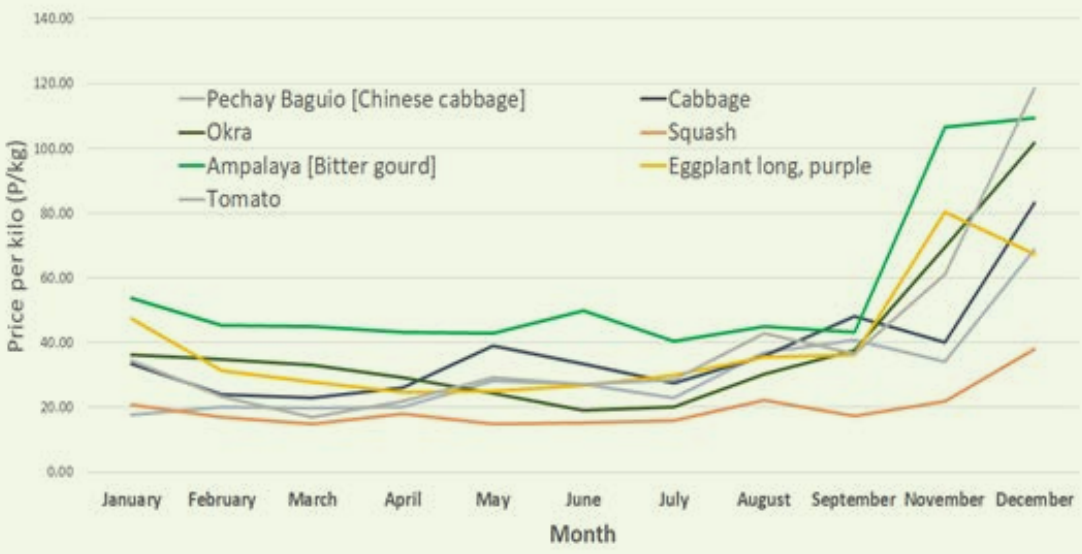
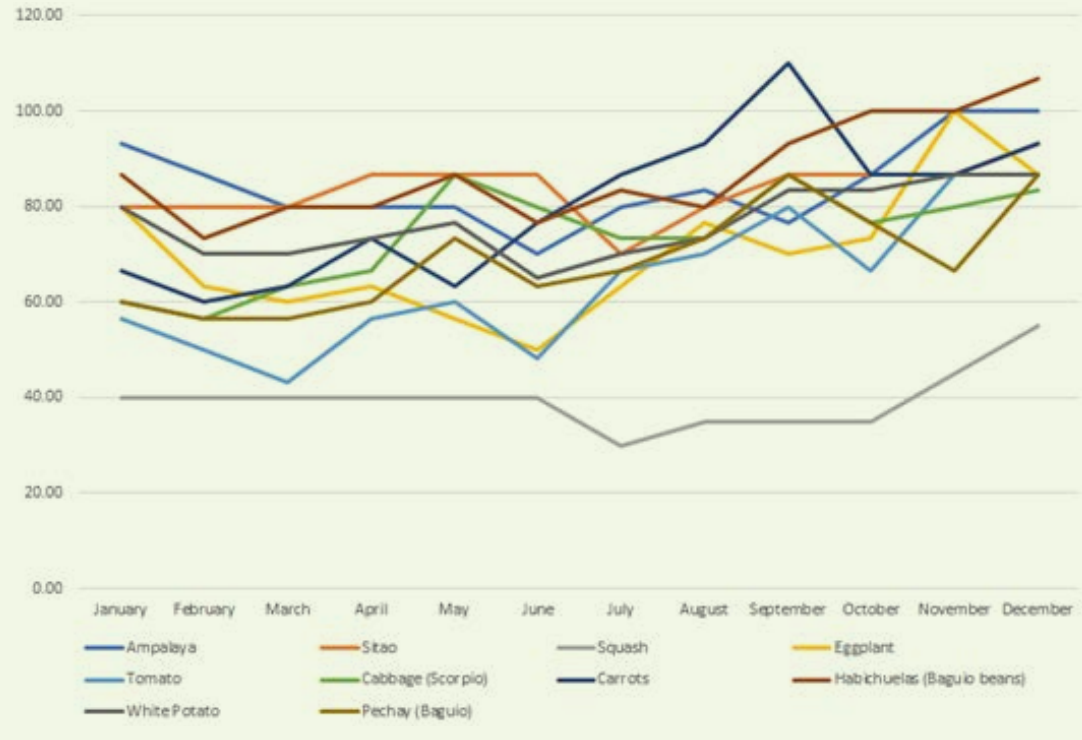


FIGURE 43. MONTHLY PREVAILING RETAIL PRICES OF SELECTED VEGETABLES, 3-YEAR AVERAGE (2018-2020) (DA-AMAS)



Based on the data on production costs and farm gate prices, farmers are getting good income from the different lowland vegetables: PhP10.11/kg from ampalaya, PhP5.36/kg from eggplant, PhP12.87/kg from sitao and PhP5.41/kg from tomato. However, looking at the wholesale and retail prices, the other actors in the supply chain are getting more per kilo per unit time. To increase farmer's income, they must get involved further up the supply chain.

ANALYSIS OF THE VEGETABLE INDUSTRY

Supply/Value Chain Analysis

The Vegetable Supply Chain

The value chain map of vegetables shown in Figure 44 identifies the actors, tasks and functions, locations, and the business enabling environment along the value chain. The actors along the input provision are the input suppliers, including seeds, fertilizers, pesticides, agri-plastics, machineries, irrigation facilities, among others. Input suppliers are responsible for supplying all the required inputs to the farmers and other stakeholders. They are usually located within the farming community or the nearest town/ municipality.

On the other hand, the actors along the production chain include farmers, contracted vegetable growers, corporate farms, cooperatives, rice and coconut farmers who are practicing diversification, and school and urban garden operators. They are responsible for the management of the crops including fertilizer application, irrigation, pest and disease management, harvesting, sorting, packaging, and transport.

For the postharvest and processing chain, the actors include the community-level and/ or commercial processors, manufacturers, transport and logistic service providers, plastic crate, and other packaging manufacturers. They are responsible for sorting and grading, cleaning, processing, storage, and distribution.

For the trading and marketing chain, the actors include major trading centers, wholesalers, wholesalers-retailers, wholesalers-traders, viajeros, disposers/ facilitators, and assemblers-wholesalers. They are responsible for hauling, (re)assembling, (re) sorting, (re) packing, and storage.

The providers of the business enabling environment for the value chains include the government and private sectors which include but are not limited to the following: Department of Agriculture (DA), Department of Science and Technology (DOST), State Universities and Colleges (SUCs), Financial Institutions, Industry Associations, and the Department of Trade and Industry (DTI), among others.

FIGURE 44. VALUE CHAIN MAP OF VEGETABLES

	INPUT PROVISION	PRODUCTION	POSTHARVEST / PROCESSING / TRANSPORT	TRADING / MARKETING	CONSUMPTION
ACTORS	Agricultureal Input Supply Store (seeds / seedlings, agro-chemicals, land preparation service providers, etc.), Irrigation facilities, Machineries supplier, Agri-plastics, etc	Contracted Vegetable growers, Farmers, Corporate farms, Cooperatives, Rice and coconut farmers (for diversification), Urban and school garden operators	Processors (community-level or commercial), manufacturers, Transport Service Providers, Plastic crates and packaging manufacturers	Major Trading Centers (BAPTC, NVATm Sariaya TP, etc.), Wholesalers, Wholesale-retailers, Wholesale-traders, Viajeros, Disposers / facilitators, Assembler-wholesagers	Consumers
TASKS / FUNTIONS	Seed / seedling production and distribution, Buying and selling of inputs	Fertilizer application, Pest and disease management, Irrigation, Harvesting, Hauling, Sorting, Packing, Transport	Sorting, Cleaning, Processing, Storae, Distribution	Hauling, (Re) Assembling, (Re)sorting, (Re) packing, Storage	Consumption, Storage
LOCATIONS	Farm Community	Farms, Urban gardens, Community gardens, School gardens	Processing and / or storage facilities	Trading Posts/ Centers, Supermarkets, Institutional Buyers, Divisoria, Balintawak, Wet Markets, Groceries	Household Other countries (Export)
BUSINESS ENABLING ENVIRONMENT	DA, DOST, SUCs (RDE), Crop Insurance and Financial Institutions, NIA	DA Bureau and Agenciesm DOST, SUCs (RDE), Crop Insurance and Financial Institutions, Industry Associations	DA, DOST, SUCs (RDE), Logistic Service Providers	DA, DTI	DTI

Lowland Vegetables Value Chain

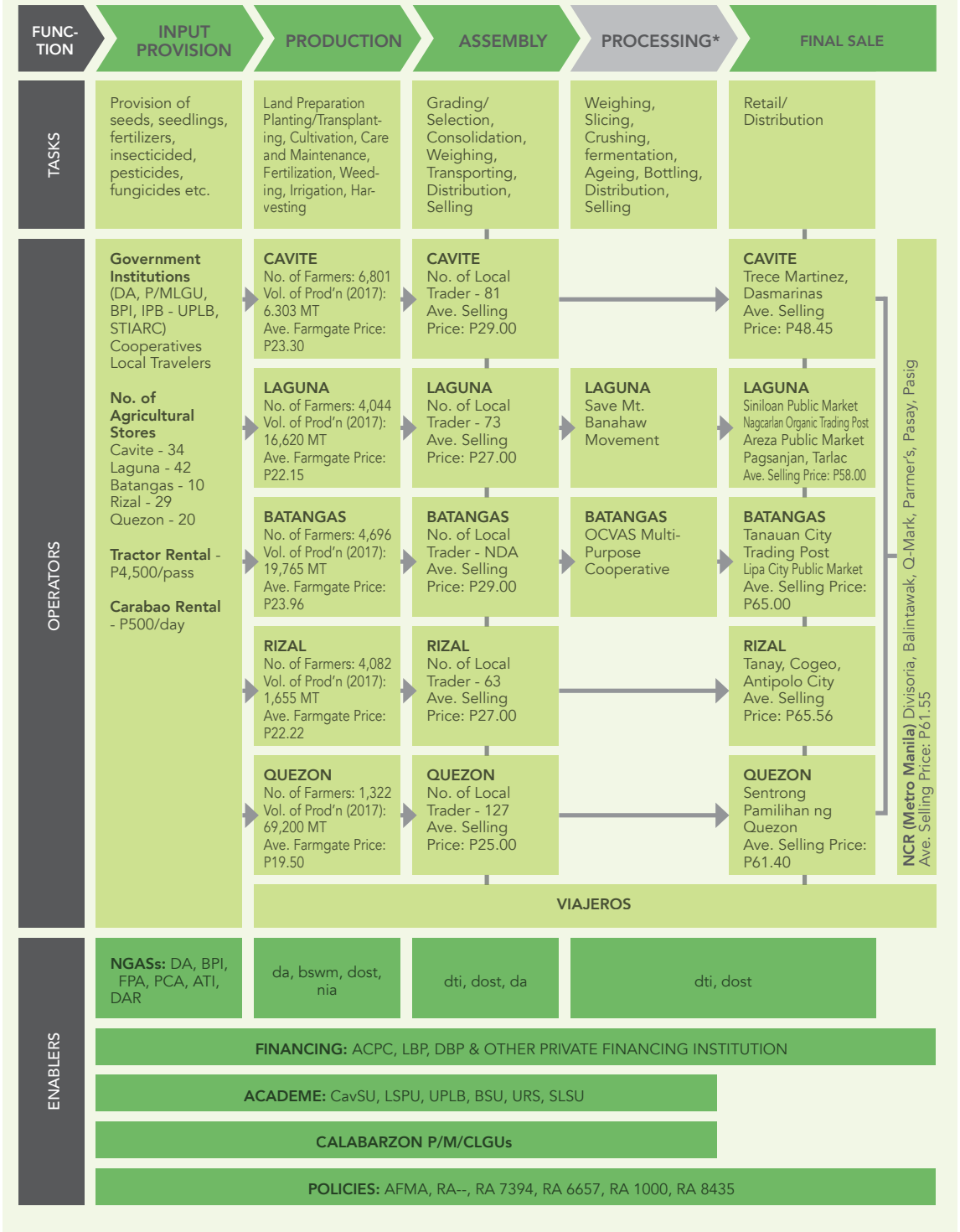
Lowland vegetables were identified as priority commodities not only because of their satisfactory production performance but also because of their potential for value-adding opportunities. While the demand for fresh lowland vegetables is increasing, the demand for value-added products is likewise increasing since people are now opting for a healthier food product. Furthermore, lowland vegetable production is also identified as an industry with the ability to meet the daily subsistence requirements of a farming family especially those on a backyard scale. The large and increasing market demand coming from Metropolitan Manila is likewise a good opportunity to seize.

In CALABARZON, lowland vegetables value chain mainly includes four segments: input supply, production, assembly, and trading, and final segment for wholesale and retail sale (Figure 45). It can be noted, however, that the segment for processing is not applicable to all of the involved vegetables since only ampalaya is being processed into ampalaya wine and pickled ampalaya. Hence, the value chain map will only present the processing segment applicable and available for ampalaya.

The general flow of the commodity trail is basically from the production area then to the consolidation area/market then to the major or big markets. The volume of how much has been transported from one point to another varies per transaction depending on the existing supply and demand situation.

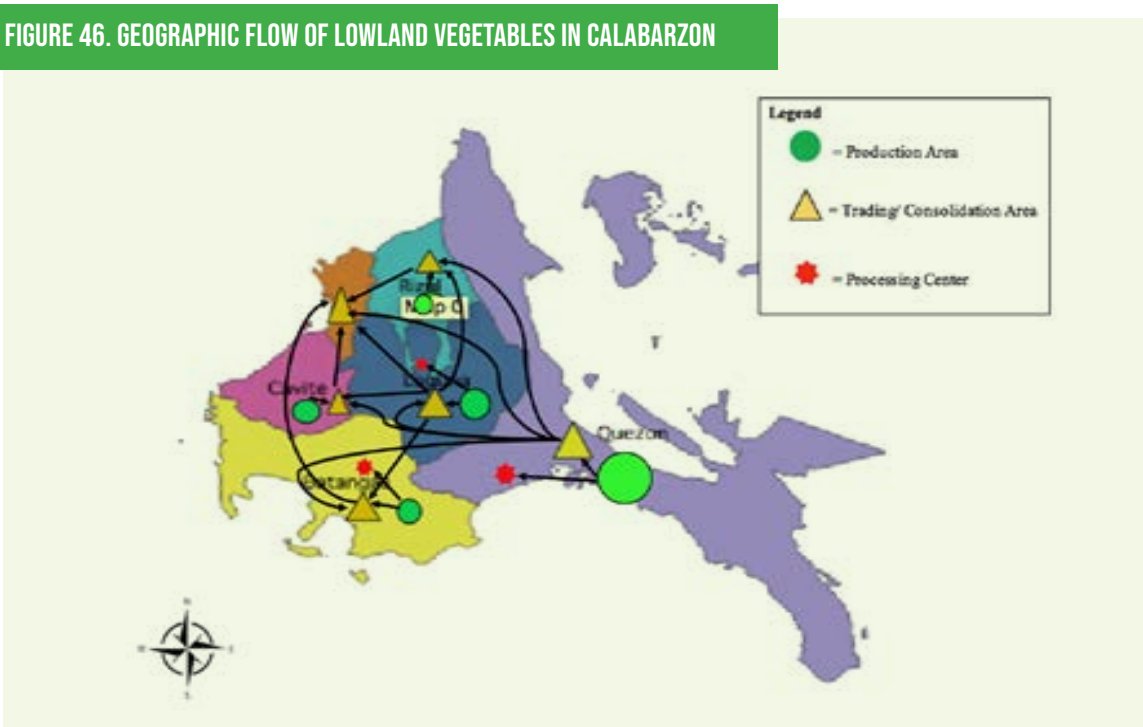
Farmers from the production areas in Quezon Province such as those from the municipality of Buenavista, where majority of the production volume came from, usually transport their produce to be consolidated at the Sariaya, Quezon trading post (Sentrong Pamilihan ng Produktong Agrikultura ng Quezon). These products are then transported to major consolidation areas (or palengke) in cities like in Manila (Divisoria), Quezon City (Balintawak), and some are also transported as far as the Northern Luzon (Ilocos, Pangasinan, Nueva Ecija, Isabela, and Baguio).

FIGURE 45. VALUE CHAIN MAP OF LOWLAND VEGETABLES ((DA-PRDP, 2019B)



The proximity of production and consolidation areas to the major markets of lowland vegetables in CALABARZON is a known advantage for this sector. The fresh produce coming from all the provinces in the region are being brought to Metro Manila specifically in Divisoria and Balintawak markets. It is also apparent that before these produce reach Metro Manila, they have to be consolidated in each provinces' main consolidation area. In addition, Quezon province being the top vegetable producing province, delivers vegetables to other four provinces in the region. Vegetables produced in Batangas, and Rizal are likewise being traded in Laguna and Cavite and vice versa whenever there is a surplus of supply from the province of origin (Figure 46). Similarly, volume traded varies with the day-to-day supply and demand situations.

FIGURE 46. GEOGRAPHIC FLOW OF LOWLAND VEGETABLES IN CALABARZON



Highland Vegetables Value Chain

The highland vegetable value chain is composed of six segments: (1) Input Provision; (2) Production; (3) Postharvest; (4) Trading; (5) Processing; and (6) Sale (Figure 47).

The input provision segment provides the important materials needed for production like seeds, fertilizers, pesticides, and farm implements. It also provides training that helps educate and equip farmers with the different techniques of highland vegetable production.

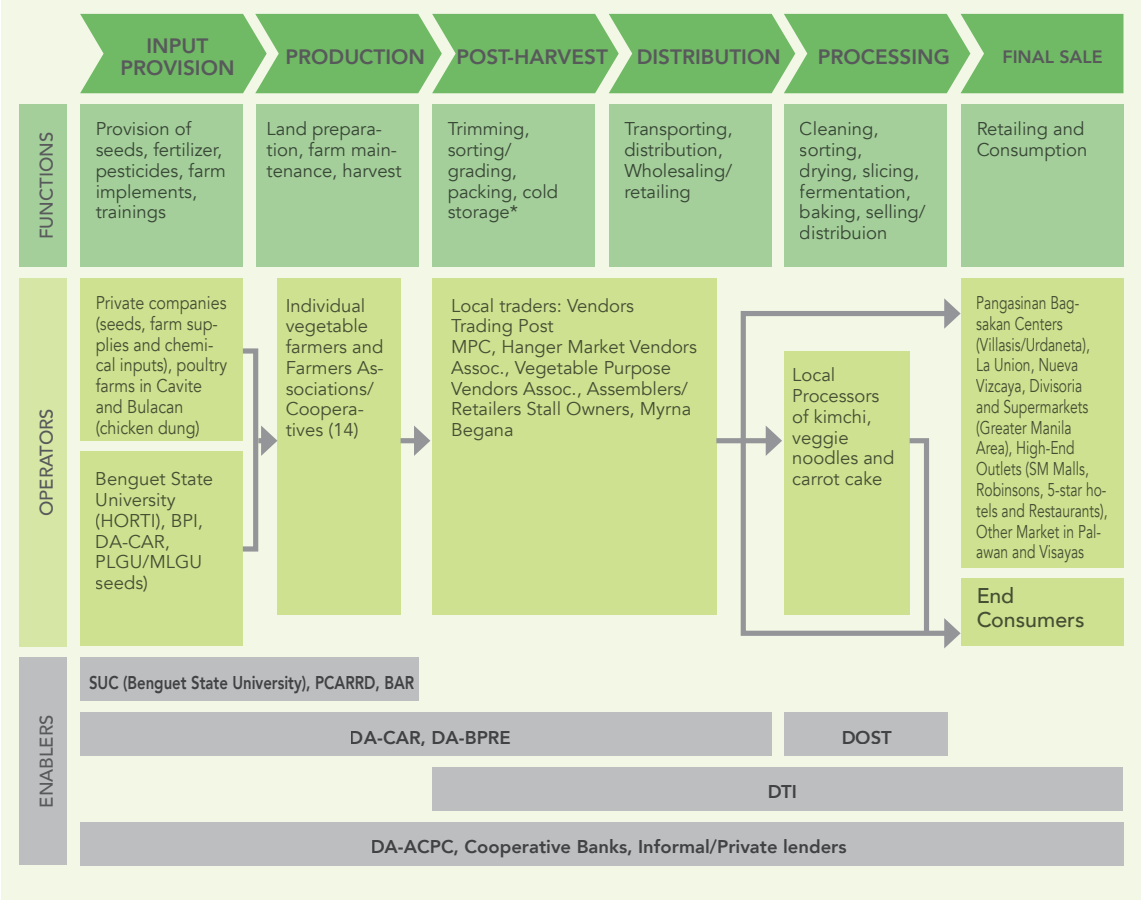
The production segment generally involves the different cultural managements employed in the farm that include cleaning, land preparation, fertilizer application, hilling-up, maintenance and harvesting.

The postharvest segment includes cleaning, trimming, sorting/classification, packing and transportation to and away from the trading centers. Some highland vegetables are processed like Chinese cabbage and carrots (kimchi, carrot cake, carrot juice and vegetable noodles) locally and exported in the form of dried and processed vegetables.

Farmers either sell their farm produce (highland vegetables) in vegetable trading centers like the La Trinidad Trading Post, Benguet Agri-Pinoy Trading Center and Baguio Hangar Market for further transportation to different parts of the country. Some farmers also sell their produce to contract buyers who in turn sell to trading centers, hotels and restaurants or high-end markets.

The processed products like kimchi are sold in Korean restaurants and local food malls while carrot cake is on per order basis and carrot juice is only processed and available when the price of carrot is low. Vegetable noodles are sold domestically in trade fairs and exhibits, conferences, and pasalubong centers. The processed vegetables are exported to China, Singapore, and Japan in the form of dried, frozen, and provisionally preserved vegetables.

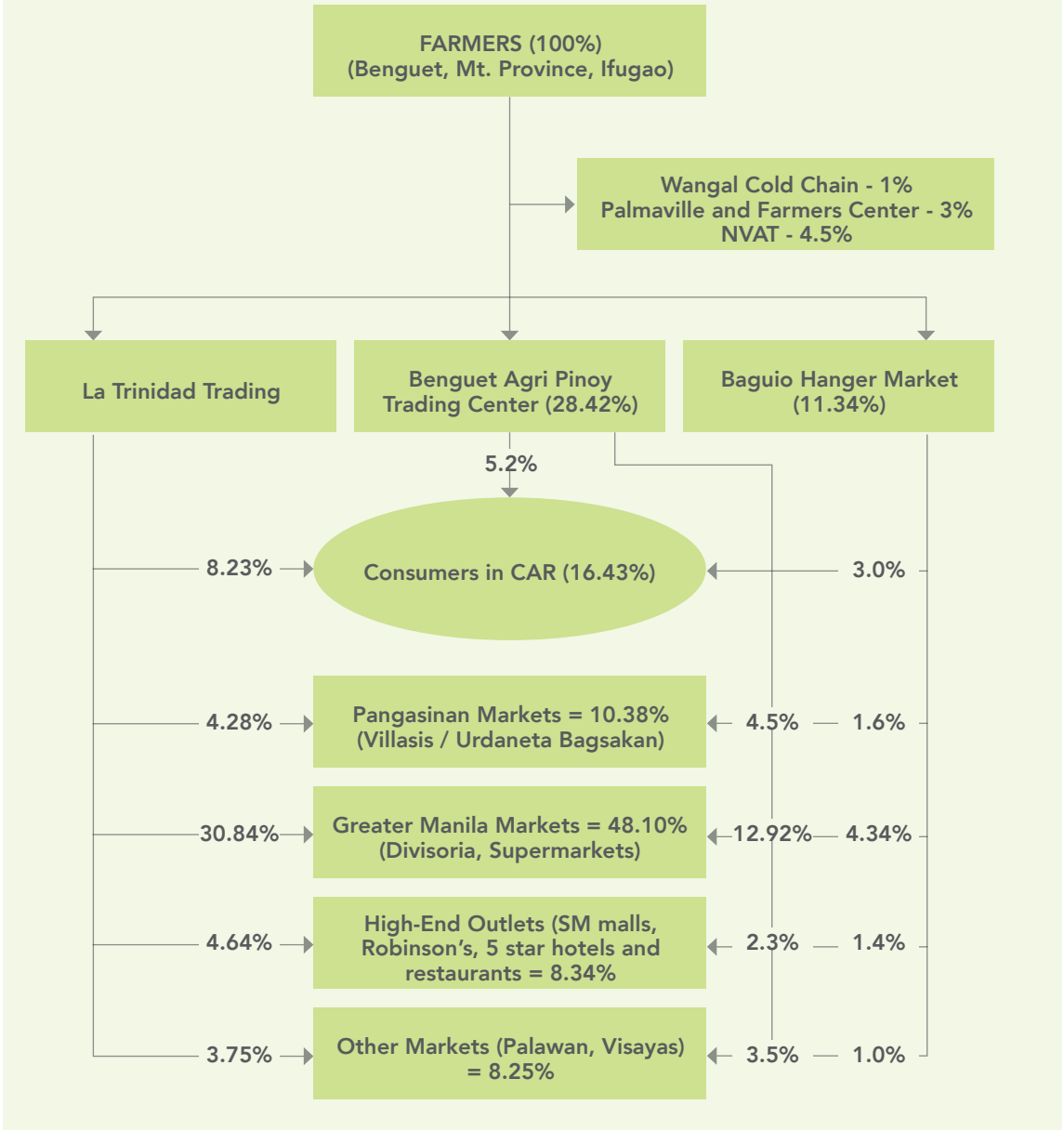
FIGURE 47. VALUE CHAIN MAP OF HIGHLAND VEGETABLES ((DA-PRDP, 2019A)



From the farm, the highland vegetables are delivered to La Trinidad Vegetable Trading Post, Benguet Agri-Pinoy Vegetable Trading Center or to the Baguio Hangar Market. In the trading centers, the vegetables are brought in by trucker-wholesalers from Metro Manila and other traders from the different regions and provinces in Luzon. The highland vegetables are brought to the pakyawan area in Divisoria and the bagsakan area in Balintawak Market and nearby provinces like Pangasinan and La Union. From here, highland vegetables are disposed to the different retailing markets in Metro Manila and are also bought by traders from the different municipalities and cities in Southern Luzon and other areas. From the trading center, wholesalers from Urdaneta deliver/wholesale the highland vegetables in Urdaneta market and these are bought by traders from La Union, other areas in Pangasinan, Nueva Ecija and other municipalities in Region 3 such as Tarlac, Pampanga, Bulacan, Bataan, Zambales and Olongapo. Some farmers in

Kabayan, Benguet bring their cauliflower and cabbage in Nueva Vizcaya Agricultural Terminal (NVAT) in Bambang, Nueva Vizcaya and from there the products are bought by traders from Metro Manila and delivered to the various marketplaces in Metro Manila (Figure 48).

FIGURE 48. DISTRIBUTION OF HIGHLAND VEGETABLES FROM FARM TO CONSUMER MARKETS SOURCE; DA-CAR- RFO, 2017



In Benguet and Mountain Province, being the key supply area in Luzon, highland vegetables are generally channeled to the main demand centers of Metro Manila. Six-wheeler or ten-wheeler trucks are used in conveying highland vegetables from the Vegetable Trading post and Benguet Agri-Pinoy Trading Center in La Trinidad, Benguet to Metro Manila, particularly to Balintawak or Divisoria markets. Smaller vehicles like Elf Truck and Jeepneys are used to transport highland vegetables in nearby provinces like Villasis, Pangasinan and La Union area.

An average of 100 tons per week are transported to Visayas (Cebu) and Mindanao. Higher quantities are supplied in Cebu as compared to Mindanao because some of the highland vegetables are produced there. Meanwhile, about 150 tons of highland vegetables per day are delivered to Manila, Urdaneta, La Union and Bambang, Nueva Vizcaya (NVAT).

Structural Analysis of the Vegetables Value Chain

In this section, the players within the following segments along the value chain together with their functions are identified: Input Provision, Production, Trading and Final Sale. Lowland vegetables are utilized mainly as fresh food and mixed with other ingredients in different recipes.

