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Project For Market Driven Enhancement of Vegetable Value Chain in the Philippines (Planning Phase)

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IC Net Limited
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List of Abbreviations

2G	2nd Generation Mobile Communication System
3G	3rd Generation Mobile Communication System
4G	4th Generation Mobile Communication System
5G	5th Generation Mobile Communication System
ABEMIS	Agricultural and Biosystems Engineering Management Information System
ACF	Agrizkaya Cooperative Federation
ADB	Asian Development Bank
AMAD	Agribusiness and Marketing Assistance Division
AMAS	Agribusiness and Marketing Assistance Service
APTC	Agri-Pinoy Trading Center
ASEAN	Association of South-East Asian Nations
ATI	Agricultural Training Institute
ATS	Agricultural Tramline System
BAFS	Bureau of Agriculture and Fisheries Standards
BAPTC	Benguet Agri-Pinoy Trading Center
BAWASA	Barangay Waterworks and Sanitation Association
BPI	Bureau of Plant Industry
BSU	Benguet State University
BSU-NPRCRTC	Northern Philippines Root Crops Research and Training Center, Benguet State University
B-to-B	Business to Business
CAR	Cordillera Administrative Region
CNAPTC	Camarines Norte Agri-Pinoy Trading Center
COVID-19	Corona virus Disease 2019
DA	Department of Agriculture
DA-ICTS	Information And Communications Technology Service, Department of Agriculture
DAR	Department of Agrarian Reform
DARBO	Daguit Agrarian Reform Beneficiary Organization
DILG	Department of Interior and Local Government
DoST	Department of Science and Technology
DTI	Department of Trade and Industry
DX	Digital Transformation

EC	Electronic Commerce
EDSA	Epifanio Delos Santos Avenue
FARIC	Federation of Aritao Rural Improvement Club
FMR	Farm to Market road
FVC	Food Value Chain
GAP	Good Agricultural Practices
GCash	GCash by Alipay
GDP	Gross Domestic Product
GGFM	Gift of Grace Food Manufacturing
HVCDP	High Value Crop Development Program
ICT	information and communication technology
IoP	Internet of Plants
JAEC	Japan Agricultural Exchange Council
JICA	Japan International Cooperation Agency
KASAMNE	Katipunan at Samahan ng mga Magsisibuyas sa Nueva Ecija
KMNE	Kababaihang Masigla ng Nueva Ecija
LGU	Local Government Unit
LPMPC	Labo Progressive Multi-Purpose Cooperative
LPWA	Low Power, Wide Area
LTVTP	La Trinidad Vegetable Trading Post
MAO	Municipal Agricultural Office
MMDA	Metro Manila Development Authority
NATCCO	National Confederation of Cooperatives
NEAPTC	Nueva Ecija Agri-Pinoy Trading Center
NEFVMC	Nueva Ecija Fruits and Vegetable Marketing Cooperative
NEPG	Nueva Ecija Provincial Government
NFC	Northern Food Corporation
NMR	Net Margin Ratio
NOAP	National Organic Agriculture Program
NPRCRTC	Northern Philippines Root Crops Research and Training Center
NVAT	Nueva Vizcaya Agricultural Terminal
NVATI	Nueva Vizcaya Agricultural Terminal Inc.
OCCP	Organic Certification Center of the Philippines
PAO	Provincial Agricultural Office
PAPTC	Pangasinan Agri-Pinoy Trading Center

PGS	Participatory Guarantee System
PHP	Philippine peso
PISOS	Pump Irrigation System for Open Source
PPP	Public Private Partnership
PRDP	Philippines Rural Development Project
PRIC-MPC	Pinagdanlayan Rural Improvement Club Multi-Purpose Cooperative
PSA	Philippines Statistics Authority
PVGA	Pangasinan Vegetable Growers Association
SARAi	Smarter Approaches to Reinvigorate Agriculture as an Industry in the Philippines
SPIS	Solar-Powered Irrigation System
SPPAQ	Sentrong Pamilihan ng Produktong Agrikultura ng Quezon
SPPAQFI	Sentrong Pamilihan ng Produktong Agrikultura ng Quezon Foundation Inc.
TMPC	Topdac Multi-purpose Cooperative
UAPTP	Urdaneta Agri-Pinoy Trading Post
UPLB	University of the Philippines Los Baños
USAID	United States Agency for International Development
USDA	United States Department of Agriculture