Input Supply

Lowland Vegetables

The inputs needed in the production of lowland vegetables are open pollinated seeds, farm implements, seedling tray, GI wire, twine, string, plastic mulch, plastic bag, and trellis. The seeds used in the lowland vegetables production came from government interventions through the local government units or in the agricultural input suppliers. The open-pollinated seeds are much cheaper and may be used for the next cropping. However, they produce lower yields compared to the hybrid seeds which are known to have a higher yielding capacity. Hybrid seeds are costly relative to the open-pollinated

seeds. Other materials include organic and inorganic fertilizers, chemicals-like herbicide, pesticide, insecticides, and weedicides, materials (e.g., poles, straw ropes, plastic, crates or sack), and farm tools and implements like bolo, scissors, shovel, sprinkler or knapsack sprayer, etc. (PRDPb, 2019).

Farmers/growers sourced their inputs (seeds, fertilizers, and farm equipment) from subsidies given by agencies like Department of Agriculture (High Value Crops Division, Southern Tagalog Integrated Agricultural Research Laboratory (STIARC), Quezon Agricultural Experiment Station (QAES), and Cavite Agricultural Research and Experimentation Station (CARES). These inputs were given to individual farmers through their associations/cooperatives. In some cases, farm machineries are also granted to them through the same process. The farmers' association/cooperative will be the one to determine the rules and ways of distribution or usage. Those organizations with active involvement in the meetings and trainings conducted by the agency are prioritized as recipients of seeds and equipment. Individual farmers also receive assistance in terms of seedlings, fertilizers, seminars, and trainings spearheaded by the Department of Agriculture and other government agencies such as Agricultural Training Institute and Fertilizer and Pesticide Authority. Table 33 presents the matrix of different input suppliers for the lowland vegetable production in CALABARZON (PRDPb, 2019).

TABLE 33. INPUT SUPPLIERS IN CALABARZON

Type	Input Supplier	Details
Government Institutions	Department of Agriculture-RFO IV-A	Department of Agriculture Region IV-A together with the High Value Crops Development Program caters to farmers' needs by distributing seeds and farm materials and machineries to different municipalities as part of its program. Cavite Agricultural Research and Experiment Station also aids in good quality seeds provision to farmers in CALABARZON.
	PLGU/MLGU	The Provincial and municipal office has a budget for input provision to farmers. Farmers can request good varieties of seeds and other planting materials needed in production.

Type	Input Supplier	Details
	BPI, IPB-UPLB, STIARC	BPI, IPB-UPLB and STIARC offers continuous research and development for the improvement of the variety of seeds, better quality of produce and resistance to pest and diseases.
	Agri-supply stores	Agricultural supply stores which offer good quality planting materials such as seeds, fertilizers, pesticides and other materials used in production. Other agricultural supply stores offer free information, demonstration about the products. All of the stores are working on a cash basis payment and do not give credit to farmers.
	Cooperatives	Cooperatives in CALABARZON can also serve as input supplier to its members. Cooperatives lend farmers all the inputs in production with payment after the harvest period.
	Local Traders	Local traders serve as financers if input supplies, labor cost and harvesting cost to farmers.

Source: Key Informant Interviews (KII)

The input suppliers offer all sorts of agricultural resources like fertilizers, chemicals, and farm tools that farmers can purchase to compliment the subsidized inputs that are given to them. Remote barangays and municipalities, especially those in the islands and in mountainous places, encounter difficulty in securing their inputs because most of the input suppliers are located in the town proper or semi-urban areas. Other sources of seed/seedlings are SUC-operated laboratories (Cavite State University (CavSU) and National Plant Genetic Resources Laboratory (NPGRL) of the Institute of Plant Breeding (IPB) - University of the Philippines Los Baños), local agricultural offices (OPA and MAO and local agro-chemical stores selling seeds from companies of East West Seeds, Condor, Syngenta, and HarBest.

The summary of input suppliers/ agricultural stores is presented in Table 34 while the detailed list of agricultural stores in CALABARZON can be found in the appendices.

TABLE 34. SUMMARY OF AGRICULTURAL STORES IN CALABARZON.

Province	No. of Stores
Cavite	34
Laguna	42
Batangas	10
Rizal	29
Quezon	20
Total	135

Source: Offices of the Municipal Agriculturist, 2016

Highland Vegetables

One of the limitations in highland vegetable production is the high cost involved. About 50% of the highland vegetable farmers in the Cordillera has no ready capital to buy inputs especially during planting season forcing them to seek loans and enter into a contract with input suppliers (traders) via the "supply system" where 50% of the net income goes to the farmers. Most of these input providers such as farm supplies and private chemical companies are found in Baguio city, La Trinidad, and Buguias, Benguet (DA-PRDP, 2019a).

Farm Production

Small to medium scale farmers cultivate their own farms but sell their produce to buyers. Only a few farmers participate in the marketing of their produce up to the final consumers. The size of land area cultivated by growers also determines the number of workers they employ during the production stage. Most of growers in CALABARZON are small-hold or backyard and practice crop rotation or intercropping. Some small growers do all the cultural management practices to save on hired-labor expense. Also, some of them employ their family members to minimize cost.

The Provincial, City, and Municipal Agriculturist's Offices have been keeping track on the number of farmers per commodity. In 2016, the greatest number of farmers are producing string beans with 5,711 and eggplant with 4,306 farmers (Table 35). Primarily, most of the vegetable growers in CALABARZON are members of the Samahan sa Industriya ng Paggugulayan (SIPAG) – a clustered group of vegetable growers in CALABARZON.

TABLE 35. NUMBER OF FARMERS PER COMMODITY IN CALABARZON, 2016

Province	No. of Farmers						Total
	Tomato	Eggplant	Stringbeans	Squash	Okra	Ampalaya	
Cavite	1,039	1,164	1,526	861	1,131	1,080	6,801
Laguna	527	891	844	638	819	325	4,044
Batangas	631	1,195	1,898	974	nda	nda	4,698
Rizal	513	746	1,141	628	688	366	4,082
Quezon	113	310	302	229	190	178	1,322
TOTAL	2,823	4,306	5,711	3,330	2,828	1,949	20,947

Source: Municipal Agricultural Office, 2016

Crop Suitability: Description, Planting, and Cultivation Practices

The planting calendar and maturity of the priority crops in this roadmap is shown in Table 36. Ampalaya, carrots, eggplant, okra, pole sitao, and snap beans can be planted all year-round while others that require lower temperatures such as cabbage and Chinese cabbage are planted from October to December. On the other hand, other seasonal crops such as potato and tomato are planted from September to January and from January and September, respectively.

TABLE 36. PLANTING CALENDAR AND MATURITY OF SOME VEGETABLE CROPS

VEGETABLE / CROP	TIME OF PLANTING	MATURITY
Ampalaya	All season	60-75 DAP
Cabbage	October - December	55-60 DAP
Carrot	All season	75-103 DAP
Chinese Cabbage	October - December	55-65 DAT
Eggplant	All season	90-120 DAP
Okra	All season	60-75 DAP
Pole Sitao	All season	50-65 DAP
Potato	September - January	110-120 DAT
Snap Bean	All season	43-52 DAP
Squash	November - January	3-5 months
Tomato	January – May September - October	55-65 DAT

Source: Adapted from DA-Bureau of Plant Industry, 2020

Ampalaya. There are at least seven varieties of ampalaya in the country namely, Sta. Rita, Makiling, Sta. Isabel, Jade Star, Mayon, Galaxy, and Million Green. In CALABARZON, only four varieties are cultivated – Sta. Rita, Jade Star, Bonito, and Galaxy F1. Among these, Sta. Rita is the only open pollinated variety (OPV) while the rest are hybrids. They are high yielding and the color ranges from green to dark green. The Bonito and Makiling varieties are used for the processing of food supplements, for the treatment of hypertension and Type 2 diabetes mellitus. They can be grown in any soil type, but sandy and clay loam soils with good drainage, high organic matter content and pH of 6.0 to 6.7 are recommended to gain optimum profit (PRDP, 2019).

Cabbage. The Scorpio is the most preferred variety of cabbage, which is usually grown by Benguet farmers. Cabbage is best suited to colder temperatures and is appropriate for drier seasons. Cabbages are planted in March in Benguet (Domingo et al., 2020). Cabbage requires a temperature of 15 to 20°C up to 28°C. It is adapted to a wide range of soil type but is best suited in loamy sand type of soil with adequate irrigation and pH between 5.6 to 7.3 (PRDP, 2016).

Carrot. The Terracotta variety is the most popular carrot variety among the Municipal Agriculturists and farmers in Atok, Benguet. Planting season begins in March and is harvested in June. In some cases, planting is preferred to be done from October to December to avoid root diseases associated with the rainy season (Domingo et al., 2020). Carrots grow best in high elevation areas (1000 masl) with an optimal temperature of 15-21°C. It also grows best in deep sandy soil with high organic matter content and pH between 5.5 to 6.8 (PRDP, 2016).

Chinese Cabbage. Chinese cabbages or napa cabbages are grown in the mid- to high elevation areas with soil pH between 5.5 and 7.6 (PRDP, 2016).

Eggplant. Eggplant is a perennial plant with round or oblong-shaped fruit. It varies in color, shape, and size depending on the variety. Some of the varieties include the elongated ovoid (elongated but rather slim than ovoid with dark purple skin), oval-shaped (with white skin), bicolored cultivars (with multiple colors), and bicolored with stripes. The varieties mostly preferred and adapted in CALABARZON are Dumaguete Long Purple OP, Morena F1, Casino F1, Gwapito F1, and Sikat F1 (HVCDP, 2018 as cited

by PRDP, 2019). Eggplant thrives well in deep, fertile, and well-drained sandy or silt loam with high organic matter content and pH between 5.5 to 6.8. The optimal temperature requirement for growth and fruit development ranges from 21°C to 29°C (PRDP, 2019).

Okra. The pods of okra are known for its high fiber content and its unique mucus. It is also a good source of antioxidants, vitamins, and minerals. The two main varieties of okra are smooth green (dark green, tapered round slender) and smooth green EW (bright green, slender round). It can be grown all year-round and is best suited in sandy loam soils with pH between 5.0 to 7.0 (PRDP, 2019). The okra varieties for the export market are the angular or penta type but farmers usually plant also F2s to F4 seeds to save on cost of seeds.

Pole Sitao. Pole sitao is also known in several names such as string beans, yardlong beans, snake bean, garter bean, asparagus bean and Chinese long bean. Locally, it is known as sitaw (Tagalog), utong (Ilokano), bantak (Waray), batong (Cebuano) and latuy (Marinduque) (dela Cueva, 2013 as cited by PRDP, 2019). It is rich in protein, Vitamins A and C, thiamin, riboflavin, iron, phosphorus, potassium, folate, magnesium, and manganese. The most popular varieties cultivated in CALABARZON are Galante, Mariposa, Sandigan, Negros, and Green Star. It is suited in areas with temperature ranging from 20°C to 35°C and pH of 5.5 to 6.8 (PRDP, 2019). As in other vegetable crops there are regional preferences in pod color, length and diameter.

Potatoes. Planting of potatoes depends on the availability of seeds. According to the Benguet farmers, the Igorota variety is available in the market in December while the Granola variety is in March and April. Potatoes in Benguet are planted in March and harvested in early July. Some farmers opt to plant during drier conditions, usually starting October, because they are sensitive to accumulated rainfall (Domingo et al., 2020). There has been a rapid decline in the number of potato varieties grown in the country in the past decades.

Snap Beans. Snap beans or "Baguio beans" grow best in medium to high elevation areas with temperature ranging from 18 to 21°C. They can also grow in low-lying areas in cool, dry months. It is best suited in well-drained, clay loam soil with high organic matter content and pH between 5.5 and 7.5 (PRDP, 2016). There are many landraces, varieties from seed companies and from SUCs such as BSU and UPLB.

Squash. According to the Agriculture and Fisheries Market Information System (AFMIS), the common varieties planted in CALABARZON are Rizalina, Gracia F1, and Suprema. The fruit shape varies from flat to high round, with regular to deep ridges, and/or a combination of these characteristics. These varieties are popular because of their tolerance to virus and other foliar diseases, adaptability, and high yield. They can be grown during dry and wet seasons with optimum monthly mean temperature between 18°C and 27°C. Soil pH must be between 5.6 to 6.5 (PRDP, 2019).

Tomato. It is grown for its edible red berry-type fruit, which contains significant amounts of vitamins A and C, and a variety of health benefits. In CALABARZON, there are at least six varieties being produced by farmers, mainly for two market classes: (1) fresh market and (2) for processing. These varieties include Apollo (fresh market), Maguilas (fresh market), Diamante Max, Atlas (F1), Atlas (grafted, kamlong), and cherry tomato. Among these, the Diamante Max is the most popular variety because it is suitable for year-round production, heat tolerance, has a high level of resistance to bacterial wilt, and with very high yields. Other common varieties cultivated in the country include Agatona, Fantastic, Mardan, Harabas, Fortune King, King Kong, Escudero, Grace, and Aegan varieties for salad-type tomatoes (PRDP, 2019). Processing tomato is mostly grown in Ilocos through the Northern Food Corporation (NFC).

Land Preparation

Preparation of the Soil. Any primary soil preparation must be aimed at creating growing conditions for tomato plants to develop the optimal root system in a specific soil profile. Although the root structure of a tomato plant can penetrate various soil types up to depths of 2 meters, the highest percentage roots will be found in the top 600mm of the soil. The advantages of soil preparation are the following:

- No restrictions on root development,
- Less chance of compaction,
- More oxygen in the soil creating better root development,
- Higher yield
- Reduction in production costs
- More vegetative growth,

- More tolerance to drought and stress,
- Less root disease prevalence,
- Horizontal and vertical compaction layers broken
- Better water retention
- Increased uptake of moisture and nutrients.

Field preparation. Shaping the land into beds and growing tomatoes on top of the bed facilitates furrow irrigation of the crop and drainage after heavy rain. Beds are prepared through the use of mechanical means, sometimes with the use of carabao-drawn plow. Plowing and harrowing are done twice before finally proceeding to furrowing.

Mulching. A mulch of rice straw, thin polyethylene plastic sheets, or other material is used to cover the soil surface. Mulches reduce fertilizer leaching, conserve moisture, and reduce weeds.

Pest and Disease Management

Table 37 summarizes the most common pests and diseases of the vegetables and the recommended control measures from IPB-UPLB. For ampalaya and squash, the most common insect pests are cucurbit beetle, aphids, fruit fly, and cutworm while the most common diseases are mosaic virus, downy mildew, bacterial wilt, and little leaf. For pole sitao and snap beans, the most common insect pests are bean fly, aphids, leaf hopper, and pod borer while the most common diseases include bean rust, Fusarium root rot, mosaic virus, and anthracnose for snap beans only. For tomato, fruit worm and white flies are the common insect pests while the common diseases are bacterial wilt and tomato yellow leaf curl virus. Fruit, tip, shoot, and stem borers are the most common insect pests of eggplant and okra. Cutworms are common to potatoes while cutworm and armyworm are common to carrots.

Some of the recommended control measures for the insect pests are dusting of leaves with wood ash, spraying of hot pepper and soap solution, use of biological control agents, crop rotation, and planting of aromatic crops to repel insect pests. On the other hand, removal of sources of inoculum and infected leaves or plant parts and the use of resistant and tolerant varieties are recommended to control the diseases.

TABLE 37. LIST OF PESTS AND DISEASES AND THEIR RECOMMENDED CONTROL

CROP	PESTS AND DISEASES	RECOMMENDED CONTROL
Ampalaya	Ampalaya mosaic virus	Remove of sources of inoculum
	Bacterial wilt	Crop rotation with non-host crops (e. pole sitao); plant at well-drained soils; use of resistant varieties, grafting of rootstocks with resistance to BW
	Downy mildew	Remove infected leaves
	Little leaf	Remove sources of inoculum
	Cucurbit beetle (Aulocophora similis)	Dusting of leaves with wood ash or rice hull ash; spray with soap solution (4 tbsp soap/16L water)
	Aphids (Aphis gossypii)	Spray with hot pepper (100g macerated hot pepper/16L water) and soap solution
	Fruit fly (Bactrocera cucurbitaea)	Fruit bagging 1-2 days after fruit set; Use of natural fruit fly attractant like methyl eugenol, basil leaves
	Cutworm (Spodoptera litura)	Spray with commercial preparations of Bacillus thuringensis (Bt) and Nuclear Polyhedrosis Virus (NPV); use of light traps
Squash	Bacterial wilt Downy mildew Cucurbit beetle (Aulocophora similis) Aphids (Aphis gossypii) Cutworm (Spodoptera litura) Viruses (mosaic virus, leaf curl virus)	Control measures same as ampalaya For viruses - use of resistant varieties; remove sources of inoculum
Pole Sitao	Bean fly (Ophiomyia phaseoli)	Spray with soap solution (4tbsp soap/16L)
	Aphids (Aphis craccivora)	Spray with hot pepper extract (100g/16L) and soap solution
	Leafhopper (Amrasca bigutulla)	Planting of sacrificial plants
	Pod borer	Planting of repellant crops (e.g., Onion, basil, and marigold); spraying of Bt & NPV
	Cowpea rust	Use of resistant varieties, pruning of infected leaves
	Mosaic Virus	Use of resistant or tolerant varieties
	Fusarium root rot	Use of resistant varieties; plant in well-drained soils

CROP	PESTS AND DISEASES	RECOMMENDED CONTROL
Snap Bean	Bean fly Aphids Leafhopper Pod borer Bean rust Fusarium root rot Anthracnose	Control measures same as pole sitao Anthracnose – use of resistant varieties; remove sources of inoculum
Tomato	Tomato fruitworm (Helicoverpa zea)	Use of Biocon agent (egg parasitoid of Trichogramma)
	White flies (Trialeurdes vaporariorum)	Spray with soap solution (4tbsp soap/16L)
	Bacterial wilt	Crop rotation with non-host crops (e. pole sitao); plant at well-drained soils; use of resistant varieties, grafting of rootstocks with resistance to BW
	Tomato yellow leaf curl virus	Use of resistant or tolerant varieties; remove sources of inoculum
Eggplant	Tip and fruit shoot borer, aphids, thrips, and green leaf hopper	Practice intercropping; planting of aromatic crops as pest repellant
Okra	Green leafhopper, fruit, and stem borer	Practice intercropping; grow aromatic plant as insect repellant
Carrot	Cutworm and armyworm	Spraying of biological pesticides (Bt and NPV)
Potato	Cutworms	Spray with hot pepper extract (100g/16L) and soap solution

Source: Vegetable Production Guides

Post-Harvest Handling and Processing

Harvesting Practices

Farmers use similar maturity indices such as color and shininess of the peels. Harvesting is done using small sharp tools like scissors, knives, and cutters but some pick using their bare hands and place the fruits in a sack or basket. Some use crates, plastic bags, laundry tub and pail as a container. Harvesting varies depending on the area of production. Harvested fruits are hauled to a shed where they are sorted, washed and packed (Antolin, n.d).

Sorting is done in a temporary shed located within the farm or near the farmer's house. The fruits are classified according to size and quality. Fruits which are over mature, infected with diseases are considered rejects but fruits which are infested but are still edible are packed separately and sold at a lower price. The classification of vegetables depends on size, shape, weight, and other physical appearances. When the vegetables do not meet at least one or more of the required characteristics, they are categorized as rejects.

Cleaning and packaging practices

Cleaning is usually done by wiping with soft damp cloth or cotton to remove dirt and reduce the field heat to maintain the quality. The fruits are packed in polyethylene plastic bags lined with either banana leaves or newspapers at the bottom (Antolin, n.d.). The produce is packed according to grade and classification such as good and semi-good weighing 10 kilograms per pack. Packaging materials are usually shouldered by the farmers themselves, but some are provided by the buyers.

GAP on Postharvest

The government provided facilities to improve the quality of produce. As part of the government's effort of helping the upland farmers, the local government unit of La Trinidad through the leadership of the Mayor, now Governor Nestor B. Fongwan personally requested President Gloria Macapagal Arroyo in one of her visits in the province to provide the farmers with facilities to extend the shelf life of the farmers' produce. This will minimize postharvest losses of crops and increase the income of farmers.

The Bureau of Postharvest Research and Extension (BPRE), an attached agency of the Department of Agriculture and the government's frontrunner in the implementation of the national cold chain program, provided the cold storage facility in Wangal, La Trinidad, Benguet. It aims to develop the vegetable industry in the province by providing the competitive edge of catering to the demand for fresh vegetables in the high-end market.

To address the issue on low product quality and high chemical residues on vegetable products, the practice of organic farming and GAP certification and accreditation has a great potential for investment because of the growing awareness on health, food safety and environmental protection.

Postharvest Losses and Waste Disposal

The postharvest losses of perishable crops (highland Vegetables) in the Philippines are about 20-30% (Bautista, O.K. 1992). These postharvest losses occur during harvesting, trimming, packing, and repacking, during hauling and transport. In the trading centers, the primary source of postharvest losses is during trimming, sorting, and packaging. During hauling, improper practices of hauling and loading to trucks are usually done by porters and dead loading from people on top of the commodity during transport especially during short distance travel. Excessive trimming of leafy vegetables (cabbage, Chinese cabbage, lettuce, broccoli, and cauliflower) when price is low leads to high postharvest loss. Improper washing in carrots like the use of hard brush and carrot contamination due to not changing water of containers regularly also leads to postharvest losses (DA-PRDP, 2019a).

Discarded vegetable trimmings are collected by the municipal government of La Trinidad, Benguet for input in the municipality-owned composting facility. Also, some of the leaf trimmings from cabbage and Chinese cabbage are segregated by some people in the community for feeding to pigs.

Packing House Operations

The different packing house operations usually done on highland vegetables at the trading centers are washing, trimming, sorting, and packing. These activities enhance the salability of the highland vegetables and give consumers the quality they want.

Marketing and Trading

Trading of highland vegetables is done in the primary trading centers in La Trinidad, Benguet. The trading activities in La Trinidad Vegetable Trading Post (LTVTP) are whole day where traders buy the produce of farmers depending on their day's quota/order. Wholesale selling and retailing is also done on the different stalls. In BAPTC, trading is from 4am to 2pm only because after 2pm traders usually transfer to LTVTP where middleman and wholesalers go due to its proximity and accessibility to the main road. Wholesaling and retailing are usually done in the Hangar market in Baguio city (DA-PRDP, 2019a).

La Trinidad Vegetable Trading Post (LTVTP)

LTVTP is the center of marketing activities in the province. Highland vegetables are on display for wholesalers and retailers to choose from (PSA-CAR, 2012). The objectives of the LTVTP are to serve as a venue for a more effective and efficient system of marketing and distribution of highland-grown vegetables and to provide the facility for producers as well as traders for increased trade and commercial activities thus promote the development of the local and the national economies (DA-PRDP, 2019a).

According to the market supervisor of the LTVTP, there are 230-270 vehicles entering the facility everyday with an average of 130-170 tons of highland vegetable per day or 60% from the commodities entering the trading post. The cart (kariton) is commonly used to haul vegetables from wholesaler to truckers.

Truckers' entry into the trading post is of two batches with different schedules to minimize traffic congestion. In first batch are the Urdaneta truckers (4:00 A.M), Divisoria (5:00 A.M to 10:30 A.M) and Balintawak (8:30 A.M-12:00 nn). Only the Urdaneta truckers are allowed in the second batch (11:00 A.M to 1:30 P.M).

Aside from LTVTP, which is government owned, there are 3 more vegetable trading facilities in Benguet, these are; Backfill, Bahingawan and Farmer's Center, all of which are privately-owned.

The presence of communication facilities or the advent of cell phones and good road networks connecting Benguet, Pangasinan and the Metro Manila had tremendously facilitated the flow of communication between markets. Moreover, the large volume of highland vegetables bought and sold in Divisoria market generated significant results as compared with Balintawak and Urdaneta markets. The large bulk of vegetables bought from Benguet are largely unloaded in Divisoria market, being the largest wholesale or bagsakan market in Manila (ISSAAS, 2012, as cited in PRDP 2019 (VCA of Highland Vegetables).

Benguet Agri-Pinoy Trading Center (BAPTC)

The Benguet AgriPinoy Trading Center (BAPTC), under the AgriPinoy Trading Center Program (APTC), serves as an alternative marketing outlet to which vegetable farmers can directly sell their produce at rationalized prices, thereby ensuring reasonable returns to the farmers-producers. It is created by virtue of Special-Order No. 369 issued by secretary Proceso J. Alcala on August 16, 2010.

Factors affecting price setting includes:

- Traders' pricing based on quality and quantity (assumed)
- Type of pricing – mark up from disposer to trader
- Farmer and disposer relationship – "supply system" (disposers provide inputs to farmer because farmer's lack capital)
- Traders mark-up to cover expenses.
- Payment of terms either partially or by arrangement by the traders/disposer with the farmers.
- Highly perishable goods obliges the farmer to sell immediately the commodity even if the price is low as dictated by disposers
- Not all farmers are updated on prices leading to their limited bargaining power
- Possibility of non-payment of commodity by the trader/disposer (some instances of bouncing cheque)
- Weather conditions and fortuitous events
- Pricing is recorded and monitored by DA for record purposes only

Current Practices on Day's Selling Price

- Traders/Disposers estimate the volume and type of commodity in the queuing area as the basis of prices:
  - 30 – 50 trucks: current price is higher than yesterday's price
  - 51 – 100 trucks: constant price is offered (steady price or same as yesterday).
  - 101 and more: current price is lower than yesterday's price
- Basis of prices are from the wet markets through message from their group (Urdaneta, Balintawak, and Divisoria)

Nueva Vizcaya Agricultural Terminal, Inc. (NVAT)

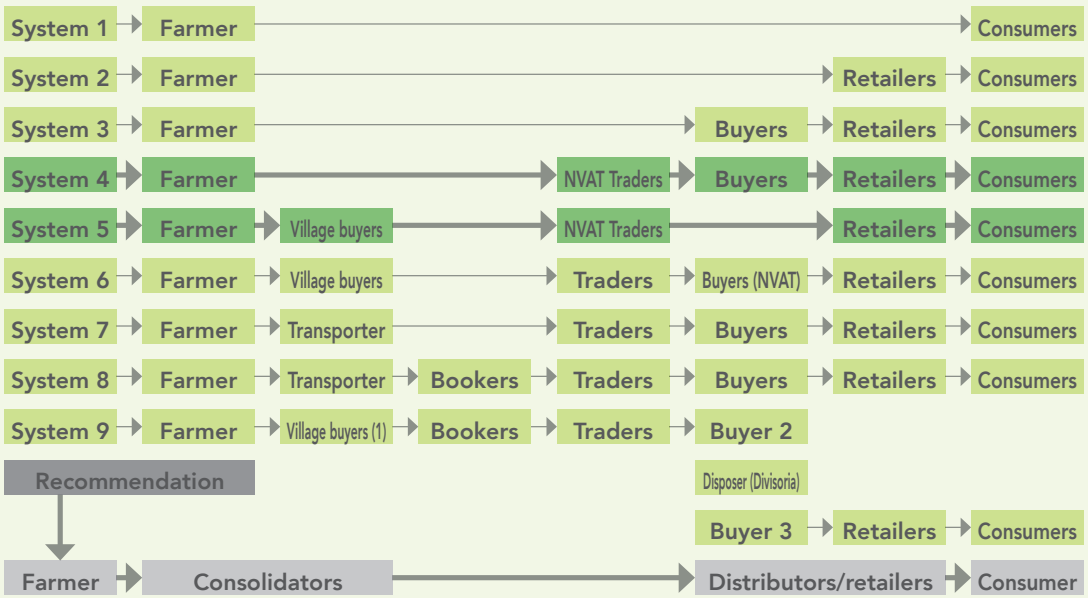
NVAT is a 6.7-hectare facility that serves as the market facility for the agricultural and non-agricultural products and services of Nueva Vizcaya and adjoining provinces of Benguet, Ifugao, Quirino, Isabela, Nueva Ecija and Pangasinan. The objectives of NVAT are to: 1) assist producers to improve their productivity and profitability and 2) provide facility where they can engage in trading, processing, storing, and marketing of agricultural and non – agricultural products and services. Table 38 shows the sources of major vegetables in NVAT while Figure 49 illustrated the marketing system/scheme of NVAT. In this figure, Systems 4 and 5 were more preferred by the NVAT administration.