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Summary

1. Background and Objectives of the Project

1. Although agriculture accounts for about 25% of the total working population in the Philippines, it contributes only 9.3% of GDP, and the productivity growth has been sluggish. In recent years, the purchasing power of the middle class has increased with economic growth, and a shift to emerging modern distribution systems such as supermarkets has been observed in vegetable value chains. On the other hand, planned production and shipment, standards for product quality, access to agricultural finance, development of market access roads and cold chain facilities, and the participation of private companies are limited. Therefore, the agricultural sector has not been able to capture changes in demand or leverage them in its development.

2. In the long-term development vision "Ambisyon Natin 2040," announced in October 2016, the government listed agriculture as one of the priority sectors for becoming an upper-middle-income country. Moreover, the Philippine Development Plan 2017–2022, developed in February 2017, and "We Recover as One," a measure announced in May 2020 that responds to the new normal in light of the COVID-19 pandemic, aim to increase the income of farmers and achieve food security through value addition to agricultural products and the construction of an efficient transportation logistics system.

3. The objective of the project is twofold: to formulate and have stakeholders agree on a draft roadmap for FVC modernization to be undertaken jointly by the public and private sectors (planning phase) and by conducting pilot FVC projects starting from the target provinces, build the capacity of FVC stakeholders and develop, verify, and update an inclusive FVC inclusive FVC model for horticultural crops (implementation phase). In the implementation phase, the inclusive FVC model will be shared with FVC stakeholders nationwide and will help improve farmers' profitability, thereby contributing to the self-sustaining expansion of profitable FVCs of horticultural crops.

2. Framework for Improving the Vegetable Value Chain

4. In this Project, an "ideal value chain" is referred to as a value chain that allows FVC stakeholders to benefit more than they do from the existing system. To realize an ideal value

chain, three improvement approaches are required: (1) cost reduction, (2) increasing value addition, and (3) mitigation of price volatility.

5. The Project Team conducted a study in the planning phase centered on the following four strategies: (1) proposing 10 promising provinces based on vegetable production as the starting point for narrowing down the target areas of the pilot projects; (2) generalizing the pilot projects through comparing two provinces where the pilot project will be implemented with the other three or four provinces in Luzon; (3) conducting objective analysis of the economic situation through qualitative and quantitative surveys of value chains and market surveys; and (4) considering an ideal value chain model and formulating a roadmap based on the existing successful FVC model.

3. Current Situation of Vegetable Distribution

3.1. Traditional Distribution

6. In traditional distribution, there are wholesale markets established in provinces with the support of government agencies, mainly the Department of Agriculture (DA), and downstream of these markets, there are wholesale markets run by municipalities that accommodate a mix of wholesalers and retailers. The retailers closest to the consumer are mainly Talipapa (small vegetable shops), Sari Sari stores (small grocery stores), and Kolong-Kolong and Habal Habal (vegetable tricycles for mobile sales).

7. Farmers in highland vegetable production areas: Highland vegetables such as potatoes, cabbages, carrots, tomatoes, and cauliflowers are grown in Benguet Province and Nueva Vizcaya Province, which are located in the highlands. In Benguet, the annual average temperature is below 20°C; therefore, cool-season vegetables can be grown two to three times a year. For the cultivation of crops, medium-to-early-maturing varieties that are popular in the market for their taste and transportability are commonly used. In the survey area, farmers generally raised seedlings on their own. In Benguet, about 30% of the surveyed farmers raised seedlings using pots or seedling trays, but in Nueva Vizcaya, most of the seedlings are raised in open fields. Regarding cultivation facilities, there are no farmers using greenhouses in Nueva Vizcaya and some facilities exist in Benguet, but they are mainly used for raising seedlings. The average agricultural income was around PHP 90,000 in the two surveyed towns in Benguet Province, which is less than the PHP 100,000 needed to buy food for a family of five in the Philippines.