TABLE 38. FARM SOURCES OF MAJOR VEGETABLES COMMODITIES IN NVAT

Commodities	Farm Source of Major Vegetable Commodities
Beans	All Municipalities of Nueva Vizcaya, Ifugao, Quirino, and Benguet
Broccoli	Bokod, Kabayan, Benguet and Kayapa, Nueva Vizcaya
Cabbage	Buguias and Kabayan Benguet, Ifugao, Kayapa (20%), Kasibu, Dupax Norte and Sur (5%) Nueva Vizcaya
Carrots	Bokod, Buguias and Kabayan Benguet
Cauliflower	Bokod and Kabayan Benguet and Kayapa, Nueva Vizcaya
Celery	Kayapa, Bambang, Kasibu, Dupax del Norte and Sur, Nueva Vizcaya, Benguet
Citrus	Kasibu, Dupax del Norte and Sur, Nueva Vizcaya
Cucumber	All Municipalities of Nueva Vizcaya

Commodities	Farm Source of Major Vegetable Commodities
Eggplant	Aritao, Bambang, Bayombong, Diadi, Bagabag, Kasibu, Dupax Norte and Sur, Nueva Vizcaya
Gabi (galyang)	Ambaguio, Kasibu, Dupax Norte and Sur, Nueva Vizcaya
Ginger	Kasibu, Dupax Norte and Sur, Nueva Vizcaya, Quirino
Onions (bulb)	Aritao, Bambang and Bayombong, Nueva Vizcaya (seasonal)
Potatoes	Buguias and Kabayan Benguet
Red Pepper	Aritao, Bambang, Kasibu, Dupax Norte and Sur, Kayapa Nueva Vizcaya
Sayote	Kayapa, Aritao, Kasibu, Sta. Fe, Dupax Norte and Sur, Nueva Vizcaya, Bokod Benguet
Squash	Kasibu, Dupax Norte and Sur, Ambaguio, Kayapa, Bambang, Nueva Vizcaya
Sweet Potato	Ambaguio, Kasibu, Dupax Norte and Sur, Kayapa Nueva Vizcaya
Tomatoes	All Municipality of Nueva Vizcaya, Kabayan and Bokod Benguet
Wombok	All Municipality of Nueva Vizcaya, Kabayan and Bokod Benguet
Yakun	Kasibu, Dupax del Norte and Sur, Nueva Vizcaya

FIGURE 49. EXISTING MARKETING SYSTEM OF NVAT.



Tables 39 and 40 show both the inflow and outflow of vegetables in NVAT, respectively, from January – June 2021. The major sources of vegetables are Nueva Vizcaya (64.41%), Quirino (2.39%), Isabela (0.38%), Benguet (14.15%), Ifugao (11.41%), Mountain Province (3.74%), and Nueva Ecija (3.52%). On the other hand, these vegetables were bought by buyers from the following regions: Region 3 (37.34%), Region 2 (31.68%), NCR (24.25%), Region 1 (4.15%), Region 4A (1.33%), CAR (1.33%), and Region 8 (0.02%).

TABLE 39. INFLOW OF VEGETABLES IN NVAT (TONS) AS OF JANUARY 2021 TO JUNE 2021

Source of Commodities		Percentage	January-June 2021 (MT)	Monthly Average (MT)
REGION 2	Nueva Vizcaya	64.41	58,400.37	11,680.01
	Quirino	2.39	2,169.35	433.87
	Isabela	0.38	341.07	68.21
CAR	Benguet	14.15	12,830.95	2,566.19
	Ifugao	11.41	10,345.80	2,069.16
	Mountain Province	3.74	3,386.78	677.36
REGION 3	Nueva Ecija	3.52	3,187.18	637.44
	TOTAL	100	90,661.50	18,132.35

TABLE 40. OUTFLOW OF VEGETABLES IN NVAT (TONS) AS OF JANUARY 2021 TO JUNE 2021

DESTINATION	Percentage	January-June 2021 (MT)	Monthly Average (MT)
Region 3	37.34	28,248.91	4,708.15
Region 2	31.68	23,971.62	3,995.27
NCR	24.25	18,350.10	3,058.35
Region 1	4.15	3,154.83	525.80
Region 4A	1.33	1,009.89	168.32
CAR	1.21	914.14	152.36
Region 8	0.02	13.00	2.17

The traders of lowland vegetables in CALABARZON are usually referred to as local traders (distributes the crops within the locality) and viajeros (traders who deliver the crops to relatively farther trading centers like Divisoria in Metro Manila). Most of them are responsible for the assembly of vegetables or consolidating those from major producing municipalities. Large traders are trading not only one commodity in one transaction but a

variety of vegetables such as tomato, eggplant, okra, squash, string beans, and ampalaya (DA-PRDP, 2019b). The major trading centers in CALABARAZON are listed in Table 41.

In Cavite, the traders are mostly centralized in Tanza and Dasmariñas. They are trading their consolidated vegetables mostly in Divisoria, Balintawak, Q-Mart, and Farmer's Market in Metro Manila markets and usually in Tanza public market for local market destination.

Laguna traders are commonly found in Sta. Maria and Siniloan. Most of their tomato produce are traded in Siniloan public market, at the Areza Public Market in Pagsanjan, Rizal Public Market, and some are traded in Tanauan City and Sariaya Quezon.

Meanwhile, in Batangas province, traders and consolidators are from San Juan, Tanauan City, and Malvar. Most of the traders and consolidators are bringing their tomato produce in Tanauan City's trading post.

In Rizal, Cogeo Public Market in Antipolo and Tanay Public Market are the major market destinations for lowland vegetables and other agricultural products.

In Quezon, the center of trading for vegetables and other agricultural products is the Sentrong Pamilihan ng Produktong Agrikultura ng Quezon in Sariaya, Quezon (SPPAQ). The consolidators of vegetables in Quezon are commonly found in Sariaya, Dolores, and Buenavista. These municipalities are the key producers of vegetables in the province.

TABLE 41. LIST OF MAJOR TRADING CENTERS FOR LOWLAND VEGETABLES IN CALABARZON

Province	Public Market	Location	No. of Traders
Cavite	Tanza Public Market, Damariñas City Public Market, and Kadiwa	Tanza, Cavite Dasmariñas City, Cavite	81
Laguna	Rizal Public Markets, Areza Public Market, and Pagsanjan Public Market	Siniloan, Laguna Pagsanjan, Laguna	73
Batangas	Tanauan City Public Market, Lipa City Public Market	Tanauan City and Lipa City, Batangas	No data available
Rizal	Tanay Public Market Antipolo Cogeo Public Market	Antipolo City, Rizal	63
Quezon	Sentrong Pamilihan ng Produktong Agrikultura sa Quezon	Sariaya, Quezon	127

Source: DA-PRDP 2019b (Value Chain Analysis for Lowland Vegetables in CALABARZON)

The traders and consolidators are responsible for sorting and grading of the lowland vegetables and other vegetables. The damaged produce from natural and unintentional causes are removed from the lot of good quality ones.

Hauling and Transporting

In Benguet and Mountain Province, the highland vegetables are hauled using "thick laced" bamboo basket and the use of tramline for some areas that are far from the road and no accessible road. Based on interviews, trading of highland vegetables from farm to LTVTP, BAPTC and Hangar market (DA-PRDP, 2019a).

The transportation of highland vegetables from the farm to LTVTP and BAPTC is through the use of Elf, Ford Fiera, and other SUVs. Normally, the vegetables are carefully arranged in the vehicles bed until full capacity then covered with canvass if the vehicle is open. After the different packinghouse operations have been done vegetables will be carried by a kariton to a waiting ten-wheeler truck for transport to Metro Manila and nearby provinces (DA-PRDP, 2019a).

Support Mechanisms, Policies, and Regulations

Key Institutions and Functions Related to the Vegetable Industry

Table 42 shows the key institutions that are related to the vegetable industry along with their functions such as international organizations, government agencies in the Philippines, RDE centers, and financial institutions.

TABLE 42. KEY INSTITUTIONS AND FUNCTIONS RELATED TO THE VEGETABLE INDUSTRY

KEY INSTITUTIONS	FUNCTIONS/OBJECTIVES
International Organizations	
Asian Vegetables Research and Development Center (AVRDC)	Alleviate poverty and malnutrition in the developing world through the increased production and consumption of nutritious and health-promoting vegetables.

KEY INSTITUTIONS	FUNCTIONS/OBJECTIVES
Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA)	Promoted and implemented the School-plus-Home Gardens Project (S+HGP) to complement the Gulayan sa Paaralan Program (GPP) of DepEd. One of the project's objectives is to increase diversity and availability of food within the local community that will meet the nutritional needs of the school children. Organic agriculture and edible landscaping are two of the major concepts behind the project. Aside from the establishment of school gardens, home/community gardens were also supported by the project. Locally, the project was piloted in Laguna and will be scaled-up and replicated in Busuanga and Coron, Palawan.
Government	
Department of Agriculture (DA)	Promote the growth and development of agricultural and fisheries sectors; Provide the policy framework, assist direct public investments, provide support services to agri-based enterprises. The Department of Agriculture CALABARZON's High Value Crops Development Program (HVCDP) offer support to farmers by providing seeds of high yielding variety through Municipal Agriculture Offices (MAOs) and APCO of different provinces. Moreover, package of technology for cultural management, pest and diseases, harvesting, post harvesting and processing are given to farmers to improve their production.
DA-High Value Crops Development Program (HVCDP)	Promote the production, processing, marketing, and distribution of high value crops.
DA-Agricultural Training Institute (ATI)	It is the extension and training arm of DA.
DA-Bureau of Plant Industry (BPI)	Promote the development of plant industries through R&D, crop protection and production, and effective promotion and transfer of technology.
DA-BPI Baguio National Crop Research and Development Center (BNCRDC)	
DA-Bureau of Agricultural Research (BAR)	Fund research programs of various institutions and state universities and colleges (SUC).
Department of Science and Technology (DOST)	The DOST, with the help of DTI, provides training on Good Manufacturing Practices (GMP) and Hazard Analysis and Critical Control Points (HACCP). These agencies would help them improve their products and compliance to food safety.

KEY INSTITUTIONS	FUNCTIONS/OBJECTIVES
Department of Trade and Industry (DTI)	The DTI offers package and label design services through the Product Development and Design Center of the Philippines (PDDCP). DTI has also been working with processors in the development of new variants of lowland vegetables chips.
Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development (PCAARRD)	Formulate policies, plans, and programs for science and technology-based R&D in the different sectors under its concern. It also allocates government and external funds for R&D and generates resources to support its programs.
Philippine Center for Postharvest Development and Mechanization (PhilMech)	Develop a package of postharvest technologies for vegetables.
Agricultural Credit Policy Council (ACPC)	
Philippine Crop Insurance Corporation (PCIC)	Provide insurance protection to farmers against losses arising from natural calamities, plant diseases, and pest infestations of palay and corn, as well as vegetable crops.
Philippine Statistics Authority (PSA)	Provide data on vegetable production, area, price, costs and returns, etc.
Research, Development, and Extension (RDE)	
University of the Philippines Los Baños (UPLB)	
Benguet State University (BSU)	
Financial Institutions	
Land Bank of the Philippines	Offers credit to farmers and taps technologies available in universities for farmers.
The Development Bank of the Philippines	Has designated funds for income generating projects of SUC's including those that may help vegetable sector through its Industrial Guarantee Loan Fund.
Small Business Guarantee and Finance Corporation	Offer financial services for small and medium enterprises engaged in manufacturing, processing, agribusiness and services.
Agricultural Credit Policy Council (ACPC)	Gives credit assistance to farmers/producers. Its mission is to provide a better and accessible guarantee system and convenient credit-support mechanism.
Other Rural banks	

Policies and regulations

High Value Crops Development Act of 1995 (RA 7900)

This act promotes the production, processing, marketing, and distribution of high-valued crops. It was passed to enhance the productivity and income of the farmers. It aims to accelerate the growth and development of agriculture, enhance the productivity and incomes of farmers and the rural population, improve the investment climate, competencies, and efficiency of agribusiness, and develop high value crops as export crops to significantly augment the foreign exchange earnings of the country.

Agricultural and Fisheries Mechanization (AFMech) Law (RA 10601)

This law focuses on research, development, extension, promotion, distribution, supply, assembling, manufacturing, regulation, use, operation, maintenance, and project implementation of agricultural and fisheries machinery and equipment.

Organic Agriculture Act of 2010 (RA 10068)

This act aims to promote, propagate, develop further and implement the practice of organic agriculture in the Philippines that will cumulatively condition and enrich the fertility of the soil, increase farm productivity, reduce pollution and destruction of the environment, prevent the depletion of natural resources, further protect the health of farmers, consumers, and the general public, and save on imported farm inputs.

Food Safety Act of 2013 (Implementing Rules and Regulations on RA 10611)

This act was signed into law on August 23, 2013 and is intended to strengthen the Philippine food safety regulatory system to protect consumer health and facilitate market access of local foods and food products. Under the Food Safety Act of 2013, the Food Safety Regulation Coordinating Board was created to coordinate food safety regulation functions between DA, DOH, DILG, and LGUs. The DA which includes NFA, is responsible for setting mandatory food safety which is anchored in the Codex standards. It is expected that the standard shall be opted "except when they are in conflict with what

is necessary to protect consumers and scientific justification exists for the action taken." It strengthens the national food safety regulatory system to protect consumer health, facilitate market access of local food products, and other purposes.

Agricultural Investments Incentives Act (Presidential Decree 1159)

Prescribes the framework for the incentives for investments in agricultural enterprises to reinforce balance in the development of the agricultural and industrial sectors of the country.

Traditional and Alternative Medicine Act (TAMA) of 1997 (RA 8423)

This act was signed by President Fidel V. Ramos to bring traditional medicine into the modern world. The Philippine Institute of Traditional and Alternative Health Care (PITAHC), a state-owned corporation under the Department of Health (DOH), encourages scientific research on medicinal herbs and plants.

The Consumers Act of the Philippines (RA 7394)

This act is made for product standardization and consumer safety. It formulates and enforces standards of quality in the processing, preservation, packaging, labeling, importation, exportation, distribution, and advertising of agricultural and fisheries products. It also conducts research on product standardization; aligns local with the international standards; and conducts regular inspection of processing plants, storage facilities. In addition, it strengthens the public and private markets in order to ensure freshness, safety and quality of products.

The Plant Quarantine Law (RA 3027)

This law was enacted together with the Plant Quarantine Service (PQS) of BPI under DA (PD 1433), which was eventually revised through the Administrative Code of 1987. It defines the import and export quarantine procedures in the Philippines.

Agri-Agra Reform Credit of 2009 (RA 10000)

This act is responsible in facilitating smallholders' access to financial services. It promotes equal access to opportunities under the environment of sustained growth and expanding productivity as the key to raising the quality of life of the farmers. It also promotes modernization in the rural agricultural sector to increase market efficiency.

Agriculture and Fisheries Modernization Act (AFMA) (RA 8435)

RA 8435 signed into law in December 1997, is the primary policy in the development of the agriculture and fisheries sector. It is considered a landmark law where major programs and policies in developing the sector are anchored. AFMA is based on seven core principles, namely: poverty alleviation and social equity, food security, rational use of resources, global competitiveness, sustainable development, people empowerment and protection from unfair competition.

An act to strengthen agriculture and fisheries modernization (RA 9281)

RA 9281 specifically stipulated amendments on payment of duties and tariff of agricultural imports. This act provides for tax incentives to all enterprises engaged in agriculture and fisheries and funds to support agriculture and fisheries modernization.

National Programs

Gulayan sa Paaralan Program

The Department of Education (DepEd)'s program on school gardens also known as the "Gulayan sa Paaralan Program" (GPP) is one of the flagship programs being implemented nationwide following the DepEd Memorandum No. 293, s. 2007. Since 2007, the GPP was established to support the government's initiative to prevent hunger and malnutrition among school children. DepEd, in coordination with the Anti-hunger Task Force, National Nutrition Council, and Local Government Units (LGU), implemented the "Food for School Program" and other feeding schemes for the most vulnerable and food-insecure sectors and provinces in the country. The GPP was initially aimed to raise the public's consciousness on health, nutrition, and economic benefits of the school, home, and community gardens; establish school gardens as a source of food for the feeding programs; intensify fruits and vegetable production; showcase garden models in schools for replication in the home/community; and inculcate the values of health, nutrition, industry, love of labor and caring for others among the school children (DepEd, 2007).

It was in 2016 when the DepEd released Memorandum No. 223, s. 2016 to strengthen the implementation of the GPP to address malnutrition, promote vegetable production and consumption among school children and encourage all schools to have their garden to supplement the School-Based Feeding Program (SBFP) (DepEd, 2016). Aside from the initially specified objectives in the previous memo, the school garden as an added venue or laboratory for learners was considered.

National Urban and Peri-Urban Agriculture Program (NUPAP)

NUPAP aims to promote agricultural development in the urban and peri-urban setting by providing policies, investments, and support services to realize food security. Through collaboration with stakeholders, it aims to capacitate urban farmers and partners in the private sector to create innovate, viable, competitive, and resilient technologies and applications toward 'Masaganang Ani at Mataas na Kita!".

Private Sector Initiatives

The private sector has been active in introducing innovation aimed at efficient production and increased consumption by making vegetables more convenient to buy, prepare, and/or consume.

Tanim sa Kinabukasan (TSK) by East West Seed Philippines is an advocacy project that is aimed at teaching school kids improved techniques of planting vegetables and eventually influence them to love eating the same. It also aims to encourage the whole community (parents, teachers, LGUs, and other stakeholders) to learn and appreciate the value of growing and eating vegetables thereby promoting food security, good nutrition, clean and green environment and creating livelihood opportunities.

Breeding program of seed companies. Aside from distribution of imported seed, the seed companies that service the vegetable sector have been active in developing appropriate varieties for a given agro-climatic condition. Moreover, they have set up demo farms for suitability testing as well as for showcasing their products as well as for training their potential customers or development partners. The representatives of the seed companies are some of the most active extension agents serving the plant industry.

Increasing convenience in vegetable purveying. Like the butchers who make sausages with left-over meats, vegetable retailers are now selling pre-cut ready to cook pinakbet and sinigang mixes using edible portions of partially damaged vegetables. Now, even the supermarkets are accelerating this popular trend.

Jollibee Group Foundation (JGF) – Farmer Entrepreneurship Program of the JGF aims to link small scale farmers to their supply chain by helping them sharpen their technical skills and agro-entrepreneurial mindset.

Support and Related Industries

Breeding Activities

The University of the Philippines Los Baños (UPLB) through the Institute of Plant Breeding (IPB) is the leading institution in terms of vegetable breeding. It has several breeding activities for eggplant, squash, onion, okra, cucurbits, tomato, and ampalaya, among others. Table 43 provides the list of the ongoing and future breeding activities of IPB-UPLB.

TABLE 43. ONGOING AND FUTURE VEGETABLE BREEDING ACTIVITIES OF IPB-UPLB

ONGOING VEGETABLE BREEDING PROJECTS	FUTURE VEGETABLE BREEDING PROJECTS
UPLB ongoing core funded projects on vegetable breeding	UPLB Target projects on vegetable breeding (for core or external funding)
1. Varietal Evaluation of Selected Vegetables Under Organic Conditions 2. Varietal Improvement in Eggplant and Squash 3. Varietal Development and Improvement in Allium 4. Varietal Development in Okra 5. Variety Development in Traditional Cucurbits 6. Breeding in Leafy Vegetables for Abiotic Stresses 7. Development of Abiotic Stress tolerant varieties of tomato	1. Variety development of selected indigenous vegetables 2. Variety development of vegetable legumes for health and wellness 3. Breeder seed production of organic vegetable varieties OR Breeder seed production of vegetable varieties developed under organic conditions 4. Breeder seed maintenance of IPB GTRRO (Germplasm and Technology Registration and Release Office) approved vegetable varieties 5. Variety development of selected vegetables for unique/special purposes 6. Variety development of semi-temperate vegetables for low or mid elevation conditions 7. Variety development of cherry tomato for improved nutritional quality 8. Regional adaptability and on farm trials of IPB developed vegetable varieties 9. Development of vegetable varieties through participatory plant breeding 10. Technology piloting of IPB developed lowland vegetables in selected growing areas 11. Promoting the utilization of indigenous vegetables through mass propagation and distribution of planting materials

ONGOING VEGETABLE BREEDING PROJECTS	FUTURE VEGETABLE BREEDING PROJECTS
	12. Rootstock breeding on solanaceous and cucurbits for soil borne disease resistance 13. Development of speed breeding technology in selected vegetables (Molecular Breeding) 14. Development of vegetable varieties for urban agriculture 15. Upgrading vegetable breeding facilities to support variety development 16. Enhancing varietal development of mungbean, peanut, soybean, tomato for high yield and improved nutrition (Molecular Breeding)
IPB Vegetable Breeding Activities Core Projects: 1. Development of abiotic stress tolerant varieties of tomato 2. Variety Development in Traditional Cucurbits 3. Varietal Development in Okra 4. Varietal Improvement in Eggplant and Squash 5. Varietal Evaluation of Selected Vegetables Under Organic Conditions 6. Variety Development and On-Farm Trials of Indigenous Cucurbits (Ampalaya, Patola, Upo and Kundol) 7. Development of Multiple Disease Resistant Varieties of Tomato 8. Varietal Evaluation of Selected Vegetables Under Organic Conditions 9. Breeding in leafy vegetables for abiotic stresses 10. Varietal development and improvement in Allium 11. Development of Ampalaya Varieties with Resistance to Biotic Stresses 12. Development of broad-based OPV's of Ampalaya	IPB Future Breeding Activities 1. Speed Breeding in Tomato and Eggplant 2. Marker-Assisted Breeding for Salinity Tolerance in Tomato 3. Cherry Tomato Breeding for Fruit Quality and Special Uses 4. Breeding for Resistant Rootstock against BW in Solanaceous Crops (tomato, eggplant) 5. Development of Tomato Varieties Suitable for Greenhouse Production 6. Development of Drought-tolerant varieties of Eggplant 7. Breeding towards the utilization and promotion of other species and wild types of eggplant for fruit and nutritional quality 8. Development of Eggplant Breeding Populations with resistance to Bacterial Wilt and Phomopsis 9. Improvement of Ampalaya (Momordica charantia L.) cv. "Makiling" for herbage yield and nutraceutical properties 10. Marker-Assisted Breeding for Virus (ZYMV, PRSV, SLCV) Resistance in Squash 11. Adaptation of other squash types (Zucchini, etc.) in low and mid-elevations 12. Exploitation of Heterosis in Luffa Interspecific Hybrids for the Production of Secondary Metabolites with Anti-Cancer Properties

ONGOING VEGETABLE BREEDING PROJECTS	FUTURE VEGETABLE BREEDING PROJECTS
Externally-funded Projects	13. Development of Rootstock varieties with Resistance to Soil-borne Diseases in Cucurbits
13. Vegetables Varieties for Sustainable Yields, Quality and Seed Supply	14. Breeding of Snap Beans and Garden Pea for Heat Tolerance
14. Varietal evaluation, multiplication and promotion of selected indigenous vegetables	15. Development of Special type Carrot Varieties (Multi-Colored) for Nutritional Quality
15. Varietal development and improvement of shallot towards high yielding, pest and diseases resistant/tolerant and longer shelf-life varieties	16. Development of Carrot and Radish for Short Duration and Heat Tolerance
16. Development of Okra Varieties for the Local and Export Markets	17. Breeding of Kale Varieties for Yield and Nutritional Quality
17. Development of Waterlogging Tolerant Population of Tomato	18. Breeding for Early Maturing and Abiotic Stress Tolerant Varieties of Leafy Vegetables
18. Ensuring Farmers' Access to Improved Varieties of Lowland Vegetables through Basic Seeds and Technical Support to DA Regional Field Offices Seed Production	19. Varietal Development of Drought/Heat Tolerant Cowpea
	20. Compositional analysis and antioxidant profiling of indigenous vegetables
	21. DNA barcoding of selected indigenous vegetables

Banking and finance

Most lowland vegetables farmers or smallholders usually tap the available resources, services and credit facilities offered by their cooperatives and other support institutions to finance their farm activities. In most cases, due to limited working capital, these cooperatives are only able to provide short-term loans for its members. Some lowland vegetables farmers secure credit from local and/or commercial banks. They also tap the Land Bank of the Philippines (LBP) and the Agricultural Credit Policy Council (ACPC) both of which have programs that support lowland vegetables production activities (DA-PRDP, 2019b).

The Agricultural Production Credit Program (APCP) is a Landbank initiated loan facility intended to finance the farm inputs in growing crops; to provide working capital for agri-enterprise and livelihood projects; and to purchase tools, equipment, and machineries. The Table 48 shows the features of the loan program.

The Agro-Microfinance Program (AMP) is a program under the ACPC that is intended for agriculture and fisheries. It helps microfinance institutions such as cooperative/rural banks, cooperatives, non-government organizations and other people's organizations that pass credit evaluation of PCFC.

Agricultural and Fisheries and Financing Program (AFFP). Pursuant to the 2013 General Appropriations Act, P 1.0 billion shall be used to implement a flexible credit facility for small farmers and fisherfolk who are registered in the Registry System for Basic Sectors in Agriculture (RSBSA), which is intended to serve as an alternative to the rigid and stringent credit facilities usually provided by banks. The funds will be channeled through Government Financial Institutions and cooperative banks. Of the P1.0 billion, P550 million shall be administered by Landbank (DA-PRDP, 2019b).

The objectives are to help increase the productive capacity of small farming and fishing households in the priority provinces, raise their income, and contribute to the attainment of food self-sufficiency; increase access to sustainable credit and to broaden agricultural credit delivery system in the countryside particularly in geographic areas underserved by formal financing institutions. The AFFP is being implemented in partnership with the Department of Agriculture (DA) and the ACPC.

The Cooperative Bank of Benguet is also one source of financial assistance. The Cooperative Bank will play a major role in the socio-economic development of Northern Luzon by expanding its banking facilities and financial services attuned to modern and future technologies; developing professional, competent, dedicated and highly motivated management and staff; improving the quality of life of its member-shareholders as efficient community members contributing to the restoration of environment through financial and technical support; and ensuring mutually beneficial relationships with all stakeholders. One of the objectives of the bank is to service the financial needs of the people, groups and institutions with small and limited means such as the farmers; micro-, small-, and medium-scale entrepreneurs; salaried employees; and cooperative sector (DA-PRDP, 2019b).

Among the informal sources of credit, traders are the more popular. This maybe because these traders oftentimes provide the farm inputs to the farmers at the same time they are the assured market for latter's produce. Under this credit marketing arrangement, the payment for the farmers' loan is deducted from the sales of the farmers' produce. It should be noted however, that while the farmers are assured of a market for their harvest they on the other hand, have to accept whatever price the trader will dictate without much consideration of the prevailing market price (DA-PRDP, 2019b).

Key Industry Players

The key industry players and private institutions in the vegetables value chain/industry are listed in Table 44. They play a major role in ensuring smooth facilitation of the processes along the value chain.