8. Distributors in highland vegetable production areas: (1) The main wholesale markets in Benguet Province are the La Trinidad Vegetable Trading Post and Benguet Agri-Pinoy Trading Center (BAPTC), which are important wholesale markets that supply highland vegetables to Metro Manila and other islands and provinces. The BAPTC's main business is trading venue management and service provision, data accumulation, facility maintenance, management, etc., but it is not involved in actual trading transactions. In recent years, the BAPTC has handled 170 million tons of vegetables annually, and the amount handled is increasing every year. The parties involved in establishing sales transactions in these production area wholesale markets include disposers/market facilitators, truck wholesalers, purchasers, porters, packers, and washers.

9. Distributors in highland vegetable production areas (2): Generally, the flow of vegetable distribution is as follows: Vegetables brought into the abovementioned (provincial) production area wholesale markets by local farmers are purchased by disposers and sold to truck wholesalers and purchasers, then wholesaled to wholesale markets in consumption areas, such as Manila. In addition, there are channels through which vegetables flow from farmers to wholesalers and retailers in municipal markets and then to consumers within the province.

10. Distributors in highland vegetable production areas (3): Vegetables are sorted and graded by disposers, but there are no clear indicators or standards. After sorting, most of the vegetables are packed in plastic bags. The use of plastic crates is limited to tomatoes and other crops. In addition, romaine lettuce, broccoli, and cauliflower are packed in used cardboard boxes.

11. Distribution of highland vegetable production areas (4): According to competitiveness analysis based on a quantitative survey in Benguet Province, disposers of production area wholesale markets are in a state of such excessive competition (average net margin rate (NMR) is −5.3%) that the sustainability of their business is in question. On the other hand, other market players, including truck wholesalers, wholesaler-cum-retailers, etc., appear to be sufficiently competitive from statistical tests (the average NMR is −3.6%, but the test result shows that this level below 0% is not statistically significant). The profit margin of disposers is reduced by high transaction costs, with labor costs being the greatest, accounting for 76.5%. The payment of wages to workers for pre-sorting, sorting, packing in plastic bags, weighing, and transportation is a major burden for disposers.

12. Farmers in lowland vegetable production areas: In the four provinces of lowland vegetable production areas (Quezon, Pangasinan, Nueva Ecija, and Camarines Norte), the annual average temperature is approximately 30°C; therefore, warm-season vegetables that are relatively heat- and drought-tolerant, such as sweet potatoes, eggplants, tomatoes, bitter gourds, and yardlong beans, are generally grown. In addition, the following vegetables are cultivated in individual provinces: chayote squashes, bok choys (pechays), bottle gourds in Quezon and Pangasinan, onions in Nueva Ecija, and watermelons, sweet potatoes, and pumpkins in Camarines Norte. Generally, vegetables are grown annually. In lowland vegetable areas, water shortages occur at times of high temperatures; therefore, early-maturing varieties are preferred for all crops for water-saving advantages. Many farmers in the survey area purchased seedlings rather than raising them on their own. Among those who raise their own seedlings, only a limited number use pots or seedling trays. As for cultivation facilities, none of the farmers uses greenhouses for main cultivation, and the farmers who use greenhouses to raise seedlings account for only a little over 10%. The average agricultural income in the two surveyed towns in Quezon Province is approximately PHP 330,000, but there is great variation, ranging from PHP 18,000 to PHP 670,000, depending on the town.

13. Distributors in lowland vegetable production areas (1): The wholesale markets in the five surveyed provinces include the Sentrong Pamilihan Ng Produktong Agriculturura Sa Quezon (in Quezon Province), Pangasinan Agri-Pinoy Trading Post (PAPTC), Nueva Vizcaya Agricultural Terminal (NVAT), Sanguitan Vegetable Wholesale Market (in Nueva Ecija), Nueva Ecija Agri-Pinoy Trading Center (NEAPTC), and Camarines Norte Agri-Pinoy Trading Center (CNAPTC).