TABLE 44. KEY INDUSTRY PLAYERS OF THE VEGETABLES VALUE CHAIN

COMPANY NAME / GROUP	MAJOR CONTRIBUTION / FUNCTION
Input Suppliers	
East West Seed Company	Leading tropical vegetable seed company in the Philippines. It provides excellent quality, high-yielding, and innovation-driven products.
Harbest Agribusiness Corporation	One of its missions is to give tested and appropriate agricultural technology for short-term high value crops production and provide support in market development.
Seminis Vegetable Seeds	Producer of hybrid vegetable seeds.
Allied Botanical Corporation	
Ramgo International Corporation	
Kaneko	
Production - Farmers Associations/Cooperatives	
Benguet Farmers Multipurpose Cooperative, Inc.	One of the biggest and most organized farmer-cooperative in Region 2 mainly producing fruits and highland vegetables
KinGBiKS (Kinabuan, Ganao, Biruk, Kimbutan, Sanguit) Farmers Marketing Cooperative	Produces around 30% of the total vegetable production of Nueva Vizcaya

COMPANY NAME / GROUP	MAJOR CONTRIBUTION / FUNCTION
Basuit Farmers Multipurpose Cooperative of Central Luzon	Provide an avenue for farmers to train and learn about modern technology in vegetable production, and to establish fair and competitive prices for its members' produce.
Laguna Provincial Vegetable Industry Council (Sta. Cruz, Laguna)	Vegetable Farmers' Council at Laguna
Montalban Farmer Cooperatives (CALABARZON)	Vegetable Farmers' Cooperative at CALABARZON
Quezon Betu Multipurpose Cooperative (CALABARZON)	Vegetable Farmers' Multipurpose Cooperative at CALABARZON
Philippine Okra Producers and Exporters Association (POPEA)	POPEA is an association of Okra producers and exporters in the Philippines. Due to probable depreciation of Okra exports to Japan, POPEA is requesting the DA to increase its campaign to educate and train vegetable farmers in the proper usage of pesticides and fertilizers to comply with the quality standards needed by the Japanese market.
Production, Storage and/or Distribution	
Del Monte Philippines, Inc. (DMPI)	DMPI is the leading producer, distributor, and marketer of premium quality and healthy food and beverage products. It operates an integrated pineapple operation and a fruit processing facility in Bukidnon and a beverage polyethylene terephthalate plant in Cabuyao, Laguna.
Dole Philippines	It is a producer and marketer of high- quality fresh fruits and vegetables and various lines of packaged foods.
Dizon Farms Produce Inc.	Line of business includes the wholesale distribution of fresh fruits and vegetables.
Processors	
Universal Foods Corporation / Del Monte Philippines, Inc.	Leading manufacturer of tomato catsup
Northern Foods Corp. (NFC)	Manufacturer of tomato paste and sauces
Multiline Food Processing Plant	Provide a middlemen-free scheme through which Ilocos farmers would earn more for their produce that the establishment would buy from them.
Food Terminal/Trading Post	
Nueva Vizcaya Agricultural Terminal (NVAT)	Seller and Producer Trading Center
Sentrong Pamilihan (Sariaya)	

COMPANY NAME / GROUP	MAJOR CONTRIBUTION / FUNCTION
Integrators / Commissaries / Traders	
AgriNurture Inc. (ANI)	Its Farming Group manages farms divided into lowland and highland vegetables. Company managed farms are located in Dau, Pampanga, Capas, Tarlac, Trece Martirez, Cavite, and Indang, Cavite. It is also engaged in the distribution of farm inputs such as seeds, fertilizers, pesticides, greenhouse technology, farm machineries and equipment.
Vegetable Importers, Exporters & Vendors Association (VIEVA)	The organization consisted of traders involved in marketing vegetables. The group's objective is to produce quality agricultural products and be able to export to foreign countries.
Normin Veggies	Composed of individual producers, development foundations, corporate farms, farmers' associations, farmers' cooperatives, input and service providers, and institutional partners. It aims to be competitive in the vegetable industry, producing high-value commodities for domestic and international markets.
Vegetable Industry Council of Southern Mindanao (VICSMIN), Inc	VICSMin is an organization of vegetable industry stakeholders, individual farmers, farmer cooperatives and associations, academic institutions, government and nongovernment organizations, supermarkets, and input suppliers in Southern Mindanao. The organization aims to strengthen linkages among stakeholders to become highly competitive and competent entrepreneurs.
Munsec Fruits & Vegetable Dealer (Bicol Region)	Lowland vegetable supplier from Bicol Region
Storage and Distribution	
Royal Cargo	
Vifel Ice Plant and Cold Storage, Inc.	
Glacier Megafridge Inc.	
Jentec Storage	
Wholesale and Retail	
SM Food Retail	
Metro Retail Stores Group Inc.	
Puregold	
Rustan's Supercenters, Inc.	
Robinsons Supermarket Corporation	

Source: Various company websites; JICA, 2019,

SWOT Analysis

The SWOT Analysis is a tool to identify the strengths, weaknesses, opportunities, and threats of a system. The SWOT of the lowland and vegetable industry were identified separately because of the differences in the concerns of each sector across the value chain. Tables 45 and 46 show the SWOT for lowland and highland vegetables, respectively, across the value chain segments.

TABLE 45. SWOT FOR LOWLAND VEGETABLES

STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
INPUT SUPPLY			
Available varieties	Limited conservation of heirloom varieties and breeding works High input costs Increasing reliance to hybrids	Breeding for more climate-resilient or tolerant varieties Involvement or expansion of seed system to SUCs and DA Research Centers Hydroponics for cost efficiency	Policy environment not conducive to long term activities
PRODUCTION			
Matured technologies and vegetable growers Large available areas for expansion for off season planting	Seasonality of production Food safety concerns Improper use of pesticides High cost of production	Healthy and cheap source of vitamins, minerals, and dietary fibers Production clustering Home gardens Urban gardening Smart/Precision Agri Systems	Adverse effects of climate change Pest and disease infestation

STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
POSTHARVEST/PROCESSING			
	Heavy damage due to poor handling Inadequate storage and processing facilities High postharvest losses	Export potential of both traditional (okra, asparagus) and non-traditional crops Retail packaging Environment-friendly packaging	
MARKETING			
	Fragmented (inefficient) supply chain Seasonal price fluctuation High cost of transport Low vegetable consumption	Increasing demand due to population increase Production forecasting Online marketing Promotion of vegetable consumption	E-commerce and online selling platforms

TABLE 46. SWOT FOR HIGHLAND VEGETABLES

STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
INPUT SUPPLY			
	Reliant on imported planting materials High cost of inputs Inefficient local seed supply	Local breeding for crop where applicable Include indigenous vegetables Strengthen variety selection/ development	Policy environment not conducive to long term activities
PRODUCTION			
Proven farm technology Year-round production	Inaccessible production areas Limited area for expansion Improper use of pesticides High cost of production	Import substitution Production clustering/ programming Community, home, urban, and school gardens Smart/Precision Agri Systems	Adverse effects of climate change

STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
POSTHARVEST / PROCESSING			
	High postharvest losses	Value-adding activities	
	High packing cost	Retail packaging	
	Food safety concerns	Branding	
		Environment-friendly packaging	
		Machine sorting	
MARKETING			
Preferred by upscale consumers	Inadequate market information system	Increasing demand for organic vegetables	E-commerce and online selling platforms
Increasing availability of pre-cut vegetable mixes	Still few well-organized farmer groups	Health benefits	
	High transportation cost	Production forecasting	
	Inefficient supply chain	Market linkage	
	Low vegetable consumption	Real time pesticide monitoring	
		Online marketing	
		Promotion of vegetable consumption	
SUPPORT SYSTEM			
	Weak implementation of targeted assistance	Strengthening regulatory support services	Smuggling (inputs and vegetables)

Cost and Return Analysis

Farm Income Analysis

Typical vs. Modern

As with other commodities, instead of comparing what the academics consider typical with modern farms in which stakeholders could not relate to, comparisons for commodities under the highland vegetable groups where there is available data are presented. The analyses would serve as a local benchmark, and the results would be used in the competitive analyses for commodities where significant amounts are imported. For all practical purposes, all growers of highland vegetables are market- oriented and already familiar with the recommended technologies and can be considered modern farmers. However, despite their knowledge on appropriate technologies, in practice there are deviant behaviors. Notable of these deviations is the tendency to over fertilize and the indifference to public safety. Many farmers could not resist harvesting newly sprayed crops if the price is good, and many still use unprocessed chicken manure as fertilizer.

Yields and incomes of the vegetable farms can be improved in several ways. Usually, the focus of improvement is via the reduction in cost of production while making the use of inputs more efficient. Another is the use of better inputs such as organic fertilizers and pesticides. In farms already employing optimum cultural management practices, proper choice of variety can improve farm yields and income. However, proper crop programming with respect to season and market condition is also a good option. In effect, farmers should be aware of the other players and factors outside their farm to maximize the use of limited land and other resources.

One of the main indicators to consider in this analysis is the profitability of each commodity within the chain. This part shall present the price-cost structure per commodity and will also discuss the relative financial position of each player.

The following are some of the assumptions applied accordingly:

1. The farm level income is based on the per hectare yield ranging from low, medium, and high volume (in kilograms) extracted from the data collected per province.

2. There is no definite percentage of production loss and shrinkage cost that can be considered as acceptable. Literatures have suggested, however, that it can be about 12% of the vegetable production and 5% of the post-harvest shrinkage were put into waste or not consumed for to any reason.
3. A depreciation schedule (Sum-of-years' Digits method) was prepared for vehicle and other equipment used in the operations.
4. Realization of profit for production sector is on per cropping cycle while trading and retailing profits are estimated to be profitable for either daily or weekly operations.

Farmer's Price and Cost Structure

Table 47 presents the summary of the price and cost structure of the mentioned commodities. The matrix includes the usual revenue and cost items. It can be seen that the average yield a farmer can harvest in one hectare is 19,570 kilograms which can be sold at PhP26.50 per kilo (farm gate price).

Individually, it can be seen in the same matrix that string beans production is the most profitable and efficient at 68.76% net profit margin and 220.08% return on investment (assumption of highest crop productivity per cropping season). It was followed by okra with 65% net profit margin and 186% ROI per one cropping season. On the average, lowland production is sound at 60% net profit margin and 150% ROI per cropping season. It is also worthy to note that, on the average, 34% of the total cost of production or PhP 204,153.00 is being incurred for input materials (seeds, fertilizers, pesticides, etc.) while 31.88% of the production cost is spent for labor (see detailed matrix in the annex). During the conduct of key informant interviews and focus group discussions, most of the farmers prefer to use mechanized land preparation to lessen the labor cost.

It is on a positive note that the farmers will incur a positive net profit margin and return on investment even on medium and low assumption of crop productivity. It is assumed that crop productivity is decreasing at the average of 5% in medium and low yield per hectare respectively. In CALABARZON, most of the farmers is practicing crop rotation to increase crop yield and soil fertility more effectively.

TABLE 47. SUMMARY OF COST AND RETURNS PER HECTARE OF LOWLAND VEGETABLES

	TOMATO	SQUASH	OKRA	STRING BEANS	EGGPLANT	AMPALAYA	ALL
RETURNS							
Yield (High Assumption	20,900.00	12,700.00	16,040.00	24,200.00	28,060.00	15,520.00	19,570.00
Selling Price	21.00	14.00	31.00	25.00	23.00	45.00	26.50
Gross Sales	438,900.00	177,800.00	497,240.00	605,000.00	645,380.00	698,400.00	518,605.00
COSTS							
Material Cost	103,760.00	32,246.00	50,060.00	58,517.00	63,193.00	107,232.00	69,168.00
Labor Cost	85,280.00	28,960.00	60,020.00	55,300.00	94,380.00	66,620.00	65,093.33
Fixed Cost	13,300.00	13,300.00	13,300.00	13,300.00	13,300.00	13,300.00	13,300.00
Postharvest Loss	50,220.00	18,630.00	50,400.00	61,900.00	77,424.00	80,976.00	56,591.67
Total Cost of Production	252,560.00	93,136.00	173,780.00	189,017.00	248,297.00	268,128.00	204,153.00
NET PROFIT	**186,340.00**	**84,664.00**	**323,460.00**	**415,983.00**	**397,083.00**	**430,272.00**	**314,452.00**
ROI (%)	**73.78**	**90.90**	**186.13**	**220.08**	**159.92%**	**160.47**	**154.03**
Break-even Price (PhP/kg)	**12.08**	**7.33**	**10.83**	**7.81**	**8.85**	**17.28**	**10.43**

Source: Focused Group Discussion, Stakeholder's Consultation of Vegetable Growers in CALABARZON, March 15, 2019, (DA-PRDP, 2019b)

TABLE 48. SUMMARY OF LOWLAND VEGETABLES COST AND RETURNS PER CROPPING CYCLE PER HECTARE

ITEM	TOMATO	SQUASH	OKRA	STRING BEANS	EGGPLANT	AMPALAYA	LOWLAND VEGETABLES
Yield/cropping (mt)							
High	20,900	12,700	16,040	24,200	28,060	15,520	19,570
Medium	19,855s	12,065	15,238	22,990	26,657	14,744	18,592
Low	18,862	11,462	14,476	21,841	25,324	14,007	17,662
Price/kilogram (PhP/kg)	21.00	14.00	31.00	25.00	23.00	45.00	26.50

ITEM	TOMATO	SQUASH	OKRA	STRING BEANS	EGGPLANT	AMPALAYA	LOWLAND VEGETABLES
Gross Sales (PhP)							
High	438,900.00	177,800.00	497,240.00	605,000.00	645,380.00	698,400.00	510,453.33
Medium	416,955.00	168,910.00	472,378.00	574,750.00	613,111.00	663,480.00	484,930.67
Low	396,107.25	160,464.50	448,759.10	546,012.50	582,455.45	630,306.00	460,684.13
Total Cost of Production (PhP)	252,560.00	93,136.00	173,780.00	189,017.00	248,297.00	268,128.00	204,153.00
Net Sales (PhP)							
High	186,340.00	84,664.00	323,460.00	415,983.00	397,083.00	430,272.00	306,300.33
Medium	164,395.00	75,774.00	298,598.00	385,733.00	364,814.00	395,352.00	280,777.67
Low	143,547.25	67,328.50	274,979.10	356,995.50	334,158.45	362,178.00	256,531.13
Net Profit Margin(%)							
High	42.46	47.62	65.05	68.76	61.53	61.61	60.01
Medium	39.43	44.86	63.21	67.11	59.50	59.59	57.90
Low	36.24	41.96	61.28	65.38	57.37	57.46	55.68
ROI (%)							
High	73.78	90.90	186.13	220.08	159.92	160.47	150.03
Medium	65.09	81.36	171.83	204.07	146.93	147.45	137.53
Low	56.84	72.29	158.23	188.87	134.58	135.08	125.66

Source: Focused Group Discussion, Stakeholder's Consultation of Vegetable Growers in CALABARZON, March 15, 2019 ((DA-PRDP, 2019b))

Trader's Price and Cost Structure

TABLE 49. COST AND RETURNS FOR LOWLAND VEGETABLE TRADING IN CALABARZON

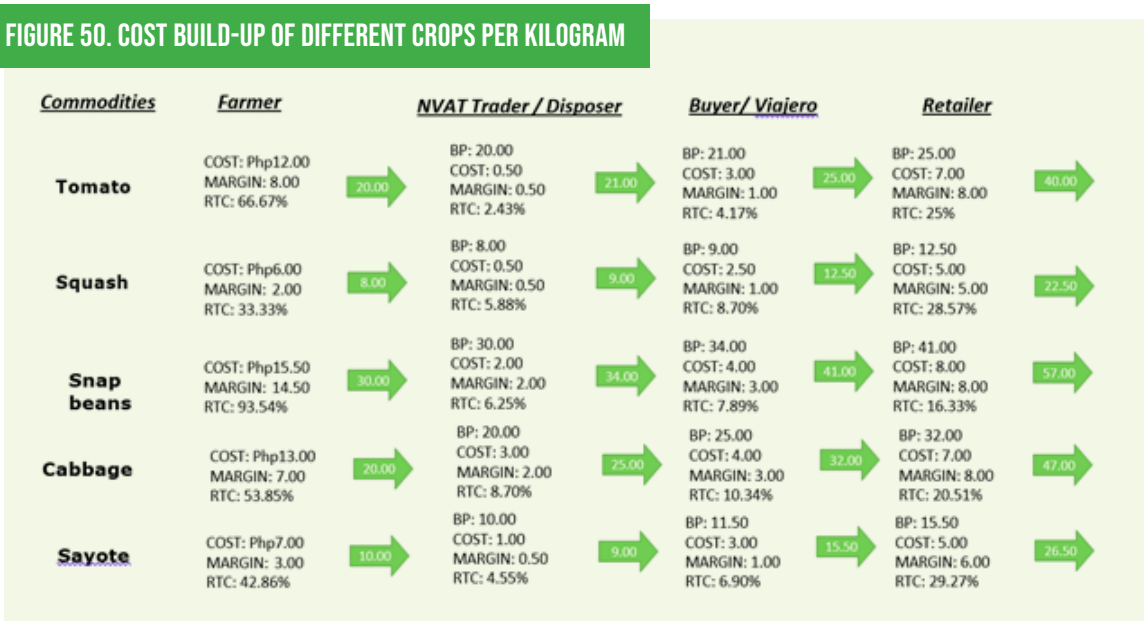
ITEM	TOMATO	SQUASH	OKRA	STRING BEANS	EGGPLANT	AMPALAYA	LOWLAND VEGETABLES
Yield/cropping							
High	20,900	12,700	16,040	24,200	28,060	15,520	19,570
Medium	19,855s	12,065	15,238	22,990	26,657	14,744	18,592
Low	18,862	11,462	14,476	21,841	25,324	14,007	17,662
Price/kilogram	21.00	14.00	31.00	25.00	23.00	45.00	26.50
Gross Sales							
High	438,900.00	177,800.00	497,240.00	605,000.00	645,380.00	698,400.00	510,453.33
Medium	416,955.00	168,910.00	472,378.00	574,750.00	613,111.00	663,480.00	484,930.67
Low	396,107.25	160,464.50	448,759.10	546,012.50	582,455.45	630,306.00	460,684.13
Total Cost of Production	252,560.00	93,136.00	173,780.00	189,017.00	248,297.00	268,128.00	204,153.00
Net Sales							
High	186,340.00	84,664.00	323,460.00	415,983.00	397,083.00	430,272.00	306,300.33
Medium	164,395.00	75,774.00	298,598.00	385,733.00	364,814.00	395,352.00	280,777.67
Low	143,547.25	67,328.50	274,979.10	356,995.50	334,158.45	362,178.00	256,531.13
Net Profit Margin (%)							
High	42.46	47.62	65.05	68.76	61.53	61.61	60.01
Medium	39.43	44.86	63.21	67.11	59.50	59.59	57.90
Low	36.24	41.96	61.28	65.38	57.37	57.46	55.68
ROI (%)							
High	73.78	90.90	186.13	220.08	159.92	160.47	150.03
Medium	65.09	81.36	171.83	204.07	146.93	147.45	137.53
Low	56.84	72.29	158.23	188.87	134.58	135.08	125.66

(DA-PRDP, 2019b)

Cost Build-Up

The producers bring their crops to the auction market instead of selling ex-farm, they incur additional expense but, in a day, or so they get back a much higher return and increasing their overall income per crop. At the trader's level, performing marketing functions such as cutting, cleaning and packaging enabled the local trader to obtain a higher value added or 56 percent return to cost from trading carrots. Meanwhile, the transport cost incurred by the wholesaler and the retailer reduces their profit. The production and transportation costs and high margins, however, tripled the price once the product reaches the consumers.

FIGURE 50. COST BUILD-UP OF DIFFERENT CROPS PER KILOGRAM



Benchmark Analysis

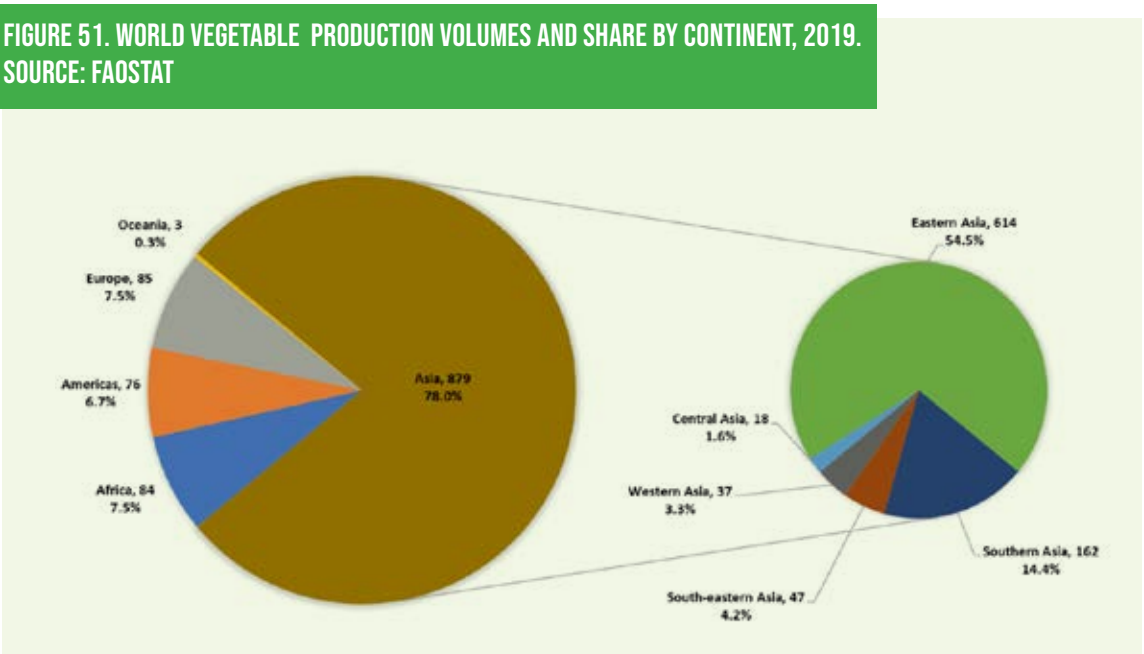
The Philippines is in the world map in the production of tropical vegetables. In the highland vegetables, understandably, the Philippines production is relatively insignificant. The country is in the map as a market of seeds of potato, cabbage, carrot, Chinese cabbage, and similar semi-temperate vegetables. It also imports some temperate vegetables legally or otherwise for institutional users and for consumers. To situate the local temperate vegetable industry, it would be interesting to review the global vegetable industry and relevant international trade, particularly for imported commodities.

Global Benchmarking

PRODUCTION, AREA, AND YIELD OF WORLD TOP PRODUCERS

Asia remains as the top vegetable producer in the world, accounting for 78% of total volume produced in 2019. Among its regions, East Asia (54.5%) ranks first mainly driven by China, while Southeast Asia (4.2%) ranks third (Figure 51).

FIGURE 51. WORLD VEGETABLE PRODUCTION VOLUMES AND SHARE BY CONTINENT, 2019. SOURCE: FAOSTAT



On the country-level, China continues to dominant the world vegetable market, producing more than half (52.4%) of total volumes in 2019. India (11.7%) and the USA (2.7%) follow in at second and third places. The Philippines, on the other hand, currently ranks 20th in the world at 0.6% share (Table 50).

TABLE 50. TOP VEGETABLE (PRIMARY) PRODUCING COUNTRIES, 2019

Rank	Country	Production			Area (ha)	Yield (MT/ha)
		Volume (MT)	Share (%)	AAGR*		
1	China	590,676,143.0	52.4	2.9	25,164,183.0	23.5
2	India	132,026,555.0	11.7	4.0	8,483,717.0	15.6
3	USA	29,999,514.0	2.7	-1.9	849,758.0	35.3
4	Turkey	25,338,974.0	2.2	1.8	747,417.0	33.9
5	Viet Nam	16,966,279.0	1.5	10.4	1,020,612.0	16.6
6	Nigeria	16,670,642.0	1.5	3.9	4,350,890.0	3.8
7	Egypt	15,419,841.0	1.4	-1.8	636,001.0	24.2
8	Mexico	15,226,085.0	1.3	4.2	681,630.0	22.3
9	Russia	14,153,617.0	1.3	1.0	575,034.0	24.6
10	Spain	13,259,340.0	1.2	1.6	323,960.0	40.9
20	**Philippines**	**6,977,857.0**	**0.6**	**1.8**	**801,861.0**	**8.7**

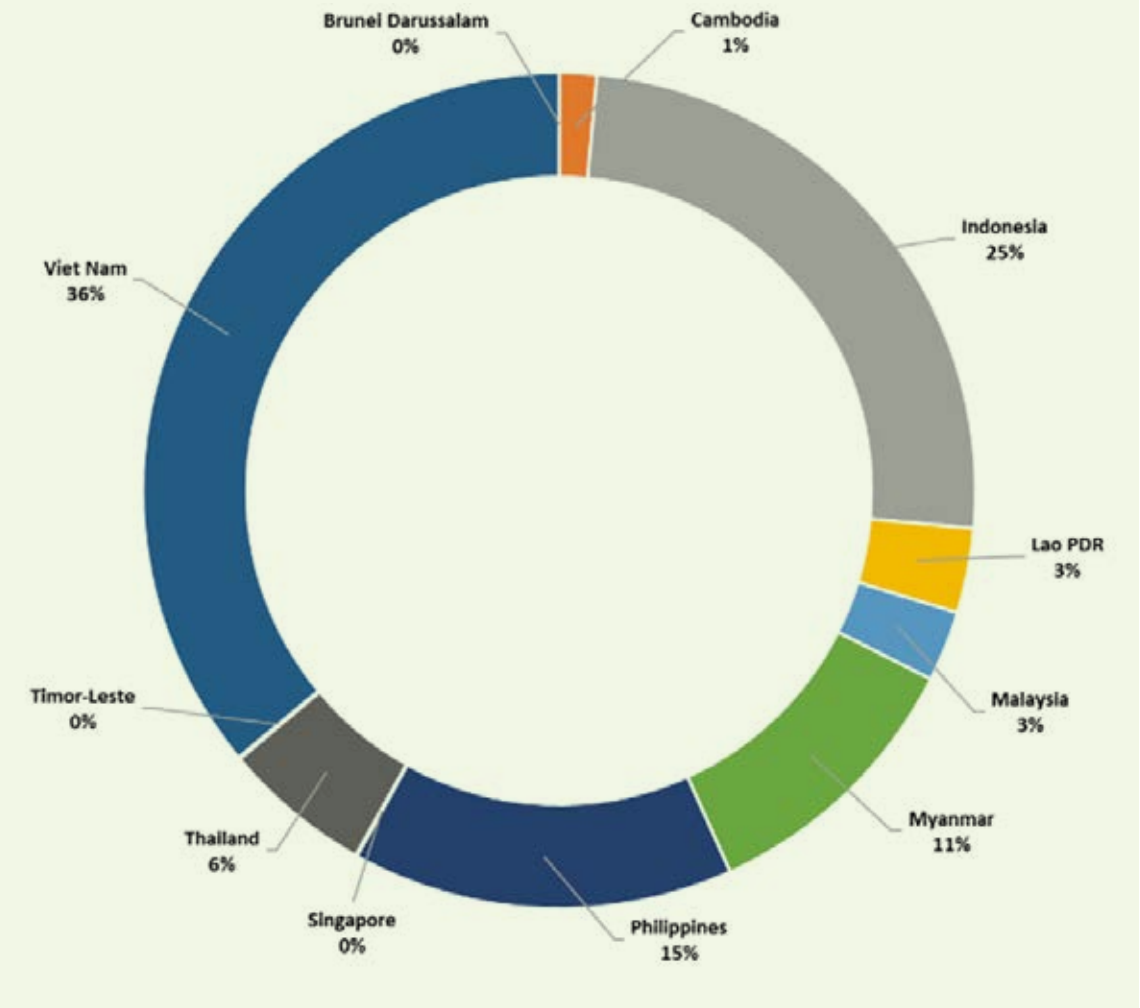
Source: FAOSTAT, *2010-2019

In terms of annual production growth, Vietnam outperforms all top producing countries, recording a double-digit average of 10.4% during the 2010-2019 period. This is way above those of China, India, and the USA, who hold the top three spots in terms of volume. The Philippines likewise showed slower growth at only 1.8% per annum.

Looking at the efficiency levels, Spain achieved the highest yield for vegetable production in 2019 at 40.9 MT/ha. The USA and Turkey shortly follow with 35.3 MT/ha and 33.9 MT/ha, respectively. The Philippines is at the lower spectrum with just 8.7 MT/ha. This is lower compared with the other top Asian countries, namely China (23.5 MT/ha), India (15.6 MT/ha), and Vietnam (16.6 MT/ha).

Zooming in to Southeast Asia, the top vegetable producing countries in 2019 were Vietnam (36%), Indonesia (25%), and the Philippines (15%) Philippines (Figure 52). These countries hold the 5th, 12th, and 20th place in terms of total vegetable production in 2019.

FIGURE 52. VEGETABLE PRODUCTION IN SOUTHEAST ASIA, BY COUNTRY (2019). SOURCE: FAOSTAT



LOWLAND VEGETABLES

Based on the 2019 FAO data, China is still the top producer of major lowland vegetables such as pumpkins, squash, and gourds; eggplant, and tomatoes. This is further shown in the following discussions.

Pumpkin, Squash, and Gourds. Table 51 presents the top producing countries of pumpkins, squash, and gourds in 2019, with China (36.8%), Ukraine (5.9%), and Russia (5.2%) taking the top three spots. In Asia, Bangladesh, Turkey, and Indonesia are the other leading producers, with volumes reaching more than half a million MT. No data is available for India in 2019, who is also one of the biggest producers of pumpkin, squash, and gourds; therefore, it was excluded in the list. Ukraine and Bangladesh, on the other hand, displayed strong growth in production in the past ten years (2010-2019) with average growth of 11.9% and 10.4%, respectively. Interestingly, despite being the top producer in the world, China has a significantly lower yield (18.6 MT/ha) as compared to Indonesia (62.3 MT/ha) and Spain (49.1 MT/ha). The Philippines ranked 16th, having produced 271,416 MTs with yield of 13.7 MT/ha. The country also experienced declining volume of production during the 2010-2019 period with average annual growth rate of -2.5%.