14. Distributors in lowland vegetable production areas (2): Although there are differences between provinces, the flow of vegetable distribution is generally as follows: Lowland vegetables are collected from local farmers by traders and then shipped to the abovementioned provincial wholesale markets. Both vegetables are then supplied to such destinations as municipal markets and small-scale vegetable shops, and are subsequently distributed to consumers in the provinces. Highland vegetables are transported from Benguet Province to the wholesale markets in lowland via inter-provincial wholesalers to the same markets. At the end of the supply chain, in addition to traditional small vegetable stores, there are small grocery stores and vegetable tricycles that have started selling vegetables owing to the spread of

COVID-19.

15. Distributors in lowland vegetable production areas (3): In Sentrong Pamilihan, which is an agricultural wholesale market in Quezon Province, unlike BAPTC in Benguet Province, the management entity (Sentrong Pamilihan Ng Produktong Agricultura Sa Quezon Foundation Inc.: SPPAQFI) includes farmers and wholesalers as its members and provides them with a fair trading platform. The SPPAQFI intermediates between farmers and wholesalers to facilitate transactions using a purchase and sales management system that registers shipping information (such as member names, crops, quantities, and prices) using barcodes. The SPPAQFI sets wholesale market purchase standards—defining three grades: "good," "normal," and "defective"—and provides guidance to the market users.

16. Distributors in lowland vegetable production areas (4): The results of a competitiveness analysis based on a quantitative survey in Quezon Province confirmed that collectors are sufficiently competitive, and the common claim that collectors are unfairly taking profits from farmers may not be true (the average NMR is −5.3%). Labor costs account for the majority of costs for collectors at 59.1%, which is about 10% lower than in Benguet. Instead, the percentage of service usage fees (mainly paid for services provided by the production area wholesale market) averaged 25.6%, which is nearly 20% higher than in Benguet.

17. Consumption area (Metropolitan Manila) (1): Metro Manila's consumption area wholesale markets include the Divisoria and Balintawak Markets, and the downstream markets include hub- and sub-wholesale and retail markets, such as the Marikina, Commonwealth, Mega Q Mart, and Araneta producer markets. Downstream retailers include small vegetable stores, food stalls, and restaurants. Thus, the market distribution of consumption areas is multi-layered, and it takes time for goods to move from the Divisoria and Balintawak Markets to small vegetable stores.

18. Consumption area (Metropolitan Manila) (2): According to the results of a competitiveness analysis based on a quantitative survey in Metro Manila, hub-wholesalers were sufficiently competitive (the average NMR was 7.9%). Verification was not possible for sub-wholesalers because of the small number of samples (seven samples). In the costs of hub- and sub-wholesalers' business operations, labor costs make up the largest portion at 56% on average, but this figure is slightly lower than that of the production areas. Another characteristic is that

the ratio of service charges to capital costs is higher than in the production areas.

19. Consumption area (Metropolitan Manila) (3): Vegetable retailers that sell vegetables directly to consumers in Metro Manila include (1) retailers located in the wholesale market, (2) retailers in the retail market, and (3) small vegetable stores scattered outside the market (Talipapa). These retailers primarily source vegetables through traditional wholesalers.

20. Consumption area (Metropolitan Manila) (4): Supermarkets are retailers in urban areas such as Manila. Supermarkets can be categorized by target consumer income level (high-, middle-, and low-income). In addition, supermarkets are chain stores or parts of huge mall facilities that are operated by large corporations. These companies rent their vegetable counters to outside distributors (concessions), and distributors (shelf renters) procure their own vegetables and arrange them on the shelves of supermarket vegetable counters for sale. They give their sales income to the supermarkets. In terms of suppliers, it is believed that shelf-renting companies adjust their supply volume by combining sources such as contract farming, procurement in the production area wholesale market, and procurement in the wholesale market in Metro Manila. Clearly, procurement from traditional distribution plays a complementary role in adjusting supply and demand for modern distribution.

3.2 Modern Distribution

21. Contract farmers: In the survey area, the number of farmers who produce vegetables under a contract with buyers is limited, and the qualitative survey confirmed only two farmers in Benguet and one each in the Quezon and Pangasinan Provinces. Nearly half of the farmers surveyed viewed contract farming negatively, responding that they were “not interested” and “wanted to sell freely where they wanted.” The factors behind farmers’ negative opinions against contract farming are that fixed prices work against farmers when the prices of inputs and vegetables soar, and the difficulty of continuously meeting the quality and quantity demands of contractors.

22. Buyer-sellers, packers, warehousing, and processors: Intermediaries in modern distribution mainly include suppliers of vegetables to supermarkets and restaurants for middle- and high-income consumers such as Dizon Farms and North Point. Packers include manufacturers of packaging materials as well as companies that package fresh and processed vegetables and supply them to supermarkets and restaurants. An example of this category is Diajam, which

packs ginger powder tea produced by a cooperative in Dolores, Quezon Province, and wholesales it to 7-Eleven and other stores. The number of storage companies for all vegetables is still limited; however, the establishment of storage facilities for onions is relatively advanced. In Nueva Ecija, Tarlac, and Pangasinan Provinces, which are the major onion production areas, there are 18 cold storage facilities, including those of the Nueva Ecija Onion Producers Association and Jadeco Cold Storage. Processors include small-scale enterprises such as the Topdac Multi-Purpose Cooperative, which purchases raw materials from its cooperative farmers, and large-scale companies such as Northern Food Co., Ltd., which procures through contract cultivation with farmers.

4. Current Situation of Infrastructure

4.1 Production and Distribution Infrastructure

23. Facilities in production areas (1): Water sources differ between highlands and lowlands. It is common to irrigate lowlands with groundwater while pumping river water, and springs are used in the highlands. Furrow irrigation is used in the lowlands and sprinklers in the highlands. The power sources of the pumps are both engines and electricity, and the sources of electricity are a normal distribution network or solar power. In recent years, DA has focused on the solar-powered irrigation system (SPIS) and supports its installation from the DA's High-Value Crop Development Program (HVCDP) budget or other sources.

24. Facilities in production areas (2): As for horticultural facilities, greenhouses and shade are not used in most areas, and where they are used, their use is limited to seedling production. For plowing, tractors are commonly used, but it is still not uncommon to use livestock and manpower in some areas of the lowlands. Thus, the mechanization of horticultural production has been delayed in some areas. The DA supports the construction of horticultural facilities, and according to data, an average of 33 greenhouses are built every year in Benguet with the budget of HVCDP and the National Organic Agriculture Program, but installation is not progressing in other provinces.

25. Facilities in the production area (3): Farmers do not have storage facilities and thus ship produce immediately after harvesting. An exception is onions, which can be stored for a long time. There are cold storage facilities for onions in Nueva Ecija and Pangasinan, where they are widely cultivated. Currently, there are 11 onion refrigeration facilities in the province, and applications have been submitted for 3 more.

26. Facilities in production areas (4): To improve market access, the DA started to provide trucks and refrigerated vehicles to transport agricultural products nationwide using Kadiwa ni Ani at Kita Program through its regional offices. As of July 2022, 30 refrigerated vehicles and 42 transport trucks/vans have been provided nationwide, including those under procurement. The beneficiaries include cooperatives and local government units, and the total budget is approximately PHP 200 million. Tramlines (Agricultural Tramline System, ATS) are also used in mountainous areas, where it is difficult to construct roads for vehicles. ATS connects farmlands to the nearest farm to the market road (FMR), and they are being developed by the DA and others.

27. Access to agricultural products: Although there is no clear definition of FMR, it is reasonable to assume that it corresponds to barangay roads in the road classification system of the Philippines. Looking at the pavement rate, almost all national roads are paved, while only approximately 40% of barangay roads are paved. The road density is 0.56 km/km^2, which is far from the desirable figure of 1.0 (3.24 in Japan according to 2020 statistics). Therefore, road extensions are required, especially in rural areas.

28. Distribution facilities: There are 22 wholesale markets in production areas nationwide, of which 8 are under construction and 1 is not in operation; thus, 13 are currently in operation. The breakdown of the 22 markets is as follows: 9 APTCs, 4 trading posts, 3 food terminals, and 6 other facilities. There are various management entities, such as cities/municipalities, provinces, and market management organizations, but city/municipality management is the most common.