TABLE 51. TOP PUMPKINS, SQUASH, AND GOURDS PRODUCING COUNTRIES, 2019

Rank	Country	Production			Area (ha)	Yield (MT/ha)
		Volume (MT)	Share (%)	AAGR*		
1	China	8,427,676	36.8	2.6	453,104	18.6
2	Ukraine	1,346,160	5.9	11.9	62,800	21.4
3	Russia	1,195,611	5.2	1.1	56,088	21.3
4	Spain	734,640	3.2	9.7	14,950	49.1
5	Mexico	679,145	3.0	2.0	33,941	20.0
6	Bangladesh	634,951	2.8	10.4	58,378	10.9
7	USA	610,120	2.7	-1.0	24,767	24.6
8	Turkey	590,414	2.6	4.0	126,200	4.7
9	Italy	569,120	2.5	1.2	19,080	29.8
10	Indonesia	522,486	2.3	6.3	8,385	62.3
16	**Philippines**	**271,416**	**1.2**	**-2.5**	**19,871**	**13.7**

Note: No data for India in 2019; Source: FAOSTAT, *2010-2019

Eggplant. The top eggplant producers in the world are shown in Table 52. Again, China is in the lead with 35 million MT produced, equivalent to 64.5% of total world volume in 2019. The country also exhibited the fastest growth in production with average annual growth rate of 3.2% in the past ten years (2010-2019). India, ranked 2nd, also displayed strong growth at 2.1% per annum. The Philippines is currently at 9th place, with volumes growing faster than most of its competitors at 2.2% annually. In terms of yield, Spain is significantly higher at 70.6 MT/ha as compared to China's 45.5 MT/ha in 2019. Other high yielding countries are Turkey (35.3 MT/ha) and Japan (34.9 MT/ha).

TABLE 52. TOP EGGPLANT PRODUCING COUNTRIES, 2019

Rank	Country	Production			Area (ha)	Yield (MT/ha)
		Volume (MT)	Share (%)	AAGR		
1	China	35,590,700	64.5	3.2	782,998	45.5
2	India	12,680,000	23.0	2.1	727,000	17.4
3	Egypt	1,180,240	2.1	-0.7	43,818	26.9
4	Turkey	822,659	1.5	0.1	23,337	35.3
5	Iran	670,158	1.2	-3.5	21,350	31.4
6	Indonesia	575,392	1.0	2.5	43,954	13.1
7	Japan	301,700	0.5	-1.4	8,650	34.9
8	Italy	300,620	0.5	0.1	9,550	31.5
9	**Philippines**	**249,890**	**0.5**	**2.2**	**21,819**	**11.5**
10	Spain	245,150	0.4	2.2	3,470	70.6

Source: FAOSTAT, *2010-2019

String beans. There is a relatively small number of string beans producers in the world, with only 18 countries based on the latest FAO data (Table 53). The USA is at the top of the list, producing 54.1% of total world volumes in 2019. Among the Asian countries, the Philippines is in the lead, being the 4th largest producer of string beans. However, it can be observed that most of the top producing countries experienced contracting volumes over the past ten years (2010-2019) such as the USA, Morocco, the Philippines, Japan, and China. Yet, despite the significant difference in the volumes produced by the USA and the Philippines, their yields are not that variant, at 9.8 MT/ha and 8.1MT/ha, respectively. This implies that the country has potential to expand its production of string beans and capture a larger share of the market.

TABLE 53. TOP STRING BEANS PRODUCING COUNTRIES, 2019

Rank	Country	Production			Area (ha)	Yield (MT/ha)
		Volume (MT)	Share (%)	AAGR*		
1	USA	751,017	54.1	-2.4	76,769	9.8
2	Mexico	131,620	9.5	2.0	12,931	10.2
3	Morocco	119,927	8.6	-2.5	6,019	19.9
4	Philippines	112,311	8.1	-0.6	13,915	8.1
5	Turkey	89,860	6.5	2.8	9,705	9.3
6	Argentina	49,586	3.6	0.7	6,650	7.5
7	Japan	35,152	2.5	-3.5	5,086	6.9
8	Malawi	33,877	2.4	60.0*	1,262	26.8
9	Peru	27,193	2.0	0.7	9,432	2.9
10	China	9,990	0.7	-3.8	855	11.7

Source: FAOSTAT, * 2017-2019; no data available for 2010-2016.

Tomato. Table 54 shows the world's top tomato producers in 2019. At 1st place is China, with a significantly larger volume produced at 62 million MT versus the other major producers. This is equivalent to 34.7% of the total world produce for the year. Based on the rankings, Asia currently dominates tomato production, with the top three performing countries, China, India, and Turkey, recording continuous growth from 2010 to 2019. The Philippines, however, has a meager share of 0.1% of the world total despite annual growth of 1.2% in the past ten years (2010-2019). In terms of efficiency, the USA recorded an outstanding 98.0MT/ha in 2019, followed by Spain at 87.8 MT/ha, Brazil at 71.8 MT/ha, and Turkey at 70.8 MT/ha.

TABLE 54. TOP TOMATO PRODUCING COUNTRIES, 2019

Rank	Country	Production			Area (ha)	Yield (MT/ha)
		Volume (MT)	Share (%)	AAGR*		
1	China	62,869,502	34.8	3.3	1,086,771	57.8
2	India	19,007,000	10.5	6.2	781,000	24.3
3	Turkey	12,841,990	7.1	1.9	181,488	70.8
4	USA	10,858,990	6.0	-3.0	110,760	98.0
5	Egypt	6,751,856	3.7	-3.9	173,276	39.0
6	Italy	5,252,690	2.9	-2.4	91,410	57.5

Rank	Country	Production			Area (ha)	Yield (MT/ha)
		Volume (MT)	Share (%)	AAGR*		
7	Iran	5,248,904	2.9	-0.8	121,203	43.3
8	Spain	5,000,560	2.8	1.0	56,940	87.8
9	Mexico	4,271,914	2.4	5.7	87,917	48.6
10	Brazil	3,917,967	2.2	-0.8	54,537	71.8
61	Philippines	223,294	0.1	1.2	16,360	13.6

Source: FAOSTAT

HIGHLAND VEGETABLES

Similar to the case of lowland vegetables, the production of highland vegetables is also dominated by China in 2019, claiming the top spot for all major crops reported.

Cabbages and other Brassicas. The top producing countries of cabbages and other brassicas in 2019 are shown in Table 55. China ranks 1st in terms of volume of production at 34.2 million MT, or 48.7% of the world total. However, in terms of growth, Vietnam and India recorded the highest during the 2010-2019 period at 3.1% and 3.0% average per annum, respectively. The Philippines is way below the current rankings, placing 43rd in the world with a miniscule share of 0.2%. Looking at the 2019 yield, it is worth noting that the Republic of Korea is significantly more efficient with 71.2 MT/ha as compared to China's 33.8 MT/ha. The Philippines is way below at 43rd, with a minimal share of 0.2% of the world's total production.

TABLE 55. TOP CABBAGES AND OTHER BRASSICAS PRODUCING COUNTRIES, 2019

Rank	Country	Production			Area (ha)	Yield (MT/ha)
		Volume (MT)	Share (%)	AAGR*		
1	China	34,151,665	48.7	1.2	1,009,223	33.8
2	India	9,127,000	13.0	3.0	400,000	22.8
3	Russia	2,623,230	3.7	-1.4	72,188	36.3
4	Republic of Korea	2,573,532	3.7	0.7	36,157	71.2
5	Ukraine	1,732,920	2.5	1.9	65,900	26.3
6	Indonesia	1,413,059	2.0	0.5	64,991	21.7
7	Japan	1,380,883	2.0	-4.2	33,118	41.7

Rank	Country	Production			Area (ha)	Yield (MT/ha)
		Volume (MT)	Share (%)	AAGR*		
8	Viet Nam	1,053,316	1.5	3.1	38,494	27.4
9	USA	984,568	1.4	0.5	23,917	41.2
10	Poland	899,100	1.3	-2.3	25,800	34.8
43	**Philippines**	**128,050**	**0.2**	**0.3**	**7,847**	**16.3**

Source: FAOSTAT, *2010-2019

Green beans. Table 56 lists the top green beans producing countries in 2019, with China still in the lead, accounting for 80.6% of total world production. Indonesia and India are the far competitors, taking the 2nd and 3rd spots with just 3.5% and 2.7% shares, respectively. The Philippines is way behind at 38th place, with a measly produce of 14,029 MT for 2019, and has been experiencing declining volumes since 2010 with -1.4% average annual growth. France and Morocco, on the other hand, recorded impressive growth during the 2010-2019 period at 93.8% and 30.0%, respectively. The most efficient producers of green beans in 2019 are China (29.3 MT/ha) and Morocco (23.1 MT/ha) with yields above 20 million.

TABLE 56. TOP GREEN BEANS PRODUCING COUNTRIES, 2019

Rank	Country	Production			Area (ha)	Yield (MT/ha)
		Volume (MT)	Share (%)	AAGR*		
1	China	21,761,383	80.7	4.0	743,143	29.3
2	Indonesia	948,285	3.5	0.8	122,121	7.8
3	India	725,998	2.7	2.4	256,271	2.8
4	Turkey	596,074	2.2	-0.1	43,702	13.6
5	France	337,950	1.3	93.8	27,820	12.1
6	Thailand	290,307	1.1	-0.2	152,604	1.9
7	Egypt	288,630	1.1	0.5	27,934	10.3
8	Morocco	210,597	0.8	30.0	9,122	23.1
9	Italy	154,390	0.6	-1.7	18,250	8.5
10	Bangladesh	144,050	0.5	5.2	20,873	6.9
38	**Philippines**	**14,029**	**0.1**	**-1.4**	**3,092**	**4.5**

Source: FAOSTAT, *2010-2019

Potato. The world market for potato is one of the largest, with 159 producing countries recorded for 2019. China, as expected, is still the number one producer, with 91.9 million MT produced in 2019, or 24.8% of the total. Another big potato producer is India with 50.2 million MT or 13.5% share, followed by Russia and Ukraine, with 6.0% and 5.5% shares, respectively. In terms of growth, Bangladesh and India experienced the highest during the 2010-2019 period at 7.1% and 4.1% annual average, respectively. Despite having the largest volume, China has a relatively lower efficiency in producing potatoes at just 18.7 MT/ha as compared to other top producing countries such as the USA (50.3 MT/ha), Netherlands (42.0 MT/ha), France (41.3 Mt/ha), and Germany (39.0 MT/ha). The Philippines' share in the world potato market is negligible and declining, ranking a far 104th in 2019 with just 116,061 MT produced (Table 57).

TABLE 57. TOP POTATO PRODUCING COUNTRIES, 2019

Rank	Country	Production			Area (ha)	Yield (MT/ha)
		Volume (MT)	Share (%)	AAGR*		
1	China	91,881,397	24.8	2.8	4,914,746	18.7
2	India	50,190,000	13.5	4.1	2,173,000	23.1
3	Russia	22,074,874	6.0	-0.9	1,238,575	17.8
4	Ukraine	20,269,190	5.5	0.9	1,308,800	15.5
5	USA	19,181,970	5.2	-0.1	381,290	50.3
6	Germany	10,602,200	2.9	0.1	271,600	39.0
7	Bangladesh	9,655,082	2.6	7.1	468,395	20.6
8	France	8,560,410	2.3	2.6	207,160	41.3
9	Netherlands	6,961,230	1.9	0.2	165,730	42.0
10	Poland	6,481,620	1.7	-2.5	302,480	21.4
104	**Philippines**	**116,061**	**0.03**	**-0.24**	**7,514**	**15.4**

Source: FAOSTAT, *2010-2019

Carrots and Turnips. Lastly, for carrots and turnips, the top producers in the world for 2019 are listed in Table 58. Again, China is at the top, with 21.5 million MTs produced or a share of 47.8%. Uzbekistan and the USA trails behind at 2nd and 3rd spots, respectively, in terms of volumes produced. However, it can be observed that Uzbekistan and the USA have been experiencing stronger production growth in the past ten years (2010-2019) at 8.7% and 6.3%, respectively, as compared to China's 3.6%. Furthermore, the two countries also recorded significantly higher yields than China in 2019 at 71.2 MT/ha and 70.1 MT/ha, respectively. The Philippines, on the other hand, currently ranks 50th in the world in terms of carrots and turnips production with just 73,663 MT produced in 2019.

TABLE 58. TOP CARROTS AND TURNIPS PRODUCING COUNTRIES, 2019

Rank	Country	Production			Area (ha)	Yield (MT/ha)
		Volume (MT)	Share (%)	AAGR*		
1	China	21,482,971	48.0	3.6	415,656	51.7
2	Uzbekistan	2,769,613	6.2	8.7	38,922	71.2
3	USA	2,259,000	5.0	6.3	32,210	70.1
4	Russia	1,558,866	3.5	1.2	48,702	32.0
5	Ukraine	869,450	1.9	2.7	43,000	20.2
6	United Kingdom	830,259	1.9	1.8	14,132	58.8
7	Germany	791,110	1.8	4.2	13,730	57.6
8	Indonesia	698,880	1.6	7.4	42,895	16.3
9	Poland	678,300	1.5	-2.1	22,500	30.1
10	Turkey	666,270	1.5	1.7	11,311	58.9
50	**Philippines**	**73,663**	**0.2**	**-0.1**	**5,450**	**13.5**

Source: FAOSTAT, *2010-2019

Major Asian Importers and Exporters

MAJOR ASIAN IMPORTERS

Table 59 presents the top 10 vegetable importing countries (in terms of value) in 2019. East Asian countries Japan, Republic of Korea, and Hong Kong hold the top three spots, with Japan accounting for 25.8% of total Asian imports at USD 3.8 billion. In terms of volumes, Middle Eastern countries, Iraq, and UAE, recorded the highest growth during the 2010-2019 period with 19.4% and 9.3% annual average, respectively. In the case of the Philippines, vegetable imports have been increasing dramatically in the past ten years, recording a double-digit average of 11.5%.

TABLE 59. TOP VEGETABLE IMPORTING COUNTRIES IN ASIA, 2019

Rank	Country	Import Value			Import Quantity			Unit Price ('000 USD/ MT)
		('000 USD)	Share (%)	AAGR*	(MT)	Share (%)	AAGR*	
1	Japan	3,845,060.00	25.8	4.1	2,263,776	13.1	3.0	1.70
2	Republic of Korea	989,997.00	6.6	8.6	1,277,570	7.4	7.1	0.77
3	Hong Kong	968,735.00	6.5	10.4	995,290	5.8	3.6	0.97
4	United Arab Emirates	841,103.00	5.6	7.3	1,405,192	8.2	9.3	0.60
5	Saudi Arabia	830,403.00	5.6	10.5	1,101,717	6.4	6.9	0.75
6	Malaysia	742,490.00	5.0	6.6	1,233,619	7.2	3.1	0.60
7	Indonesia	719,775.00	4.8	11.6	699,499	4.1	2.9	1.03
8	Thailand	638,419.00	4.3	15.0	490,091	2.8	6.9	1.30
9	Iraq	634,253.00	4.2	19.3	1,351,432	7.8	19.4	0.47
10	Singapore	603,294.00	4.0	6.5	541,702	3.1	2.0	1.11
	Philippines	**176,779.00**	**1.2**	**14.2**	**255,843**	**1.5**	**11.5**	**0.69**

Source: FAOSTAT, *2010-2019

MAJOR ASIAN EXPORTERS

The top vegetable exporting countries in Asia are listed in Table 60. China (mainland) clearly outperforms its other Asian counterparts with total export values reaching USD 14.0 billion in 2019. This is equivalent to 62.6% of total Asian vegetable exports during the year. However, it is worth noting that Vietnam and Iran exhibited drastic growth in import values at 89.8% and 78.9%, respectively. In terms of volumes, China accounted for more than 50% of total Asian vegetable exports at 10.6 million MT in 2019. However, looking at the average annual growth in volumes during the 2010-2019 period, Iran (54.7%), Vietnam (19.8%), and UAE (19.5%) recorded the fastest expansion. The Philippines, on the other hand, only accounted for 0.05% of total vegetables exports with an average growth of 1.8% in the past ten years (2010-2019).

TABLE 60. TOP VEGETABLE EXPORTING COUNTRIES IN ASIA, 2019

Rank	Country	Export Value			Export Quantity			Unit Price
		('000 USD)	Share (%)	AAGR*	(MT)	Share (%)	AAGR*	('000 USD/ MT)
1	China (mainland)	14,043,162.00	62.6	9.2	10,316,176	50.4	3.8	1.36
2	Iran	1,496,526.00	6.7	89.8	1,184,267	5.8	54.7	1.26
3	Turkey	1,469,477.00	6.6	1.2	1,760,706	8.6	2.2	0.83
4	India	1,072,060.00	4.8	2.7	2,129,719	10.4	0.6	0.50
5	Thailand	666,092.00	3.0	3.5	434,948	2.1	-0.2	1.53
6	Israel	398,391.00	1.8	-2.3	320,889	1.6	0.6	1.24
7	Viet Nam	359,757.00	1.6	78.9	144,812	0.7	19.8	2.48
8	Republic of Korea	352,196.00	1.6	5.2	207,961	1.0	9.8	1.69
9	United Arab Emirates	339,776.00	1.5	26.2	353,362	1.7	19.5	0.96
10	Jordan	263,547.00	1.2	-3.1	424,422	2.1	-5.2	0.62
	Philippines	**27,419.00**	**0.12**	**5.6**	**10,090**	**0.05**	**1.8**	**2.72**

Source: FAOSTAT, *2010-2019

Competitiveness Analysis

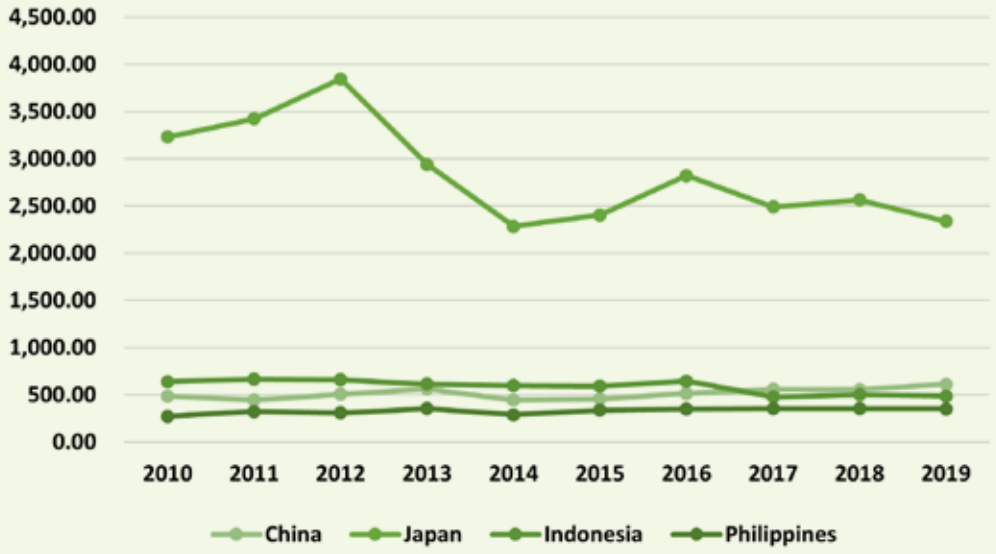
The following section presents an analysis of producer's prices for selected lowland and highland vegetables for major Asian producers. This is to compare the performance of the Philippines in terms of price paid to vegetable producers with its other neighboring Asian countries. Although China mainly leads in terms of volumes produced both at the regional and global levels, Japan, on the other hand, seems to top the price charts as clearly depicted in the following figures.

Lowland Vegetables

For lowland vegetables, producer's prices for tomato, eggplant, and string beans are shown in Figures 53-55.

Tomato. Figure 53 shows the comparative producer's prices of tomato in China, Japan, Indonesia, and the Philippines. Japan clearly beats its major Asian competitors in terms of tomato prices, ranging between USD 2,000 - USD 4,000 per MT. However, it is also evident that Japan's prices have been declining significantly over the past ten years (2010-2019). China, on the other hand, had a relatively stable increase in prices, growing at an average of 2% per annum during the same period. The Philippines, on the other hand, exhibited the highest average annual growth in prices at 3.5%, while Indonesia's was pegged at 1.6%.

FIGURE 53. PRODUCER'S PRICES OF TOMATO IN SELECTED ASIAN COUNTRIES, 2010-2019

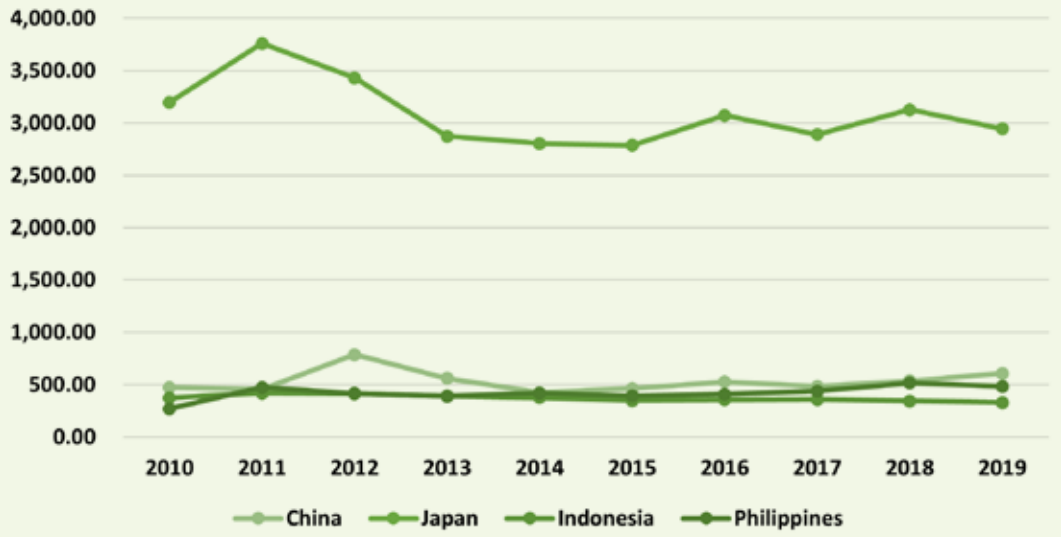


Tomatoes	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	AVE. GR. '10-'19
China	485.9	444.9	506.9	562.2	444.7	456	513.8	556.4	554.2	610	1.99
Japan	3,229.70	3,423.90	3,844.40	2,940.70	2,284.20	2,402.00	2,821.90	2,489.60	2,562.90	2,336.90	-0.44
Indonesia	637.5	664.6	657.7	612.2	595.2	590.8	644.9	476.7	499	484.6	1.65
Philippines	270.9	321.1	306.9	353.9	288.5	335.7	347	354.3	354	349.1	3.48

Source: FAOSTAT

Eggplant. Producer's prices of eggplant in China, Japan, Indonesia, and the Philippines are presented in Figure 54. Like the tomatoes, Japan also recorded the highest price for eggplant during the 2010-2019 period, with an average annual growth rate of 1.4%. China, on the other hand, enjoyed strong increase in eggplant prices, growing at an average of 8.2%. The Philippines likewise experienced significant improvement in prices, with 6.1% average growth in the past ten years. Indonesian prices were also stable during the period, with average annual growth of 1.6%.

FIGURE 54. PRODUCER'S PRICES OF EGGPLANT IN SELECTED ASIAN COUNTRIES, 2010-2019

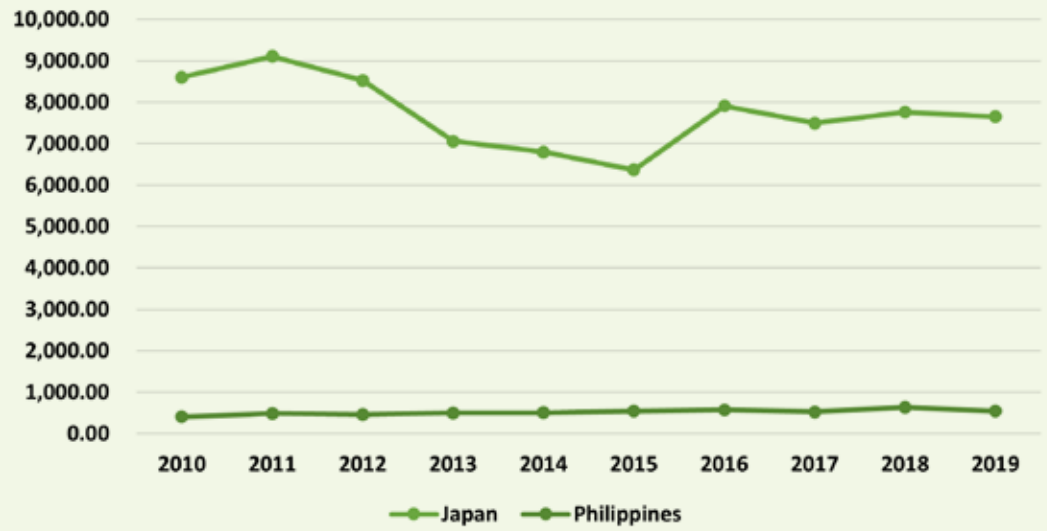


Eggplants	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	AVE. GR. '10-'19
China	472.7	455	785.8	559.4	422.2	462.5	524.2	483.3	534.3	608.6	8.23
Japan	3,196.60	3,759.10	3,429.00	2,871.00	2,803.30	2,785.80	3,071.90	2,890.40	3,126.20	2,944.70	1.4
Indonesia	374.7	417.4	414.4	389.8	376.7	349.6	356.7	358.1	342.9	329.7	1.59
Philippines	270.2	471.9	415.4	387.3	418	390	408.3	437.7	514.8	481.7	6.1

Source: FAOSTAT

String beans. Despite scarcity of data on string beans prices, it is still worth showing how the Philippines fairs with other countries, in this case, Japan, given that both countries are top producers of the crop in the world, ranking 4th and 7th, respectively, in terms of volumes (Figure 55). In 2019, Japan's string beans price was 14 times higher than that of the Philippines. Interestingly, the Philippines had significantly higher area harvested (13,915 ha vs. 5,086 ha) and yield (8.1MT/ha vs. 6.9MT/ha) in 2019 as compared to Japan. However, the Philippine's total production volumes have continued to contract over the past ten years averaging at -0.77%. Japan, on the other hand, experienced a relatively higher decline in volumes with an average of -2.13. Given this, the enormous price gap could potentially be a qualitative issue.

FIGURE 55. PRODUCER'S PRICES OF STRING BEANS IN JAPAN AND THE PHILIPPINES, 2010-2019



String Beans	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	AVE. GR. '10-'19
Japan	8,597.60	9,103.20	8,523.60	7,058.70	6,793.20	6,366.30	7,909.50	7,491.60	7,762.00	7,644.30	1.6
Philippines	407.2	486.2	464.1	499.2	501.5	542	571.2	521.4	636.7	540	3.42

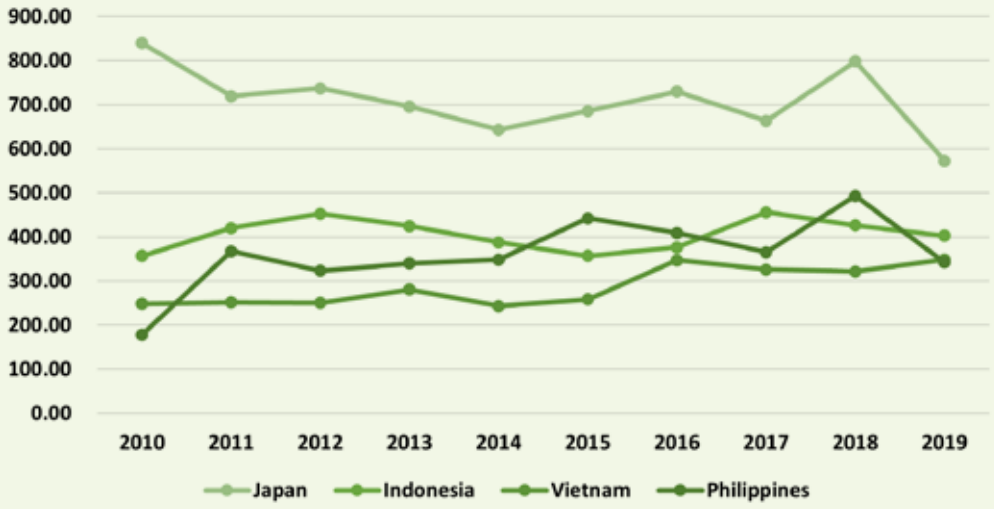
Source: FAOSTAT

Highland Vegetables

For highland vegetables, producer's prices for cabbages (and other brassicas), potatoes, and carrots (and turnips) are shown in Figures 56-58.