4.2 Digital Technologies in Agriculture Sector

29. Digital technologies in the agricultural sector can be broadly categorized into three areas: precision agriculture, e-commerce, and financial inclusion. Initiatives for agricultural digital technology in the Philippines are led by universities and research institutes in the production sector, and by government organizations and private companies in the distribution sector.

30. Government agencies in the Philippines are actively promoting digital agriculture, and the DA is implementing the “OneDA” policy and has developed a roadmap for the ICT sector in 2020. The Department of Science and Technology (DoST) is implementing the “Project

SARAi," which provides online information on weather, precipitation, and drought forecasts for each region based on environmental measurements. In addition, DeliverE, which was developed jointly by USAID, the Department of Trade and Industry (DTI), and the DA, is a one-stop system that handles everything from ordering agricultural products to transportation and sales. This is expected to become a new distribution route for fruits and vegetables.

31. In the Philippines, private companies, especially start-ups, involved in agricultural digitalization are limited to the upstream distribution sector (e-commerce). Only a few startups were involved in financial inclusion. The number of start-ups is small compared to some ASEAN countries, such as Indonesia. This is because the investment market for start-up companies is far smaller in the Philippines. In the field of precision agriculture, field survey results indicated that all start-up companies engaged in precision agriculture in the Philippines were unable to continue their businesses. This is considered to be due to the difficulty in monetizing the service by collecting service fees from farmers. Regarding financial inclusion, the introduction of digital technology has only just begun in the Philippines, and costs are an issue in the implementation of digital technology.

32. Fixed Internet is not available in the highlands, including Benguet. In addition, although the penetration rate of smartphones in rural areas exceeds 50% in many areas, there are some areas, such as in Nueva Vizcaya, where the penetration rate is only approximately 5%. Therefore, it is expected that the use of the Internet in project areas will be based on mobile phone networks. Furthermore, in highland areas, there are areas without electricity. Therefore, in these areas, issues related to ICT and power infrastructure must be addressed before considering the introduction of digital technology in agriculture.

5. Issues

5.1 Common Issues in Vegetable Distribution

33. The most serious issues raised by vegetable farmers in both the highlands and lowlands are the decline in yield caused by pests and diseases and the alleviation of sales price fluctuations caused by overproduction. Other issues include inadequate pest control technology, sharp drops in farm gate prices, inadequate fertilization management, and inappropriate shipping methods.

34. The common problems for distributors in production areas are as follows: There is a large

fluctuation in transaction prices among distributors in production areas (production area wholesale markets); the freshness and quality of vegetables are damaged, resulting in invisible costs (distributors in production areas); use of price information from APTC is limited (BAPTC and NVAT); vegetables are sorted, but grading standards are not clear (production area wholesale markets); APTC management is not unified, defaulted receivables from purchasers and truck-wholesalers (to disposers; BAPTC and PAPTC).

35. Common issues on the consumption side are lower consumption of vegetables in the Philippines than in neighboring countries, poor-quality leafy vegetables in retail stores, underdeveloped markets for processed foods, supply below potential market demand, and no proper and clear indication of organic vegetables at retail stores, making it difficult for consumers to distinguish them from non-organic vegetables.

5.2 Issues in Highland Vegetable Production and Distribution

36. (1) Low yields due to diseases and pests: The yields reported in the qualitative survey were lower than the national statistics and the potential yields of the cultivars for most crops. The main cause of low yield was pest damage. Particularly in Benguet Province, soil diseases and lower soil fertility owing to replant failure are concerns. (2) Sharp drops in farm-gate prices: According to qualitative research, potatoes, which have the smallest price difference, fluctuate by a factor of about four, and Chinese cabbages, which have the largest price difference, fluctuate by a factor of more than five. Benguet Province is a major production area for potatoes, cabbages, and carrots, but the prices of cabbages and carrots are particularly volatile. (3) Labor costs for the work performed by disposers are high: Labor costs covered by disposers account for the great majority of their costs, 76.5%. Quantitative research shows that BAPTC disposers face excessive competition, and cost reductions are needed to improve the sustainability of this value chain.

5.3 Issues in Lowland Vegetable Production and Distribution

37. (1) Low yield and climate change: In addition to the serious problem of pest damage due to the hot and humid agricultural environment in the lowlands, climate change in recent years has had major impacts. In addition to typhoons, climate change is inducing temperature increases, shortened rainfall seasons, torrential rains, and strong winds, which cause serious damage to agriculture. The yields found in the qualitative surveys are only half to one-fifth of the figures in the national statistics and cultivars' potential yields. (2) Sharp drops in farm-gate

prices: The lowest price is approximately 1/3 to 1/12 of the highest price. The price fluctuation is particularly large for eggplants, tomatoes, and yardlong beans, but it tends to be relatively small for bitter gourds; (3) Farmers' marketing channels are not diversified: Enclosure of farmers by traders (traders supporting farmers from provision of funds to harvest, shipment, and purchase) increases dependence on traders and limits diversification of sales destinations; and 4) insufficient use of market facilities: NEAPTC in Nueva Ecija and CNAPTC in Camarines Norte do not function as provincial wholesale markets.

5.4 Issues in Production and Distribution Infrastructure

38. There are issues such as insufficient irrigation facilities, inadequate horticultural facilities, inadequate storage facilities, lack of operational know-how, deterioration of vegetable quality due to the use of plastic bags for transportation, insufficient means of transporting agricultural products, erroneous support trials by the DA for wholesale markets of production areas, and processing facilities with poor marketability.

5.5 Issues in Introducing Agricultural Digital Technology

39. (1) Poor mobile coverage: In the Philippines, a telephone pole type, rather than a tower type with a wide coverage area, is used for mobile phone networks; thus, mobile coverage is limited to around roads, and the mobile signal is cut off when one moves away from them. IoT devices required for environmental measurements must use mobile phone lines (3G or higher) for data communication. Thus, there is a high possibility of IoT devices failing to function properly owing to poor connection if they are installed in fields far from roads. (2) Problems with IT literacy in rural areas and mobile applications for farmers: Few farmers are aware of the existence of Bayani Kita and DeliverE, which are promoted by DA and DTI. In addition, user registration in the Bayani Kita app is a cumbersome process requiring a large amount of information, which makes it difficult for farmers to use.

Issues Related to Gender Mainstreaming

40. Gender needs were analyzed from the survey results of each field using the perspective of five elements (production, resources, income, leadership, and time) of women's empowerment in agriculture. As a result, there were few problems in terms of engagement in production activities, access to resources, exercise of leadership and decision-making power, and the burden of domestic work. However, it was found that, for some women, it becomes difficult to

manage time for negotiating with buyers and suppliers after childbirth because of the increase in childcare and housework.

6 Potential for Value Chain Development

6.1 Successful Cases

41. To formulate a hypothesis for a specific inclusive FVC model and verify it for designing pilot projects, existing successful cases that contribute to enhancing traditional and modern FVC were leveraged. The existing successful cases and those with future potential are believed to be tips for pilot projects and their candidates. Categorizations of successful cases were suggested based on their contribution to FVC enhancement. Thereafter, a search for successful cases was conducted through a qualitative survey of the value chain. From the 56 successful cases collected, those with the possibility of turning into a pilot project were selected using the following scoring: (a) feasibility as a pilot project, (b) possible impact on FVC improvement, and (c) applicability to other areas/situations.

6.2 Potential Crops from the Market Survey

42. A market survey on consumers confirmed that: (1) Consumers place importance on "freshness" and "nutritional aspects" of vegetables; (2) the majority of consumers purchase vegetables from supermarkets and wet markets; and (3) consumption of vegetables increased from five years ago, and the top five vegetables in order of increasing consumption were garlics, onions, tomatoes, potatoes, and eggplants. The main reasons for the increase in consumption of these vegetables are "increase in cooking on one's own" and "increase in interest in nutrition."