Cabbages and other Brassicas. Figure 56 shows the historical producer's prices for cabbages (and other brassicas) in Japan, Indonesia, Vietnam, and the Philippines. Even with highland vegetables, in this case, cabbages (and other brassicas), Japan still claims the highest price for its produce. However, the disparity is not as high as that with lowland crops presented earlier. For cabbages (and other brassicas), Japan's prices have been below the USD 1,000 mark and have been declining over the past ten years (2010-2019). On the other hand, the Philippines, together with other Southeast Asian producing countries, namely Vietnam and Indonesia, have been showing price competitiveness during the same period, recording average annual growths of 7.7%, 4.0%, and 2.7%, respectively.

FIGURE 56. PRODUCER'S PRICES OF CABBAGES (AND OTHER BRASSICAS) IN SELECTED ASIAN COUNTRIES, 2010-2019

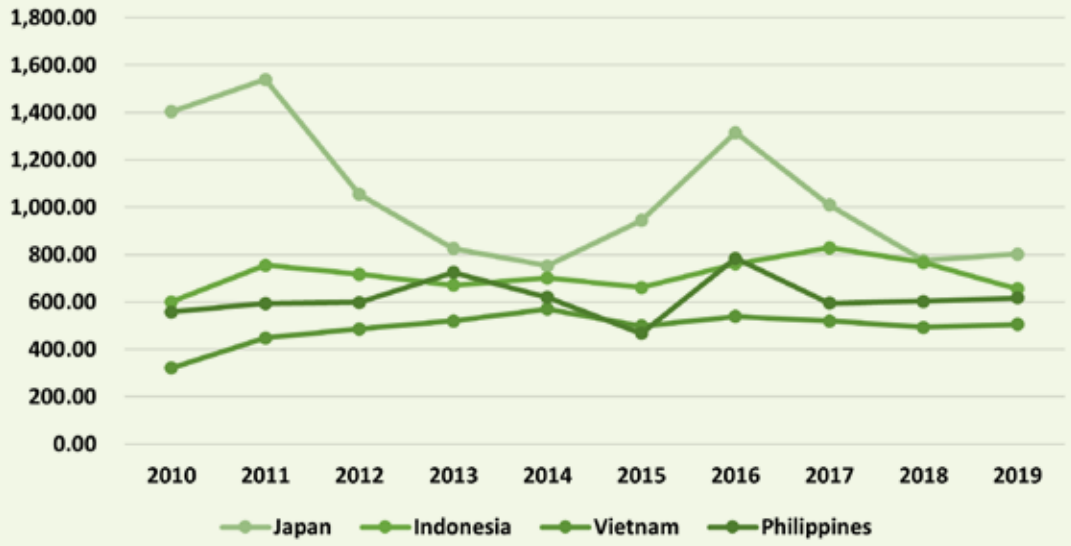


Cabbages and Other Brassicas	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	AVE. GR. '10-'19
Japan	839.6	719.2	736.9	695.7	642.8	685.7	729.8	663.3	797.8	572.4	-1.04
Indonesia	356.7	420	452.6	424.5	387.4	356.9	376.6	456.1	426.4	402.7	2.67
Vietnam	248.1	251.3	250.1	280.7	243.1	258.1	347.3	325.8	321.7	348.4	4.04
Philippines	178.2	367.3	323.2	339.7	348.5	442.7	409.1	365.1	492.6	342.1	7.67

Source: FAOSTAT

Potatoes. Comparative producer's prices of potatoes in Japan, Indonesia, Vietnam, and the Philippines are displayed in Figure 57. In case of potatoes, prices recorded during the 2010-2019 period in the countries presented are much more competitive. Here we can see the very high fluctuations in Japan's prices over time, particularly the large dips in 2014 and 2018. Among the countries presented, Vietnam is showing the fastest increase in potato prices, with an average growth of 5.7% per annum. The Philippines closely follows with 3.1%, while Indonesia is at 2.3%.

FIGURE 57. PRODUCER'S PRICES OF POTATO IN SELECTED ASIAN COUNTRIES, 2010-2019

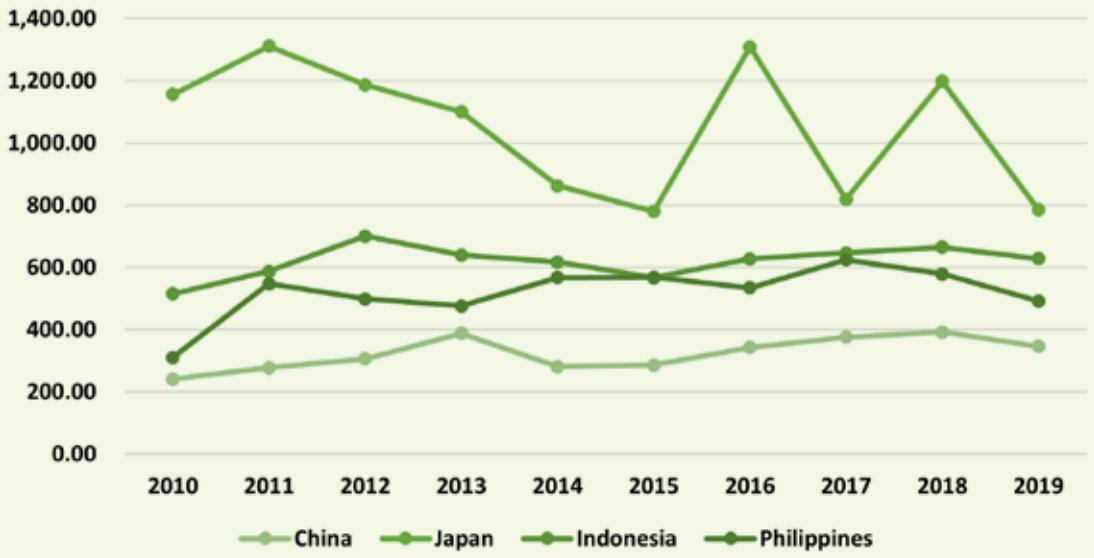


Potatoes	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	AVE. GR. '10-'19
Japan	1,403.50	1,538.70	1,054.00	825.9	753.2	944.3	1,314.40	1,009.20	775.2	801.8	1.23
Indonesia	600.6	755	717.3	671.1	700.6	660.6	761	829.3	766.1	654.8	2.33
Vietnam	321.4	448.1	486.3	519.5	569.7	498.1	538.5	520.3	493.3	505.2	5.66
Philippines	557.3	593.4	597.9	724.7	619.1	466.7	784.1	594.6	603.1	617	3.08

Source: FAOSTAT

Carrots and Turnips. For carrots (and turnips), producer prices in China, Japan, Indonesia, and the Philippines are presented in Figure 58. Japan's prices for carrots (and turnips) are still above most of its Asian competitors but have been highly volatile especially in recent years (2015-2019). China, on the other hand, had stable prices in the past ten years (2010-2019), recording a measly 0.6% average growth per annum. In case of the Philippines, the country seems to be performing well during the period, with carrots (and turnips) prices growing at 3.1% annually. Indonesia, trails closely with an annual growth in prices of 2.7%.

FIGURE 58. PRODUCER'S PRICES OF CARROTS (AND TURNIPS) IN SELECTED ASIAN COUNTRIES, 2010-2019



Carrots and Turnips	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	AVE. GR. '10-'19
China	240.8	277	305.8	387.4	280.1	286.2	342.8	375.3	392.2	346.2	0.61
Japan	1,156.30	1,310.70	1,186.90	1,100.50	862.7	779.9	1,308.00	819.3	1,198.10	786.2	3.11
Indonesia	514.8	587	700.4	639.4	616.6	566.5	627.2	646	665.1	627.8	2.71
Philippines	309.9	547.2	498.5	475.7	567.2	568.2	534.4	625	578.8	491.7	3.13

Source: FAOSTAT

Given the above analysis of recent producer's price trends, the Philippines have been performing relatively well compared with its neighboring Asian countries. For most of the lowland and highland crops presented, the Philippines mainly tops the charts in terms of average growth rate per annum over the 2010-2019 period. This, coupled with improvements in yield and product quality, could potentially bring brighter prospects for the Philippine vegetable industry in the years to come.

Moreover, an in-depth benchmark and comparative study with Japan, Vietnam, and Indonesia would be a good starting point in determining the factors that could support increasing the competitiveness of the Philippine vegetable industry in the world market.

MARKET PERSPECTIVES AND PROSPECTS

With increasing competition in the market for many agricultural crops such as vegetables and the inherent seasonality in agricultural production, market-oriented production planning is seen as a strategy that could improve the income of the farmers. This implies that farmers should not only plan their production activities but their marketing strategies as well. Poor marketing negates the gains from an efficiently managed farm because the bountiful harvest cannot be translated to the highest possible profit if they are not marketed at all. Thus, one of the important considerations that should be given emphasis by the industry is the market for vegetables. Several studies point to the fact that in developed countries short supply chains are increasingly becoming more popular as they are more profitable to the farmers, sustainable, and beneficial to the local economy. Short supply chains employ direct selling or are composed of few intermediaries and more often sell goods to markets in short distances. Short supply chains, however, can only be promoted if the required logistics are present and efficiently working.

Among the most important marketing logistics for vegetables are the trading centers where the farmers are supposed to bring their freshly harvested goods for direct selling to wholesale buyers or assemblers for less cost and increased profit. Depending on the size and other characteristics, markets in general, can attract different classes of participants (buyers and sellers) with differing requirements for services and amenities. These requirements can be location- and facility-specific suggesting the necessity of a careful study on where to locate and what amenities/ characteristics they should possess. In the absence of concrete basis for deciding where to locate them and to avoid the practice of LGUs to build them in whatever land available without due consideration of factors that can affect their viability and acceptability to intended users, studies on how to properly locate are needed. Location is vital because markets that are too far tend to lose patronage from the farmers due to difficulty of access and increased marketing cost. This was the case for many trading posts established by the LGUs earlier through a grant from the government but became mere white elephants due to non-patronage of both the buyers and eventually the sellers (Delos Reyes, et al., 2013).

Key Demand Drivers

Market-oriented production planning implies that the farmers are able to formulate their own marketing plan, not just follow what their fellow farmers do. A marketing plan could function as a road map for the marketing activities of the farmer and should specify as to what, how, where, and when he/she should produce and market for sustained increase in profits. According to FAO (2004), a marketing plan should answer the following questions:

- Who will buy the produce?
- What does the buyer want? What is currently being bought and sold?
- Is this product in demand?
- Are other farmers supplying the same product?
- How can demand for some products be created?
- Can the farmer compete in price, quality, and delivery?

Thus, first and foremost, demand for the farmer's intended product should be analyzed before any production activity is commenced. Demand analysis permits the farmers to know how demand for his/her product will change with alterations in various factors and therefore proper actions could be done. Aside from own price of the product, demand is also affected by an increase in income of consumers, the number of consuming population and their age and sex distribution, changes in taste and preferences, and many others depending on the product itself. For instance, it was found by Dueños (2019) that in Los Baños, Laguna, the volume of indigenous vegetables purchased was affected by the consumers' level of awareness. That is, consumers with higher levels of knowledge tend to purchase more indigenous vegetables. In addition, it was revealed that the principal reason for buying indigenous vegetables in the market was their nutritional value, followed by affordability, and the perception that these vegetables are healthy and are alternative natural medicines. From being perceived as "poor man's food" consumers now see them as healthy, nutritive alternatives.

The knowledge regarding indigenous vegetables has somehow been expanding through time although very slowly as they are not always available in the market. The widening of markets has been due to the growing interest of society in healthy consumption. Thus, there is a growing demand for indigenous vegetables as proven by the shifts in perception and preference of the consumers which entails great opportunity for smallholder farmers. Whether this is also true for the other vegetable types (e.g., pinakbet vegetables) should be backed up by studies/research.

Similarly, changes in the level of income of the consumers could either increase or decrease the demand for a certain agricultural commodity. Farmers should know how changes in consumer's income affect the demand for the agricultural commodity that they produce. An increase in population or the number of possible consumers will likewise increase the demand for a particular agricultural commodity. changes in tastes and preferences of consumers will either increase or decrease the demand. Also, when the female head of the household starts working outside the home, there is an increased demand for pre-cut fresh vegetables since it is more convenient to cook considering that food preparation time is saved. These and more are concerns of demand analysis.

Lowland vegetable commodities were identified as priority commodities not only because of its satisfactory production performance but it unlocks its potentials in value-adding opportunities. While the demand for fresh lowland vegetables is increasing, the demand for value-added products is likewise increasing since people are now opting for a healthier food product. Furthermore, lowland vegetable production is also identified as an industry where subsistence can be addressed on a daily basis especially to those farming on a backyard scale. The large and increasing market demand coming from Metropolitan Manila is likewise a good opportunity to cease.

Market Prospects

Farmers must also be aware of the quality requirements of buyers to compete in the market to maximize their profit. This could be made possible by the support of relevant market research such as consumer perception, behavior, and preference studies because good knowledge of the products to be produced and the potential customers or a full understanding of who buy and why they buy is essential in successful marketing.

Also, a farmer can choose from several options in selling his/her farm produce ranging from: selling at the farmgate, selling by the roadside, selling directly in the market, selling to institutional buyers (e.g., supermarkets, hotels, and restaurants), processors or exporters, and contract growing. The choice of the selling strategy depends on the location of the farm relative to the market, the costs involved in marketing, the prevailing price in the market and the volume of the produce to be marketed. In general, institutional buyers, processors, and exporters prefer to buy a large volume of the farm produce from individual or group of farmers. A study done by Nacion (2019) on the choice of marketing options for lowland vegetables in Nagcarlan, Laguna showed that knowledge on market outlets, volume, and distance to the market outlet affected the farmers' outlet choice. Farmers who are aware of more marketing options tend to lean more towards direct selling (because they can compare the costs and returns); farmers who are farther from the market favor selling directly; and those with more volume produced have a higher tendency to sell through middlemen. Studies such as this should be conducted because clearly the behavior of the farmer-respondents may not have been the usual as explained by long standing theories, necessitating more innovative marketing strategies.

PRIORITY CONCERNS & OPPORTUNITIES/ CONSTRAINTS & OPPORTUNITIES

This section highlights the supply chain issues and gaps identified by the stakeholders together with the opportunities and strategies to overcome these.

Supply Chain Issues/Gaps

Table 61 shows the key challenges of the vegetable industry per sector. As such, in the input supply sector, the key challenges are the following: high cost of inputs, lack of greenhouse facilities for seedling production; limited varieties that are resistant to diseases; regulatory issues of product registration such as seeds, pheromones, and fertilizers, among others; the farmers' reliance on imported planting materials; and cultural factors such as limited conservation of heirloom varieties.

In the production sector, key challenges include the low adoption of IPM and the use of biological control; limited climate-smart production technologies such as hydroponics and aquaponics setup; lack of greenhouse facilities for crop production; and the prevalence of pests and diseases; seasonality of production; high cost of inputs such as fertilizers, pesticides, mulching materials, etc.; and limited irrigation facilities that hinder crop growth and production.

In the postharvest and processing sectors, key challenges include the limited adoption of technology specifically on handling and storage of fresh produce; limited access to postharvest equipment; high perishability of vegetables; food safety concerns (pesticide residue level); poor handling practices along the market segments; inadequate storage and processing facilities; and poor quality of produce.

The key challenges in the marketing-related concerns include the improper utilization of the trading centers; limited capacity in engaging logistic services; limited market information/intelligence reports from concerned agencies; presence of multiple handling layers; high cost of transportation; inefficient supply chain and marketing system, in general; undeclared, smuggled, and undocumented products and vegetable produce; and fluctuating market prices and seasonality of production.

Lastly, key challenges were also identified in the consumption/consumer sector such as low vegetable consumption among Filipinos; fluctuating supplies, prices, and seasonality which also affects the decision to purchase and consume vegetables; and the safety of vegetables produced through conventional agricultural practices, i.e., the use of chemical fertilizers and pesticides.

Across all these sectors, several factors and challenges that affects vegetable production are the lack of credit facilities and programs to provide capital for farmers, climate change impacts, and a harmonized source of agricultural information.

TABLE 61. KEY CHALLENGES OF THE VEGETABLE INDUSTRY

INPUT SUPPLY	PRODUCTION	POSTHARVEST AND PROCESSING	MARKETING AND OTHER RELATED CONCERNS	CONSUMPTION
High cost of input (seeds, fertilizers, pesticides, etc.)	Low adoption of IPM Strategies and Biological control	Limited adoption of technology	Under (over) utilized Trading Centers	Below target Vegetable Consumption
Lack of greenhouse facilities (for seedling production)	Limited climate-smart production technologies	Limited access to appropriate post-harvest equipment	Limited capacity in engaging logistic services	Fluctuating supplies, prices, and seasonality
Limited (disease resistant and tolerant) varieties	Lack of greenhouse facilities (for crop production)	Vegetables are highly perishable (high postharvest losses/ wastes)	Limited market information/market intelligence	Food safety
Regulatory gaps on product registration for seeds, pheromones, fertilizers, and other inputs	Pests and diseases	Food safety concerns (pesticide residue level)	Multiple handling layers	
Reliance on imported planting materials	Seasonality of production	Poor handling practices	High cost of transport	
Limited conservation of heirloom varieties	High cost of production	Inadequate storage and processing facilities (cold storage)	Inefficient supply chain and inadequate market information system	
	Improper use of pesticides	Poor quality of produce	Undeclared/ smuggled/ undocumented products	
	Limited irrigation system; water catchment facilities		Fluctuating supplies, prices, and seasonality	
Limited loan/credit programs for capital				
Impacts of climate change				
Harmonization of data (PSA, RFO, farm)				

Required Interventions for Competitiveness

In order to overcome the challenges identified in the previous section, Table 63 shows the needed investments and capital to overcome and provide solutions to the issues and gaps on vegetable production while Tables 64 and 65 show the performance targets for lowland and highland vegetables, respectively, which are used to compute for the figures listed in Table 62.

Some of the needed capital investments for vegetable production include the provision of greenhouse for seedling production (at least one per region, or a total of 16 per year, from 2022 – 2025); provision of vegetable seeds and planting materials (at 2.5 kg/ha); construction and provision of smart greenhouses and rain shelters per province; provision of small-scale irrigation facilities, sprinklers/drip fertigation system, and solar-powered irrigation systems; provision of farm machineries and equipment such as tractor, multi-cultivator, drone sprayers, and composting facilities.

To improve the postharvest processes, some of the needed investments are plastic crates, consolidation centers, village-level processing facilities, cold storage facilities, hauling trucks (refrigerated vans), and pesticide residue laboratories.

Aside from these physical investments, there is also a need to invest in building the capacities of farmers by providing trainings that are tailored-fit to their needs. Investments should also focus on improving and enhancing the e-commerce platforms for selling and marketing fresh vegetable produce, improving the information and database systems, and the enhancement of capital and credit/loan facilities so more farmers can access these schemes.

TABLE 62. REQUIRED INVESTMENTS AND CAPITAL

PROJECTS/ PROGRAMS/ ACTIVITIES	2021		2022		2023		2024		2025		TOTAL		PROPOSED FUNDING AGENCIES/ORGANIZATIONS
	PHYSICAL TARGET	REQUIRED INVESTMENT (P'000)	PHYSICAL TARGET	REQUIRED INVESTMENT (P'000)	PHYSICAL TARGET	REQUIRED INVESTMENT (P'000)	PHYSICAL TARGET	REQUIRED INVESTMENT (P'000)	PHYSICAL TARGET	REQUIRED INVESTMENT (P'000)	PHYSICAL TARGET	REQUIRED INVESTMENT (P'000)	
CLUSTERED FARMS (10 clusters per Region at 50 has minimum)			160		160		160		160		640		DA RFOs
GAP CERTIFIED FARMS (10 farms per region)			160		160		160		160		640		ATI/BPI
LEARNING SITES (1 site per region)			16	2,400	16	2,400	16	2,400	16	2,400	64	9,600	ATI
PRODUCTION													
NURSERY (FOR SEEDLING PRODUCTION)			16	48,000	16	48,000	16	48,000	16	48,000	64	9,600	BPI/ Seed Companies
LOWLAND VEGETABLE SEEDS (in kg at 2.5kg/ha)	9,687	76,603	9,928	80,926	25,000	250,000	27,500	275,000	30,000	300,000	102,115	982,529	DA HVCDP/LGUs/FCAs
HIGHLAND VEGETABLES SEEDS (in kg at 2.5kg/ha)	1213	14,579	1,422	17,380	1,375	16,500	1,500	18,000	1,500	18,000	7,010	84,459	DA HVCDP/LGUs/FCAs
SMART GREENHOUSES (no. of units)			80	240,000	80	240,000	80	240,000	80	240,000	320	960,000	DA HVCDP/RAED/LGUs/FCAs
RAINSHELTERS (no. of units)			160	8,000	160	8,000	160	8,000	160	8,000	640	32,000	DA HVCDP/RAED/LGUs/FCAs
SMALL SCALE IRRIGATION SYSTEM (Service area,has)			1,000	100,000	1,000	100,000	1,000	100,000	1,000	100,000	4,000	400,000	DA HVCDP/RAED/LGUs/FCAs
SPRINKLER/DRIP FERTIGATION SYSTEM			160	320,000	160	320,000	160	320,000	160	320,000	640	1,280,000	DA HVCDP/BSWM
SOLAR POWERED IRRIGATION SYSTEM			160	128,000	160	128,000	160	128,000	160	128,000	640	512,000	DA HVCDP/BSWM
FARM MACHINERIES (TRACTOR), @1 unit per cluster, 10 clusters pe	17.0	17,200	160	240,000	160	240,000	160	240,000	160	240,000	657	977,200	DA HVCDP/RAED/LGUs/FCAs
FARM MACHINERIES (MULTI-CULTIVATORS), @1 unit per cluster, 1	157.0	36,970	160	240,000	160	240,000	160	240,000	160	240,000	797	996,970	DA HVCDP/RAED/LGUs/FCAs
DRONE SPRAYERS					32	32,000	32	32,000	32	32,000	96	96,000	DA HVCDP/BAFE/FPA
COMPOSTING FACILITY			160	80,000	160	80,000	160	80,000	160	80,000	640	320,000	DA HVCDP/BSWM
POST-HARVEST AND DISTRIBUTION													
PLASTIC CRATES	8,055	4,973	22,847	18,530	16,000	16,000	16,000	16,000	16,000	16,000	78,902	71,503	DA HVCDP/Trading Centers
POST-HARVEST FACILITIES (CONSOLIDATION CENTER)			32	80,000	32	80,000	32	80,000	32	80,000	128	320,000	DA HVCDP/AMAS/PhilMECH/LGUs
VILLAGE LEVEL PROCESSING FACILITIES					10	20,000	10	20,000	12	24,000	32	64,000	DA HVCDP/DTI
SOLAR POWERED MOBILE COLD STORAGE			32	144,000	32	144,000	32	144,000	32	144,000	128	576,000	DA HVCDP/PhilMech
GULAYAN SA PAARALAN	3,438	41,820	2,611	32,162	500	6,000	500	6,000	500	6,000	7,549	91,982	DA HVCDP/DepEd
URBAN AND PERI-URBAN AGRICULTURE	708	122,447	1,047	47,626	100	100,000	100	100,000	100	100,000	2,055	470,073	NUPAP/CLGU/MLGUs
REF VANS/HAULING TRUCKS (2 units per Region)			32	48,000	32	48,000	32	48,000	32	48,000	128	192,000	DA HVCDP/AMAS
PESTICIDE RESIDUE LABORATORIES IN MAJOR TRADING CENTERS			2	10,000	2	10,000	2	10,000	2	10,000	8	40,000	NVAT, BAPTC, SAPTC, other APTCs, DA
MARKETING													
SUPPORT TO KADIWA			16	32,000	16	32,000	16	32,000	16	32,000	64	128,000	DA-AMAS
COOPERATIVE-OWNED SUPERMARKETS					3	150,000	3	150,000	3	150,000	9	450,000	DA-AMAS/FCAs
OTHER SUPPORT ACTIVITIES													
TRAININGS - POT/CAP BUILD (20 batch per region @25 pax each)			3,200	80,000	3,200	80,000	3,200	80,000	3,200	80,000	12,800	320,000	DA HVCDP, ATI, TESDA,CDA
TRAININGS - Farm Business School/Farmer Field School			16	20	16	20	16	20	16	20	64	80	
RESEARCH AND DEVELOPMENT			2	10,000	2	10,000	2	10,000	2	10,000	8	40,000	BAR, DOST PCAARRD, SUCs
AGRIBUSINESS CENTERS (in top producing provinces)			5	10,000	16	16,000	5	10,000	5	10,000	31	46,000	DA-RFOs
GEO-TAGGING AND DATABASE MANAGEMENT SYSTEM			17	17,000			17	17,000			34	34,000	DA RFOs, BSWM
INFORMATION DISSEMINATION (IEC Materials, Online Campaign Materials)				10,000		10,000		5,000		5,000	-	30,000	ALL CONCERNED AGENCIES (DA, DTI, DOST, NNC)
LOAN FOR OPERATING CAPITAL, FARM IMPROVEMENT ETC				500,000		500,000		500,000		500,000	-	2,000,000	ACPC, GFIs (LBP, DBP)
TOTAL (P'000)		**314,592**		**2,544,044**		**2,926,920**		**2,959,420**		**2,971,420**		**11,533,996**	
*2021 and 2022 based on DA-HVCDP Targets													

Performance Targets

To achieve a sustainable lowland vegetable industry, this roadmap envisions to increase the country's sufficiency level from 50% in 2020 to 100% in 2025 (Table 63).

TABLE 63. PERFORMANCE TARGETS FOR LOWLAND VEGETABLES

LOWLAND VEGETABLES	SUPPLY UTILIZATION AND PERFORMANCE TARGETS (FY 2021-2025)					
	2020 (BASELINE)	2021	2022	2023	2024	2025
Population projection	109,033,245.00	110,439,773.86	111,798,183.08	113,106,221.82	114,361,700.88	115,562,498.74
Per Capita Consumption (kg/yr), NFD						
Local consumption/ Annual consumption (mt)	14.41	14.41	15.13	15.89	16.68	17.52
Demand/Utilization (mt)						
Production (mt)	888,499.71	1,075,084.65	1,300,852.43	1,574,031.43	1,904,578.04	2,304,539.42
Production volume increased (mt)						
Feeds and Waste (mt), 8%	71,079.98	86,006.77	104,068.19	125,922.51	152,366.24	184,363.15
Processing (mt)	33,300.34	43,003.39	52,034.10	62,961.26	76,183.12	92,181.58
Net Food Disposable (NFD, mt)	784,119.40	946,074.49	1,144,750.13	1,385,147.66	1,676,028.67	2,027,994.69
NFD Per Capita (based on SUA, in kg/yr)	7.192	8.566	10.239	12.246	14.656	17.549
Demand based on NFD Per Capita (SUA 2016-2018)	1,571,387.13	1,591,658.02	1,691,797.19	1,797,170.77	1,907,975.34	2,024,409.53
Area (Ha)	79,839.89	87,823.88	96,606.27	106,266.89	116,893.58	128,582.94
Increase in area/ expansion (ha)		7,983.99	8,782.39	9,660.63	10,626.69	11,689.36
Yield (mt/ha)	11.13	12.24	13.47	14.81	16.29	17.92
Increase in yield (mt/ha)		1.11	1.22	1.35	1.48	1.63
Sufficiency Level (%)	50%	59%	68%	77%	88%	100%

To achieve a sustainable highland vegetable industry, this roadmap envisions to increase the country's sufficiency level from 93% in 2020 to 122% in 2025 (Table 64).

TABLE 64. PERFORMANCE TARGETS FOR HIGHLAND VEGETABLES

HIGHLAND VEGETABLES	SUPPLY UTILIZATION AND PERFORMANCE TARGETS (FY 2021-2025)					
	2020 (BASELINE)	2021	2022	2023	2024	2025
Population projection	109,033,245	110,439,774	111,798,183	113,106,222	114,361,701	115,562,499
Per Capita Consumption (kg/yr), NFD	3.382	3.382	3.55	3.73	3.92	4.11
Local consumption/Annual consumption (mt)	368,750.43	373,507.32	397,006.53	421,734.08	447,736.09	475,059.19
Demand/Utilization (mt)						
Production (mt)	371,707.74	398,098.99	446,667.07	501,160.45	562,302.02	630,902.87
Production volume increased (mt)						
Feeds and Waste (mt)	29,736.62	31,847.92	35,733.37	40,092.84	44,984.16	50,472.23
Seeds (mt)	180.00	180.00	180.00	180.00	180.00	180.00
Net Food Disposable (NFD, mt)	341,791.12	366,071.07	410,753.70	460,887.61	517,137.86	580,250.64
Demand based on NFD Per Capita (SUA 2016-2018)	3.13	3.31	3.67	4.07	4.52	5.02
Area (Ha)	26,210.63	26,734.84	27,269.54	27,814.93	28,371.23	28,938.65
Increase in area/expansion (ha)		524.21	534.70	545.39	556.30	567.42
Yield (mt/ha)	14.18	14.89	16.38	18.02	19.82	21.80
Increase in yield (mt/ha)		0.71	1.49	1.64	1.80	1.98
Sufficiency Level (%)	93%	98%	103%	109%	116%	122%

TARGET SETTING

The vegetable industry is envisioned to be a modern competitive industry producing and supplying safe, quality, and diverse vegetables at affordable prices through sustainable production and equitable marketing systems. Table 65 shows the mission and objectives of the industry.

TABLE 65. VISION, MISSION, AND OBJECTIVES OF THE VEGETABLES INDUSTRY ROADMAP

VISION	
A modern competitive vegetable industry producing and supplying safe, quality, and diverse vegetables at affordable prices through sustainable production and equitable marketing systems.	
MISSION	**OBJECTIVES**
Empower vegetable farmers and provide livelihood for key players across the value chain	• Improve farmers' productivity and income by at least 5% per year • Reduce post-harvest losses from 40% to 5% by 2025 • Encourage more youth and women into vegetable farming • Increase per capita vegetable consumption 5% over a period of 5 years
Ensure access to quality, safe and affordable vegetables throughout the year	• Ensure year-round sufficiency level vegetables • Ensure food safety
Share timely and accurate information to consumers to assist them in making decisions on food choices	• Efficient communication and on-time data monitoring
Provide quality support services to vegetable growers and traders to enhance their competitiveness and sustainability	• Enhance KADIWA and expand access to international market • Ease access to resources and services

RECOMMENDATIONS FOR POLICIES, STRATEGIES, AND PROGRAMS

Strategic recommendations

The action programs and key result areas across the supply chain over the short, medium, and long-term periods are shown in the succeeding tables.

Top priorities (Where to focus resources)

1. Increase Production Areas and Cropping Calendars
    - To increase volume of production and achieve the target sufficiency level in the country, expansion in key production areas is the top priority. This can be implemented by providing support to farm clusters in the form of technical assistance (trainings), farm inputs such as seeds, fertilizers, farm tools and equipment and irrigation system and adapting crop diversification (majority in rice areas) and following the recommended cropping schedules. Production programming should be performed so that periods of over- and under-supply could be prevented along with highly fluctuating prices.
    - Another strategy to increase supply of vegetables are through establishment of vegetable Urban and Peri-Urban Agriculture, household or backyard level food production activities.

TABLE 66. PROPOSED EXPANSION AREAS FOR LOWLAND VEGETABLES IN THE FOLLOWING REGIONS

LOWLAND VEGETABLES	EXPANSION AREA (HAS)					
	2021	2022	2023	2024	2025	TOTAL
PHILIPPINES	8,000	9,000	10,000	11,000	12,000	50,000
CAR	200	300	400	400	400	1,700
Region I	1,000	1,100	1,200	1,300	1,400	6,000
Region II	500	500	500	500	1,000	3,000
Region III	1,000	1,100	1,200	1,300	1,400	6,000
Region IV A	1,000	1,100	1,200	1,300	1,400	6,000
Region IV B	500	600	700	700	700	3,200
Region V	500	500	500	1,000	1,000	3,500
Region VI	500	600	700	700	700	3,200
Region VII	500	500	500	500	500	2,500
Region VIII	300	300	300	300	300	1,500
Region IX	300	400	500	500	500	2,200
Region X	500	500	500	500	500	2,500
Region XI	500	500	500	500	500	2,500
Region XII	200	300	400	500	600	2,000
Region XIII	200	300	400	500	600	2,000
BARMM	300	400	500	500	500	2,200

TABLE 67. PROPOSED EXPANSION AREAS FOR HIGHLAND VEGETABLES IN THE FOLLOWING REGIONS

HIGHLAND VEGETABLES	EXPANSION AREA (HAS)					
	2021	2022	2023	2024	2025	TOTAL
PHILIPPINES	500	550	550	600	600	**2,800**
CAR	100	150	150	150	150	**700**
Region II	100	100	100	150	150	**600**
Region IV A	50	50	50	50	50	**250**
Region VII	100	100	100	100	100	**500**
Region X	100	100	100	100	100	**500**
Region XI	50	50	50	50	50	**250**

- The Department of Internal and Local Government should issue a policy for LGUs to establish Gulayan sa Barangay especially in areas with high food insecurity (Metro Cities) and high poverty level.
- Continuous and strengthened partnership with the Department of Education to implement and ensure sustained activity of Gulayan sa Paaralan (School Gardens) and inspire young students to take agriculture related courses.

2. Modernization of the Vegetable Sector (Production to Logistics) and Infrastructure Investments
    - Strengthen the anchor with the Agriculture and Fisheries Modernization Act of 1997 or RA 8345 and towards Agriculture 4.0
    - Establish Agribusiness Centers and Corridors – National Seed Technology Park, etc
    - Promote Vertical and Indoor Farming
    - Provide appropriate machineries and proper irrigation systems
    - Reduce post-harvest losses by providing appropriate packaging materials
    - Establish key infrastructures such as farm to market roads and tramlines
    - Establish cold chain system – mobile cold storages etc.
3. Mobilize partners and Improve Market System
    - Capacitate farmers and farmer groups to become agri-entrepreneurs
    - Establish post-harvest, consolidation and trading centers and upgrade capacities of existing trading centers
    - Provide incentives for the private sector to invest in logistics support (e.g.,hauling trucks and reefer vans, etc.)
    - Collaborate with private sector to facilitate market linkages and establish partnership with supermarket and food chains
    - Capacitate and support subsistence farms to enable their transformation into commercial farms (e.g., promote contract growing arrangements such as that of the Jollibee Food Corporation)
    - Provide the necessary infrastructure for faster Internet connectivity and farmers' and traders' skills enhancement for the widespread use of online marketing platforms as new mode of buying safe, fresh, and affordable vegetables, sourced directly from farmers
4. Ensure Food Safety
    - Employ policies and programs addressing food safety hazards and develop appropriate standards and control measures thru
        - Intensification of training on Good Agricultural Practices (GAP)

- Incentivize farmers who are applying for GAP and help create market for GAP Certified products
- Promotion and adoption of Philippine National Standards on Vegetables
- Establishment of MRL Testing Laboratories in major agricultural trading centers and top producing municipalities

5. Use of Technology and Digital Agriculture
    - Establish database management system to collect and analyze production and projection and harmonize data with Philippine Statistics Authority
    - Utilize SMART and Precision Agriculture Technologies such as that of the projects with Central Luzon State University and University of Southern Mindanao
    - Weekly weather advisories and 6-month forecast disseminated to vegetable farmers to aid their daily farming activities and planning for the crops to be planted as part of climate change adaptation and mitigation measures
6. Promote vegetable consumption
    - Promotion and utilization of indigenous vegetables
    - Monthly campaign for vegetables in season, cooking recipes and health benefits
    - DSWD, DILG and other institutions to include vegetables in food packs distributed during calamities
    - Promote food fortification
    - Establish village level processing facilities for value addition of products
7. Credit Support
    - Encourage farmers to venture into vegetable production by creating a loan window specifically for vegetables farmers at a low interest rate and rationalized loan requirements
8. Creation of Philippine Vegetable Industry Federation

To ensure that the vegetable sector is well represented in the policy making activities in the country, the Philippine Vegetable Industry Federation should be created. This will serve as umbrella organization of different vegetable associations and cooperatives in the country, including farm input suppliers, institutional buyers, and industry key players.

TABLE 68. SHORT-TERM STRATEGIES

KEY STRATEGIES	SPECIFIC ACTIVITIES	KEY PERFORMANCE INDICATOR	RESPONSIBLE AGENCY / GROUP
OBJECTIVE 1. Ensure year-round sufficiency levels of vegetables			
1. Clustering	Development of programming/ calendar planting	No. of clusters with approved cropping calendar	FCAs, DA HVCDP and AMAD RFOs
	Open communication among vegetable farmers nationwide to plan supply	No. of meetings conducted/ communications released Stabilize supply and prices	FCAs, DA HVCDP and AMAD RFOs
	Proper storage facilities (cold storage facilities)	No. of facilities provided/ established	DA HVCDP, PHTRC, PhilMech
	Expand Production Areas	No. of hectares for expansion	DA-HVCDP, FCAs
OBJECTIVE 2: Increase farmers' productivity and income by at least 5% per year			
1. Farm clustering and consolidation	Capacity building activities: Farm Entrepreneurship Program Farm Field School and Farm Business Schools Technology Demonstrations/Model Farms	No. of FEP/FBS conducted No. of capacity building activities conducted No. of Learning Sites Accredited	JGF, ATI, DA RFOs, East West Seeds Knowledge Transfer, CDA
	Establishment of Agricultural and Fishery Machinery Service Center	No. of centers established	BAFE, DA-RFOs
	Establishment of Packing Houses/Consolidation Facilities	No. of facilities established	DA-HVCDP, BSWM, ATI, BPI, SUC

KEY STRATEGIES	SPECIFIC ACTIVITIES	KEY PERFORMANCE INDICATOR	RESPONSIBLE AGENCY / GROUP
2. Modernization and Precision Agriculture	Promotion of new technologies: SMART Greenhouse, Drip irrigation/ fertigation system Solar Powered Irrigation System	No. of systems established	DA-HVCDP, BSWM, ATI, BPI, SUC
	Smart Precision Agriculture System	No. of systems/research created	SUC (CLSU, USM)
	Access to modern networks and markets (e.g., market digitalization, e-commerce platforms, etc.)	No. of website/database in place	DA-HVCDP, AMAS, ICTS
3. Vegetable breeding activities and researches	Varietal improvement; development of disease-resistant varieties Establishment of local seed system	No of varieties developed No. of accredited seed growers	BPI, UPLB-IPB, DOST-PCAARRD, DA-BAR, PSIA
4. Access to finance	Expand access/coverage of credit programs	No. of applications approved	ACPC, other GFIs
	Expand access/coverage of crop insurance	No. of farmers covered	PCIC
5. Access to or Presence of advisory services	Use of appropriate crop/ varieties	No. of advisories released	BPI, FCA, PSIA
	Development of crop climate calendar	No. of advisories released	DA-HVCDP, BSWM, ATI, BPI, SUC
	Capacity building activities on climate change adaptation, diversification, mitigation, and disaster resilience related to crop production	No. of advisories released No. of trainings conducted	DA-HVCDP, ATI, AMIA, DA-DRRMC

KEY STRATEGIES	SPECIFIC ACTIVITIES	KEY PERFORMANCE INDICATOR	RESPONSIBLE AGENCY / GROUP
6. Production Technologies	Integrated Pest Management	No. of trainings conducted No. of IEC materials disseminated	DA-RCPC, BPI-CPMD
7. Marketing Assistance	Direct market linkaging/ KADIWA	No. of farmer groups linked	DA-AMAS
OBJECTIVE 3: Reduce postharvest losses from 40% to 5% by 2025			
1. Information dissemination	Development/ distribution of IEC materials on proper maturity indices, postharvest handling, etc.	No. of IEC materials developed No. of IEC materials disseminated	UPLB-PHTRC, PhilMech, DOST
2. Modernization	Use of plastic crates and/ or appropriate containers for each crop Appropriate cold chain system	No. of plastic crates provided	DA-HVCDP Agriculture Trading Centers/Cooperatives
3. Value addition	Food processing technologies: Tomato paste Kimchi making Fermentation Pickling	No. of trainings conducted	DA-HVCDP, PhilMech, ATI, DTI
	Village-level processing	No. of facilities established	DA-HVCDP, DTI, DOST

KEY STRATEGIES	SPECIFIC ACTIVITIES	KEY PERFORMANCE INDICATOR	RESPONSIBLE AGENCY / GROUP
OBJECTIVE 4: Ensure food safety			
1. Promote Food Safety thru Good Agricultural Practices and/or Organic Farming	GAP Training and Certification	No. of farms certified No. of farmers trained	ATI, BPI
	Development of laymanized publication materials	No. of IEC materials/ modules produced in different language	ATI, BPI
2. Institutionalize regulation measures	Establish Pesticide Residue Analysis/MRL Laboratories in Major Production/ Trading Areas	No. of ordinances/ policies approved No. of testing laboratories established	DA – ILD RFOs P/MLGU Agriculture Trading Centers
OBJECTIVE 5: Encourage more youth and women participation into vegetable farming			
1. Mentorship, Internship, Experiential Learning Activities (Youth Engagement)	MAYA	No. of interns trained	DA-BAR
	KAYA	No. of approved applications	ACPC
	Young Farmers Challenge	No. of successful participants	DA-AMAS
	Involvement of Youth Councils	No. of youth members engaged	PCAF/ATI-4H Club
	Local Youth Development Office	No. f youth members engaged in agriculture	LGU
2. Women Empowerment	Engaging rural women in vegetable farming	Outstanding women vegetable farmers No. of women registered as vegetable farmers No. of Women RIC beneficiaries	GAD, PCW

KEY STRATEGIES	SPECIFIC ACTIVITIES	KEY PERFORMANCE INDICATOR	RESPONSIBLE AGENCY / GROUP
OBJECTIVE 6: Enhance KADIWA and expand access to international market			
1. Mobilize partners and engage private sector partners	Enhance KADIWA	No. of farmer groups linked No. of partner buying institutions	DA-AMAS, FCAs, LGUs, Private Sector
	Expand online marketing platforms	No. of online marketing platforms No. of farmer suppliers Volume of products supplied	DA-AMAS, FCAs, LGUs, Private Sector
2. Export market development	Participation in trade fairs	No. of trade fairs participated/conducted	DTI, DA-AMAS
	Development or update of product standards	No. of standards developed/updated	BAFS
	Improvement of product packaging and labelling	No. of enterprise assisted	DTI, DOST
	Conduct of competitive analysis	No. of studies conducted	DA-AMAS, PRS
	Information sharing among stakeholders (e.g., market opportunities, etc.)	No. of investment forum conducted	DA-IAD, AMAS, PRS, Agri-Attaches
OBJECTIVE 7: Increase per capita vegetable consumption by 5% over a period of 5 years			
1. Promotion of vegetable consumption	Gulayan sa Paaralan Program (GPP)	No. of School Gardens Established	DepEd, HVCDP, SEARCA
	Integration of GPP and School-based Feeding Program	No. of students fed with vegetables harvest from gardens; Decrease in malnutrition rate	DepEd, EPAHP

KEY STRATEGIES	SPECIFIC ACTIVITIES	KEY PERFORMANCE INDICATOR	RESPONSIBLE AGENCY / GROUP
	Establishment of Community (FAITH) Gardens (Gulayan sa Barangay/Bakuran/ Pamayanan)	No. of Community Gardens Established	DILG, LGU, DA,MAO
	Establishment of Urban Gardens	No. of Urban Gardens Established	DILG, LGU, DA – NUPAP, ATI, BPI
	Conduct of seminars/ trainings	No. of seminars on UA conducted	DA, ATI, BPI
	Nutrieskwela	No. of sessions conducted	NNC
	Conduct of caravans	No. of caravans conducted No. of farmers participated	DTI, DA-AMAS/AMAD
	Filipino Food Month	No. of vegetables cooking demonstration/ training conducted	NCAA, PCHM, DA
	Promotion of edible landscaping	No. of IEC materials disseminated No. of webinars conducted	UPLB, DA
	Maximize use of online platforms for disseminating info re importance of veg consumption	No. of IEC materials published/ disseminated No. of webinars conducted	All agencies
2. Value addition	R&D in food fortification	No. of food products fortified	DOST-FNRI, DOST-NNC, DA-RFOs
	Training on food processing	No. of trainings conducted No. of participants	ATI

KEY STRATEGIES	SPECIFIC ACTIVITIES	KEY PERFORMANCE INDICATOR	RESPONSIBLE AGENCY / GROUP
3. Policy formulation	Offering more vegetables in regular diets, food chains, food packs	No. of ordinances/ policies issued	DA- DLLO, Congress/ Senate, DOH-NNC, LGU
	Draft Substitute bill on Integrated Urban Agriculture Act	No. of supporting policies/approved law	DA-DLLO, Congress/ Senate
OBJECTIVE 8: Efficient communication and on time data monitoring			
1. Strategic Communication and Extension	Establish website/ database for production guides and researches	No. of interns trained	HVCDP, ICTS, BAR
	Schedule of NPBC on Fruits and Vegetables Schedule of meetings of PVIF	No. of meetings conducted	PCAF PVIF, TWG
	Centralized webinars	No. of webinars conducted	PCAF, PVIF
	Market intelligence	No. of farmers linked	DA-AMAS
	Price monitoring		DA-AMAS, BPTC
2. Digital Agriculture	Creation of online platform for regular monitoring and reporting of vegetable supply outlook, flow of goods and price analysis	No. of database established	DA-HVCDP, AMAS, ITCS, Deliver-E, PSA
OBJECTIVE 9: Ease of doing business			
1. Agri-Business Corridors	Establishment of Agri-Business Centers/ Complex offering various services – loans, agri-supplies, technical assistance	No. of centers established No. of farmers catered	DA-HVCDP, LGU, Cooperatives, Private Sector

*Project beneficiaries are major stakeholders – Farm Clusters (Associations and Cooperatives)

Medium to Long-Term Strategies

Table 69 shows the medium to long term goals of the vegetable industry cluster. It basically aims to improve on the production (diversification, farm mechanization and infrastructure investments, technology, and innovations), postharvest, processing, logistics, and marketing segments of the value chain.

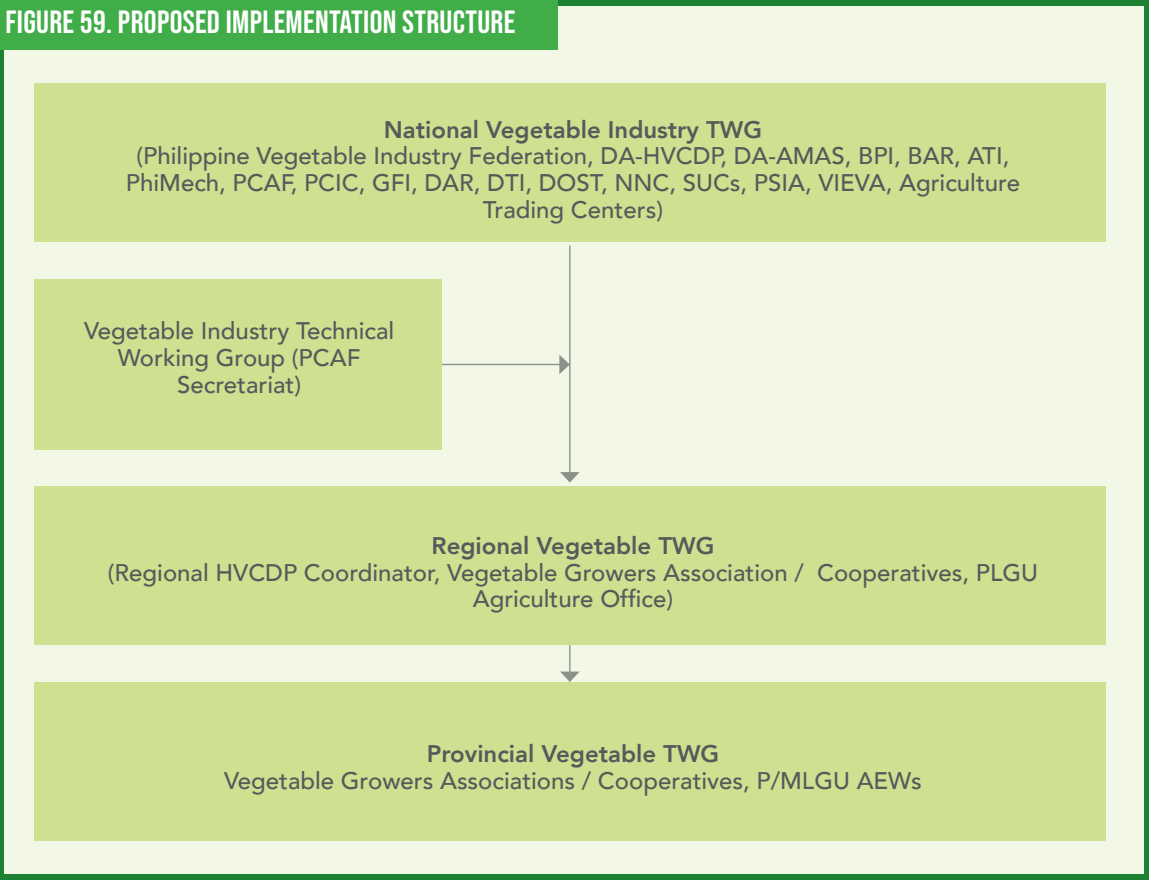
TABLE 69. MEDIUM TO LONG TERM STRATEGIES

	STRATEGIES	ACTIVITIES
INPUT SUPPLY AND PRODUCTION / POSTHARVEST AND PROCESSING	Post-harvest, Processing, Logistics, & Marketing Support Food Safety & Regulations	• Expand cold chain projects for vegetables • Develop "GAP certified" only markets • Establish Traceability system • Establish "Cooperative -owned" supermarkets • Value addition – Freeze dried vegetables/chips etc.
	Farm Mechanization & Infrastructure Investments	• Completely mechanized farming activities • Farm to market roads • Tram lines • Special lane for food/vegetables transport
	Technology & Innovation including Digital Agriculture	• Mainstream SMART Farming Technologies
MARKETING, TRADE, AND OTHER RELATED CONCERSN	Diversification Post-harvest, Processing, Logistics, & Marketing Support	• Promote the production and utilization of alternative indigenous/ underutilized vegetables • Diversification of market vegetable growers
	Global Trade, Export Development, & Promotion	• Enhance product portfolio for the international market (i.e., processed vegetables
	Education & Training: Agribusiness Management	• Provision of incentives to farmers who will undergo GAP training and certification
	Climate Change Adaptation & Mitigation Measures	• Strengthen R&D capability for breeding/ development of climate-resilient crop varieties
	Credit Support	• Provide access to credit and crop insurance including contract seed producers for vegetable farmers

INDUSTRY CLUSTER GOVERNANCE NETWORK

The proposed vegetable industry cluster governance network is presented in Figure 59. It will be composed of a National Vegetable Industry Technical Working Group (TWG), a Regional Vegetable Industry TWG, and lastly, the Provincial Vegetable Industry TWG.

FIGURE 59. PROPOSED IMPLEMENTATION STRUCTURE



The National Vegetable Industry Technical Working Group (NV-TWG) shall have the following primary roles and responsibilities:

- Assist the HVCDP-PMO implement the Vegetable Industry Road Maps (both lowland and highland)
- Validate and consolidate national and regional plans for vegetable
- Monitor the developments and implementation the Vegetable Industry Road Maps
- Update from time to time the Vegetable Industry Road Maps based on national and international developments
- Liaison with the national policy makers, Bureaus, and other stakeholders of the vegetable industry

The NV-TWG shall regularly meet the frequencies of which will be agreed upon by the TWG. It shall deal mostly with programs and issues at the National level. The TWG shall be funded by the HVCDP (re: meetings, travel expenses). The members will be pro bono (no honorarium or compensation except for the travel expenses).

The Regional Vegetable TWG (RV-TWG) shall:

- Develop the regional vegetable action plans to include municipal and provincial targets and programs
- Implement the regional plans developed from the national plan through the provincial and municipal counterparts of the Regional HVCDP
- Conduct regional vegetable congresses and field days in coordination with the regional/provincial stakeholders and relevant agencies.
- Promote GAP in vegetable production
- Ensure reliability of data and information access on production, prices, consumption, and trade
- Report and represent the region in the NV-TWG

The RV-TWG shall regularly meet, the frequencies of which will be agreed upon by the members of the TWG but should be frequent enough for more efficient implementation of the existing programs and for issues at the regional, provincial, municipal and farm levels to be immediately acted upon. The TWG shall be funded by the respective RFU (re: meetings, travel expenses). The members will be pro bono (no honorarium or compensation except for the travel expenses).

Table 70 below summarizes the actors and the responsibilities of each in the network.

TABLE 70. INDUSTRY CLUSTER GOVERNANCE NETWORK

ROLES	ACTORS	RESPONSIBILITIES
Overall implementing and monitoring body	• Department of Agriculture - National High Value Crops Development Program	• Spearhead the implementation of the strategies and programs in the vegetable roadmap
		• Conduct an internal periodic review of the roadmap
		• Mediate planning and regular consultations between the public and private sectors
		• Establish partnership with private investors/ companies and tap foreign funding institutions
Implementing Agency	• Private sector	• Provide counterpart support to scale-up interventions
	• DA RFOs • DA Services, Bureaus and Attached Agencies • SUCs • NGAs • LGUs	• Implement the targets and strategies identified in the roadmap
Monitoring Agency	• PCAF, DA-PMED, PSA	• Conduct periodic assessment of the roadmap implementation

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APPENDICES

APPENDIX 1: UTILIZATION AND OTHER USES AND PRODUCTS DERIVED FROM VEGETABLES

COMMON NAME	UTILIZATION	OTHER USES / PRODUCT FORMS
Carrot	Eaten raw or cooked (boiled, fried, or steamed) in soups and stews, as well as baby and pet foods	Blended with fruits in jams and preserves; carrot juice, puree, or seed essentials are made into soaps, creams, and lotions
White Potato	Cooked, fried, or deep fried in many forms, or unpeeled baked	Starch, processed foods (chips, fries, etc.), textile industry, paper/wood industry, and alcohol production
Cabbage	Eaten raw in salads, or fermented, steamed, or cooked	Pickled (sauerkraut), medicinal herb for the treatment of constipation, stomach ulcer, headache, obesity, skin disorder, eczema, jaundice, scurvy, rheumatism, arthritis, gout, eye disorder, and heart disease
Chinese Cabbage	Eaten raw or cooked in stir fries and other dishes, salads, soups, etc.	Fermented (kimchi)
Eggplant	Consumed fresh, steamed, and cooked	N/A
Tomato	Berries are eaten raw or pickled, in salads, or cooked (sauteed)	Liquid forms e.g., juice, sauce, paste, ketchup, or seasoned puree
String beans	Cooked	N/A
Snap beans	Cooked (stir fried)	Pickled
Squash	Cooked, good for baby's food consumption	Processed (flour, noodles, breads, etc.)
Ampalaya	Cooked	Picked, medicinal uses (powdered into capsules, tea, juice, wine, etc.)
Okra	Consumed fresh, in salads, sauteed, etc.	Frozen for industrial and food service and pickled (as appetizer)
Asparagus		

Source: PRDP, 2016; PRDP, 2019; (2009) Vegetables and Vegetable Products. In: Food Chemistry. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-540-69934-7_

APPENDIX 2: AREA PLANTED, VOLUME, AND AVERAGE YIELD OF SELECTED VEGETABLES, 2011-2020

Area Planted (Ha)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Ampalaya	10877.10	10896.44	10834.13	10681.12	10633.31	10526.07	10656.78	10679.32	10676.36	10687.78
Eggplant	21377.20	21485.08	21239.22	21159.38	21008.45	21038.21	21445.56	21651.26	21818.57	21780.33
Squash	12877.27	12873.23	12771.24	12756.98	12829.49	12901.86	13082.55	13045.56	12984.86	12962.54
Pole Sitao	14298.06	14204.82	13770.39	13786.46	13808.27	13754.21	13938.63	13906.65	13914.83	13911.50
Tomato	17556.01	17345.40	17230.51	16742.27	16165.11	16197.44	16490.86	16494.12	16360.25	16448.19
Okra	3496.62	3569.50	3587.11	3647.51	3693.37	3688.20	3845.42	3941.22	4010.80	4079.55
Cabbage	8549.63	8531.03	8414.29	8309.50	8179.35	8017.89	7912.26	7838.67	7846.75	8020.31
Carrots	4946.69	4922.59	4819.87	4760.00	4673.37	4607.00	4606.47	4531.31	4550.95	4430.38
Snap Beans	3631.98	3566.55	3503.99	3396.88	3241.07	3130.75	3149.55	3103.45	3092.89	2974.44
Chinese Cabbage	3742.37	3759.47	3775.35	3696.80	3625.07	3601.38	3553.98	3520.76	3551.67	3571.84
Potato	8170.95	8095.78	7889.53	7867.75	7842.90	7743.66	7792.84	7571.12	7514.37	7212.61

Volume Of Production (Mt)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Ampalaya	86599.32	87090.35	89886.62	90110.84	88917.53	87459.85	89459.66	87395.17	89341.04	87804.27
Eggplant	207994.01	211885.31	219911.06	225578.67	232864.47	235626.24	241900.94	244838.34	249890.48	242730.40
Squash	223790.82	222634.19	223522.49	222206.92	217908.08	214146.69	206023.53	202229.08	194771.05	193814.22
Pole Sitao	116302.47	117276.58	119535.72	117544.46	118659.92	117200.78	116804.14	114380.39	112311.44	109516.46

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Tomato	203581.71	203593.47	207668.39	214572.91	214773.95	210719.51	218793.14	220824.68	223294.47	222002.24
Okra	29128.56	29773.55	30121.58	30274.23	30638.39	30528.89	31378.58	31277.23	31707.97	32632.12
Cabbage	125309.48	126380.50	127463.46	127986.48	125752.40	123080.04	122474.10	120655.67	128050.06	129803.39
Carrots	67161.65	68453.92	68110.79	68342.09	67036.96	65986.86	65219.44	64895.74	65069.67	63527.02
Snap Beans	15425.93	15328.29	15423.27	15305.59	14745.29	14388.91	14151.15	13950.38	14028.79	13420.83
Chinese Cabbage	50581.21	51618.04	51798.20	52243.35	51434.83	50745.47	50265.62	49662.07	51454.44	51394.14
Potato	120573.73	119569.84	117721.64	119140.02	118479.32	116783.46	117637.29	117422.50	116061.09	113562.36

Yield (Mt/Ha)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Ampalaya	7.96	7.99	8.30	8.44	8.36	8.31	8.39	8.18	8.37	8.22
Eggplant	9.73	9.86	10.35	10.66	11.08	11.20	11.28	11.31	11.45	11.14
Squash	17.38	17.29	17.50	17.42	16.98	16.60	15.75	15.50	15.00	14.95
Pole Sitao	8.13	8.26	8.68	8.53	8.59	8.52	8.38	8.22	8.07	7.87
Tomato	11.60	11.74	12.05	12.82	13.29	13.01	13.27	13.39	13.65	13.50
Okra	8.33	8.34	8.40	8.30	8.30	8.28	8.16	7.94	7.91	8.00
Cabbage	14.66	14.81	15.15	15.40	15.37	15.35	15.48	15.39	16.32	16.18
Carrots	13.58	13.91	14.13	14.36	14.34	14.32	14.16	14.32	14.30	14.34
Snap Beans	4.25	4.30	4.40	4.51	4.55	4.60	4.49	4.50	4.54	4.51
Chinese Cabbage	13.52	13.73	13.72	14.13	14.19	14.09	14.14	14.11	14.49	14.39
Potato	14.76	14.77	14.92	15.14	15.11	15.08	15.10	15.51	15.45	15.74

APPENDIX 3: NNC PROGRAMS, PROJECTS, AND ACTIVITIES RELATED TO VEGETABLE CONSUMPTION

Policies/Programs/Projects/Activities	Description
1. National Dietary Supplementation Program (NDSP)	The NDSP aims to supplement the diets of nutritionally vulnerable groups, particularly pregnant women and infants 6-23 months old in food-insecure households and wasted school children, especially those from disadvantaged families. It also aims to supplement the diets of children enrolled in daycare centers. The NDSP is complemented by other PPAN programs, specifically Infant and Young Child Feeding (IYCF), Nutrition Promotion for Behavior Change, Micronutrient Supplementation, Mandatory Food Fortification, and the Nutrition-Sensitive Program to maximize and sustain the impact of dietary supplementation. Existing models like those tested by the Department of Education (DepEd) and the International Institute of Rural Reconstruction (IIRR) linked supplementary school feeding with vegetable gardening are advocated for replication and nationwide adoption.
a. Tutok Kainan Dietary Supplementation Program	Tutok Kainan Dietary Supplementation Program is the supplementary feeding of pregnant women and children aged 6-23 months old. This aims to contribute to the prevention of stunting among children 0-23 months old by improving the quality and quantity of food and nutrient intakes and utilization of related Early Childhood Care and Development – First 1000 Days (ECCD-F1KD) services among nutritionally at-risk pregnant women and children 6-23 months old in the target Tutok Kainan program areas. Commodities to be included in the Dietary Supplementation Program for pregnant women and 6-23 months old children's food ration include fresh food items such as dried or fresh legumes/beans, root crops and other vegetables, eggs or other protein source food, fortified cooking oil, sugar, iodized salt. Furthermore, through this program, LGUs are encouraged to include fruits and green leafy vegetables, rice, and other root crops in the provision of other complementary food in the food pack, preferably sourced from the local farmers' organization, Agrarian Reform Beneficiaries Organization (ARBOs), Sustainable Livelihood Associations (SLPAs), and the like.

Policies/Programs/Projects/Activities	Description
2. National Nutrition Promotion Program for Behavior Change	The National Nutrition Promotion Program for Behavior Change aims to facilitate positive nutrition and related practices that will improve nutrition outcomes. It also aims to raise consciousness on the importance of improving nutrition and ensure that the various nutrition-specific services are supported with appropriate communication activities either as a separate complementary activity or as an activity integral to the service. It recognizes the need to go beyond increasing knowledge on nutrition by analyzing why people behave the way they do and how behaviors change within broader social and economic systems to provide insight on affecting positive nutrition outcomes. NNC's promotional activities on vegetable consumption include the following: 1. Production and airing of TV and radio plugs on 10 Kumainments, specifically Kumainment No. 3 2. Printing and dissemination of IEC materials on 10 Kumainments 3. Production and airing of Nutrition School-on-the-Air on 10 Kumainments 4. Production and dissemination of Pinggang Pinoy brochures; 5. Production and airing of episodes on a healthy diet, including vegetable consumption in NNC-produced radio programs such as Radyo Mo sa Nutrisyon (2010-2020), Katumbas ay Biyaya (2007-2019), and One Nutrition, One Nation. 6. Production and airing of TV programs such as Why Not? and Busog Lusog. 7. Printing and dissemination of two (2) vegetable recipe books; 8. Printing and distribution of vegetable syllabus for community and daycare and primary grades (1990); 9. Development and dissemination of vegetable modules during the Promote Good Nutrition-IYCF trainings; 10. Celebration of Nutrition Month with a specific theme on vegetable consumption in 1994, 2012, and 2017; and 11. Development and posting of social media cards on NNC's Facebook page on vegetable consumption. 12. Conduct of digital campaign on Complementary Feeding and First 1000 Days

Policies/Programs/Projects/Activities	Description
a. NNC GB Resolution No. 6, Series of 2012: Adoption of 2012 Nutritional Guidelines for Filipinos	This is a resolution adopting the 2012 Nutritional Guidelines for Filipinos, which includes the following key message: "Eat more vegetables and fruits to get the essential vitamins, minerals, and fiber for regulation of body processes."
b. NNC GB Resolution No. 4 Series of 2018: Adopting the NNC Policy Statement on Fad Diets	This resolution approves and adopts the policy statement on fad diets, as follows: "Fad diets are not recommended for weight loss as they may pose potential health risks and dangers. Instead, the NNC recommends the adherence to a holistic, sustainable, adequate, and nutritionally balanced diet, complemented by an active lifestyle and lifelong behavioral modifications." This resolution also recommends advocating a safe, healthy, and holistic dietary, exercise, and behavioral plan as key to long-term weight loss and improvement of overall health. One of the recommendations of the policy statement is the use of the Food and Nutrition Research Institute developed the Pinggang Pinoy (also known as "Healthy Food Plate for Filipinos"). The food plate is an easy-to-understand food guide that uses a familiar food plate model to convey the right food group proportions on a per-meal basis to meet the energy and nutrition needs of Filipinos of specific age groups. It encourages larger portions for "glow" foods such as vegetables and fruits which comprise half of the plate but more vegetables than fruits; while the other half is for rice and alternatives and protein-source, with rice and alternatives occupying a bigger portion than the protein-source.
3. Nutrition in Emergencies (NiE)	Nutrition in Emergencies is one of the programs of PPAN 2017-2022 in recognition of the vulnerability of the country to natural and human-induced disasters. It recognizes that shocks resulting from natural calamities and other man-induced disasters tend to move the non-poor into poverty and the poor into deeper poverty, thereby undermining poverty reduction efforts.

Policies/Programs/Projects/Activities	Description
a. NNC GB Resolution No. No.1, Series of 2009: Adopting the National Policy on Nutrition Management in Emergencies and Disasters	This resolution adopts the National Policy on Nutritional Management in Emergencies and Disasters, which covers directions on strategies for nutrition management in emergencies and disasters, particularly on planning, surveillance, rapid nutritional assessment, and implementation of nutrition interventions at various stages. It shall also guide LGUs in preparing and managing the food and nutrition situation in emergencies and disasters at multiple stages: early, intermediate and extended emergency. This resolution indicated that the supplementary feeding should include cereals, milk, meat or fish, vegetables, and fruits.
b. Nutrition Cluster Advisory 1, Series of 2020: Nutrition Cluster Guidelines on LGU Nutrition Actions Relative to COVID-19	This advisory contains recommendations to all local government units (LGUs), non-government organizations (NGOs), business companies and other civic-oriented organizations providing nutrition services to all COVID19-affected populations. Through this advisory, LGUs are also encouraged to include fresh dark green and dark yellow vegetables and fruits in the food packs as far as practicable.
c. Nutrition Cluster Advisory 2, Series of 2020: Nutrition Cluster Recommendations on Healthful and Nutritious Family Food Packs and Sustainable Food Sources	This advisory contains recommendations to all local government units and their partners, providing detailed guidance in the distribution of healthy and nutritious food packs during this state of public health emergency. Some of the recommendations include: • To diversify and enhance the nutrient content of family food packs, LGUs are strongly encouraged to optimize the use of local fresh produce of dark green and yellow vegetables, root crops, legumes/beans/seeds, fruits, poultry, egg, meat/fish or pasteurized fresh milk. • Prioritize buying the fresh produce items directly from the small farmers, fisherfolks, and cooperatives within or adjacent communities to protect and promote the local economy. They are cheaper and fresh. • LGUs are enjoined to promote the establishment of home gardens. Given the indefinite duration of the community quarantine, this strategy will allow households to produce their own fresh and nutritious vegetables and help reduce family food expenses. LGUs may distribute seeds, seedlings through the assistance of the local city/municipal agriculture office. Choose planting materials for vegetables that are ready for harvest in 30 days.

APPENDIX 4: SUMMARY OF COST AND RETURN OF LOWLAND VEGETABLES

	TOMATO	SQUASH	OKRA	STRING BEANS	EGGPLANT	AMPALAYA	LOWLAND VEGETABLES
RETURN							
Yield (High Assump-tion	20,900.00	12,700.00	16,040.00	24,200.00	28,060.00	15,520.00	19,570.00
Selling Price	21	14	31	25	23	45	26.5
Gross Sales	438,900.00	177,800.00	497,240.00	605,000.00	645,380.00	698,400.00	518,605.00
COST							
Material Cost	103,760.00	32,246.00	50,060.00	58,517.00	63,193.00	107,232.00	69,168.00
Labor Cost	85,280.00	28,960.00	60,020.00	55,300.00	94,380.00	66,620.00	65,093.33
Fixed Cost	13,300.00	13,300.00	13,300.00	13,300.00	13,300.00	13,300.00	13,300.00
Postharvest Loss	50,220.00	18,630.00	50,400.00	61,900.00	77,424.00	80,976.00	56,591.67
Total Cost of Production	252,560.00	93,136.00	173,780.00	189,017.00	248,297.00	268,128.00	204,153.00
NET PROFIT	186,340.00	84,664.00	323,460.00	415,983.00	397,083.00	430,272.00	314,452.00
ROI (%)	73.78%	90.90%	186.13%	220.08%	159.92%	160.47%	154.03%
Break-even Price per kg	12.08	7.33	10.83	7.81	8.85	17.28	10.43

APPENDIX 5: STATUS OF IMPLEMENTATION OF AGRI-PINOY TRADING CENTERS (APTCS) PROJECTS

REGION	NAME OF APTC	Location	Total Volume Traded (MT)	Total Value of Commodities Traded (Php)	Total Number of Farmer Beneficiaries
OPERATIONAL					
APTC for Crops					
CAR	Benguet APTC (BAPTC)	La Trinidad, Benguet	86,903.90	2,728,256,362.15	22,826
I	Pangasinan APTC (PAPTC)	Urdaneta City, Pangasinan	18,910.14	709,742,402.71	20,000
II	Isabela Agri-Pinoy Trading Center (High Value Crops Trading Center)	Roxas, Isabela	99.69	2,036,069.00	267
II	Nueva Vizcaya Agricultural Terminal (NVAT)	Bambang, Nueva Vizcaya	12,622.00	717,496,874.00	1,270
III	Nueva Ecija APTC (NEA PTC)	Cabanatuan City, Nueva Ecija	560.79	22,815,923.00	360
V	Camarines Norte APTC (CNAPTC)	Vinzons, Camarines Norte	113.25	982,005,462.39	291
VII	Dalaguete Agri-Pinoy Trading Center (DaPTC)	Dalaguete, Cebu	1,362,374.10	124,317,385.00	28,369
CARAGA	Siargao Islands Agri-Pinoy Trading Center (SIAPTC)	Dapa, Siargao Island, Surigao del Norte	93.3	5,884,665.00	78

Region	APTC	Location	Remarks
NOT OPERATIONAL			
II	Regional Organic Trading Center	Bagabag, Nueva Vizcaya	Trading of organic and naturally grown fruits and vegetables was stopped in order to lessen human traffic within the government facility.
CALABARZON	Quezon Corn Trading and Processing Center	Brgy. Calumpang, Tayabas City, Quezon	Mechanical dryer not functional. Lack of trading capital.
IV-B	Puerto-Princesa City Agri-Pinoy Trading Center	Brgy. Irawan Puerto Princesa City	Has yet to start operation
V	Tabaco City Agri-Pinoy Trading Center for Marine Products	Bgy. Fatima, Tabaco City, Albay	Has yet to start operation
VIII	North Eastern Leyte APTC (NELAPTC)	Brgy Picas, Norte, Javier, Leyte	The LGU cannot start the trading operation of NELAPTC due to occasional lockdown caused by COVID-19 pandemic.
XI	Davao Food Terminal Complex	Brgy. Daliao, Toril District, Davao City	Awaiting for the approval of City Ordinance proposing DFTC as Wholesale Market, currently at the 2nd reading.

APPENDIX 6: POPULATION, BY YEAR, AND PROJECTIONS 2021-2025

REGION	POPULATION					
	2020	2021	2022	2023	2024	2025
PHILIPPINES	**109,033,245.00**	**110,439,773.86**	**111,798,183.08**	**113,106,221.82**	**114,361,700.88**	**115,562,498.74**
..National Capital Region (NCR)	**13,484,462**	13,658,411.56	13,826,410.02	13,988,179.02	14,143,447.81	14,291,954.01
..CAR	**1,797,660.00**	1,820,849.81	1,843,246.27	1,864,812.25	1,885,511.66	1,905,309.54
..Region I (Ilocos Region)	**5,301,139.00**	5,369,523.69	5,435,568.83	5,499,164.99	5,560,205.72	5,618,587.88
..Region II (Cagayan Valley)	**3,685,744.00**	3,733,290.10	3,779,209.57	3,823,426.32	3,865,866.35	3,906,457.95
..Region III (Central Luzon)	**12,422,172.00**	12,582,418.02	12,737,181.76	12,886,206.79	13,029,243.68	13,166,050.74
..Region IV-A (CALABARZON)	**16,195,042.00**	16,403,958.04	16,605,726.73	16,800,013.73	16,986,493.88	17,164,852.07
..MIMAROPA Region	**3,228,558.00**	3,270,206.40	3,310,429.94	3,349,161.97	3,386,337.66	3,421,894.21
..Region V (Bicol Region)	**6,082,165.00**	6,160,624.93	6,236,400.62	6,309,366.50	6,379,400.47	6,446,384.18
..Region VI (Western Visayas)	**7,954,723.00**	8,057,338.93	8,156,444.20	8,251,874.59	8,343,470.40	8,431,076.84
..Region VII (Central Visayas)	**8,081,988.00**	8,186,245.65	8,286,936.47	8,383,893.62	8,476,954.84	8,565,962.87
..Region VIII (Eastern Visayas)	**4,547,150.00**	4,605,808.24	4,662,459.68	4,717,010.45	4,769,369.27	4,819,447.65
..Region IX (Zamboanga Peninsula)	**3,875,576.00**	3,925,570.93	3,973,855.45	4,020,349.56	4,064,975.44	4,107,657.68
..Region X (Northern Mindanao)	**5,022,768.00**	5,087,561.71	5,150,138.72	5,210,395.34	5,268,230.73	5,323,547.15
..Region XI (Davao Region)	**5,243,536.00**	5,311,177.61	5,376,505.10	5,439,410.21	5,499,787.66	5,557,535.43
..Region XII (SOCCSKSARGEN)	**4,901,486.00**	4,964,715.17	5,025,781.17	5,084,582.81	5,141,021.67	5,195,002.40
..Region XIII (Caraga)	**2,804,788.00**	2,840,969.77	2,875,913.69	2,909,561.88	2,941,858.02	2,972,747.53
..ARMM	**4,404,288.00**	4,461,103.32	4,515,974.89	4,568,811.79	4,619,525.60	4,668,030.62

APPENDIX 7: PROJECTED DEMAND AND SUPPLY ANALYSIS FOR LOWLAND VEGETABLES IN THE PHILIPPINES, 2010-2045

Year	Population	UT per Capita (kg/yr)	Growth Rate % (Medium Assumption	Projected Demand (kg)	Projected Gross Supply in (kg)	Surplus/ Deficit (kg)
2010	93,135,100	7.31	-	680,817,581	775,368,000.00	94,550,419.00
2015	101,562,300	6.78	1.75	688,592,394	786,102,000.00	97,509,606.00
2020	109,947,900	6.89	1.60	757,368,982	796,984,598.80	39,615,616.35
2025	117,959,400	6.99	1.42	824,066,490	808,017,853.57	(16,048,636.30)
2030	125,337,500	7.07	1.22	886,299,332	819,203,849.95	(67,095,481.93)
2035	131,903,900	7.14	1.03	942,306,859	830,544,702.46	(111,762,156.24)
2045	137,532,200	7.20	0.84	990,759,982	842,042,554.88	(148,717,427.01)
2050	142,095,100	7.25	0.65	1,030,334,188	853,699,580.68	(176,634,607.76)

Source: PRDP, 2019a (Value Chain Analysis of Lowland Vegetables

APPENDIX 8: COSTS AND RETURNS ANALYSIS

Ampalaya Production Cost and Return per One Hectare of Land

ITEMS	REQUIREMENT	UNIT	UNIT PRICE	TOTAL
LABOR				
Land Preparation	4 and 6	MAD/MD	1500 and 400	8,400
Furrowing	2 and 2	MAD/MD	1500 and 400	3,800
Bedding	4	MD	400	1,600
Mulching	4	MD	400	1,600
Compost and Basal Fertilizer Application	6	MD	400	2,400
Planting	6	MD	400	2,400
Side Dress Fertilizer Application	2	MD	400	800
Trellising	15	MD	400	6,000
Irrigation (Water Management)	20	MD	400	8,000
Weeding	14	MD	400	5,600
Vine Training	5	MD	400	2,000
Spraying	8	MD	400	3,200
Harvesting	20	MD	400	8,000
Sub-Total				53,800
MATERIALS				
Complete Fertilizer (14-14-14)	12	tins @250g/tin	1,715	20,580
Trellis			30,000	30,000
Plastic Mulch	8	rolls	2,450	19,600
Manure/Compost	40bags@50kg/bags	bags	500	20,000
Complete Fertilizer (14-14-14)	2	Bags	1,400	2,800
Urea (46-0-0)	2	bags	1,350	2,700
Muriate of Potash (0-0-60)	1	bags	1,500	1,500
Fermented Plant Juice	2	L	200	400
Pesticides			5,000	5,000
Dolomite	4	bags	500	2,000
Sub-Total				104,580
Total Variable Cost				158,380
Miscellaneous (15% of Total variable cost)				23,757
TOTAL COST				**182,137**
Gross Income	**20,000**	**kg**	**30**	**600,000**
Net Income				**417,863**
Return of Investment (%)				**229.42**

Source: DA-Bureau of Plant Industry, 2020

Eggplant Production Cost and Return per One Hectare of Land

ITEMS	REQUIREMENT	UNIT	UNIT PRICE	TOTAL
LABOR				
Land Preparation				
Mowing	1	MAD	1,500	1,500
Plowing	1	MAD	1,500	1,500
Vermicompost Application	4	MD	400	1,600
Harrowing (2x)	1	MAD	1,500	1,500
Rotavation	1	MAD	1,500	1,500
Furrowing	1	MD	400	400
Sowing	1	MD	400	400
Land Prep/Potting	2	MD	400	800
Pricking	10	MD	400	4,000
Maintenance	5	MD	400	2,000
Transplanting/Basal Application	20	MD	400	8,000
Cultivation (Off-barring and Hilling-up)	4	MD	400	1,600
Irrigation (furrow-10x) MD/Irrigation – 2 workers	30	MD	400	12,000
Side dressing (3x)	4	MD	400	1,600
Weeding (3x)	12	MD	400	4,800
Spraying	30	MD	400	12,000
Harvesting	20	MD	400	8,000
Sub-Total				63,200.00
MATERIALS				
Seeds	5	tins@50g/tin	575	2,875
Plastic Mulch	8	rolls	2,450	19,600
Manure/Compost	50	bags	500	20,000
Complete Fertilizer (14-14-14)	2	bags	1,400	2,800
Urea (46-0-0)	4	bags	1,350	5,400
Muriate of Potash (0-0-60)	1	bag	1,500	1,500
Fungicide	1	box	700	700
Insecticide	2	L	700	1,400
Biological Pesticide	2	L	750	1,500
Coir Dust	1	bag	50	50
Sub-Total				55,825
Total Variable Cost				119,025
Miscellaneous (15% of Total variable cost)				17,853.75
TOTAL COST				**136,878.75**
Gross Income				**250,000**
Net Income				**113,121.25**
Return of Investment (%)				**82.64**

Source: DA-Bureau of Plant Industry, 2020

Squash Production Cost and Return per One Hectare of Land

ITEMS	REQUIREMENT	UNIT	UNIT PRICE	TOTAL
LABOR				
Land Preparation				
Clearing	20	MD	400	8,000
Plowing-Mechanized	2	MAD	1,500	3,000
Harrowing	2	MAD	1,500	3,000
Furrowing	4	MD	400	1,600
Fertilizer Application	10	MD	400	4,000
Planting	10	MD	400	4,000
Irrigation	10	MD	400	4,000
Side dressing	10	MD	400	4,000
Weeding	30	MD	400	12,000
Spraying	8	MD	400	3,200
Harvesting	30	MD	400	12,000
Sub-Total				58,800
MATERIALS				
Seeds	8	tins @ 250g/tin	1,077	8,616
Manure/Compost	40	bags	500	20,000
Complete Fertilizer (14-14-14)	2	bags	1,400	2,800
Urea (46-0-0)	1	bag	1,350	1,350
Muriate of Potash (0-0-60)	1	bag	1,500	1,500
Fermented Plant Juice	2	L	200	400
Jute Sacks	50	pcs	20	1,000
Sub-Total				35,666
Total Variable Cost				94,466
Miscellaneous (15% of Total variable cost)				14,169.90
TOTAL COST				**108,635.90**
Gross Income				**240,000**
Net Income				**131,364.10**
Return of Investment (%)				**120.92**

Source: DA-Bureau of Plant Industry, 2020

String Beans Production Cost and Return per One Hectare of Land

ITEMS	REQUIREMENT	UNIT	UNIT PRICE	TOTAL
LABOR				
Land Preparation				
Mowing	1	MAD	1500	1,500
Plowing	2	MAD	1500	3,000
Vermicompost Application	4	MD	400	1,600
Harrowing	2	MAD	1500	3,000
Furrowing	2	MD	400	800
Planting/Basal Fertilization	8	MD	400	3,200
Thinning	2	MD	400	800
Cultivation (Off-barring and Hilling-up)	4	MD	400	1,600
Irrigation	24	MD	400	9,600
Side dressing	2	MD	400	800
Trellising	30	MD	400	12,000
Weeding	30	MD	400	12,000
Spraying	8	MD	400	3,200
Vine Training	20	MD	400	8,000
Harvesting	30	MD	400	12,000
Sub-Total				73,100
MATERIALS				
Seeds	12	kgs	1350	16,200
Manure/Compost	60	bags	500	20,000
Complete Fertilizer (14-14-14)	2	bags	1400	2,800
Urea (46-0-0)	4	bags	1350	5,400
Muriate of Potash (0-0-60)	1	bag	1500	1,500
Fungicide	1	box	700	700
Insecticide	15	L	700	10,500
Foliar Fertilizer	2	L	750	11,250
Trellis				20,000
Sub-Total				88,350
Total Variable Cost				161,450
Miscellaneous (15% of Total variable cost)				24,217.50
TOTAL COST				**185,667.50**
Gross Income				**291,000**
Net Income				**105,332.5**
Return of Investment (%)				**56.73**

Source: DA-Bureau of Plant Industry, 2020

Tomato Production Cost and Return per One Hectare of Land

ITEMS	REQUIREMENT	UNIT	UNIT PRICE	TOTAL
LABOR				
Plowing and Harrowing	8	Tractor/day	1,500	12,000
Bed Making and Mulching	100	MD	400	40,000
Seedling Growing and Planting	30	MD	400	12,000
Fertilizer Application	32	MD	400	12,800
Posting and Trellising	120	MD	400	48,000
Irrigation	20	MD	400	8,000
Spraying	20	MD	400	8,000
Weeding	30	MD	400	12,000
Harvesting	50	MD	400	20,000
Sub-Total	402			172,000
MATERIALS				
Seeds	6	25g/can	2,680	16,080
Plastic Mulch	15	roll	2,150	2,150
Seedling Trays	200	pc	38	7,600
Vermicast	50	bag	500	25,000
16-16-16	16	bag	1,600	25,600
Calcium nitrate	8	bag	1,950	15,600
0-0-60	4	bag	1,180	4,720
Foliar Fertilizer	20	L/kg	350	7,000
Pesticides	20	L/kg	1,500	30,000
Bamboo/wood post	100	Pc	50	5,000
Bocaue bamboo	800	Pc	12	9,600
GI Wire	300	kg	100	30,000
Strings	8	kg	320	2,560
Bamboo Staples	30	thousand	100	3,000
Fuel	160	L	50	8,000
Total Material Cost				222,010
Total Production Cost				394.810

Source: Harbest, 2020

Cost and Return	Low Price	Ave Price	High Price
Plant population, 1.0 hectare)	20,000	20,000	20,000
Yield/Plant, kg	2	2	2
Total Yield, kg	40,000	40,000	40,000
Selling Price/kg, PHP	10	20	30
Gross Income	400,000	800,000	1,200,000
Production Cost	394,810	394,810	394,810
Breakeven price, PHP	10	10	10
Breakeven yield, kg	39,481	19,741	13,160
Net Income	5,190	405,190	805,190
Return of Investment	1%	103%	204%

Source: Harbest, 2020

PLANT. PLANT. PLANT. PROGRAM

Masaganang ANI Mataas na KITA