43. A market survey on food business operators confirmed that: (1) Food business operators place importance on "freshness" and "price" when procuring vegetables; (2) the top vegetables whose amounts purchased have increased are onions, followed by cabbages, and vegetables that have decreased are strawberries, followed by cauliflowers; (3) modern traders have important perspectives when purchasing vegetables and they incorporate information on vegetable purchases from various sources; thus, it appears that they can better respond to increases or decreases in consumers' demand than traditional traders.

44. Regarding domestically produced/imported vegetables, both consumers and food business operators hold positive images of domestic vegetables such as "good taste," "freshness," and

"high level of safety." Many consumers and business operators answered that they would purchase or procure domestically produced vegetables rather than imported ones if the prices were the same. In terms of cut, frozen, and dried vegetables, the percentage of consumers who purchase frozen and dried vegetables at least once a week is only approximately 40%, whereas approximately 60% of the customers purchase cut vegetables, indicating a higher number of purchasers for cut vegetables. Regarding organic vegetables and GAP-certified vegetables, 60% of food business operators purchase organic vegetables, whereas only 10% of them purchase GAP-certified vegetables.

45. Tomatoes, potatoes, and onions are the top three vegetables consumers are interested in increasing their consumption in the future. These vegetables have been in high demand for some time and their popularity is expected to continue. As for other vegetables, broccoli, lettuce, and moringas are vegetables whose production is not large compared to other items; however, a certain level of demand is expected, as almost 40% of the respondents answered that they would like to increase their purchases in the future. Among the vegetables for which food business operators want to increase their purchase in the future, onions ranked first, and modern traders chose lettuces and carrots as the second and third, while traditional traders chose cabbages, tomatoes, and eggplants (onion and cabbage were ranked equally as first by traditional traders).

6.3 Potential Crops from Horticultural Production Technology

46. In highland vegetable production areas, to mitigate the problems of replant failure, the spread of pests and diseases, and oversupply and farm-gate price collapse, it is important to diversify the crops and varieties grown and introduce technologies that accelerate or delay harvesting and shipping times. For crops, lettuce, celery, and broccoli, which are grown to some extent but not currently mass-produced, have been proposed. In terms of seed varieties, they pointed to varieties that mature earlier than those currently grown, are more resistant to pests and physiological disorders, and are in high demand to reduce post-harvest losses and for processing purposes, especially for potatoes, carrots, and cabbages. In addition, it is recommended that semi-determinate growth habit varieties of tomatoes be introduced to enable long-term harvesting.

47. In lowland vegetable-producing areas, effective crop types and varieties, such as those with tolerance to pests and diseases, drought, and high profitability, should be selected to diversify

vegetable production. The use of grafted seedlings with pest-resistant rootstocks for bitter gourds and tomatoes is recommended. In addition, the cultivation of sweet peppers, cabbages, and onions (which are not typical lowland vegetables) using varieties that are resistant to high temperature and humidity is proposed.

7. Draft Roadmap

7.1 Issues and Target Images

48. The various issues identified in the survey were organized into four categories according to the stages of the vegetable value chain: "(A) farming," "(B) farmers' marketing," "(C) trading and processing," and "(D) consumption." These issues were then reversed to objectives or target images and sorted according to the vegetable value chain improvement approaches to which they were specifically relevant.

7.2 Short-term and Mid-to Long-term Solutions

49. To realize the target image, Project Team experts summarized the measures that were considered effective, and the issues, target images, and solutions were then presented and discussed at the "Vegetable Value Chain Stakeholder Workshop on Draft Roadmap" in July 2022. Workshop participants were divided into four subgroups: (A) farming, (B) farmers' marketing, (C) trading and processing, and (D) consumption. Discussions were held based on the proposals of the Project Team and new ideas were added by the participants. These results are summarized as short-, medium-, and long-term solutions.

50. In July 2022, the "Philippine Vegetable Industry Roadmap 2021-2025" was released. While DA's roadmap and the project's proposal are aligned, the difference is that the Agricultural DA seeks to cover the entire vegetable value chain, while the Project's proposal emphasizes the improvement of the distribution.

7.3 Platform for Promoting VVC Improvement

51. A platform was formed to promote the improvement of the vegetable value chain by allowing those involved in such chains to take possible initiatives from their respective business standpoints through information sharing and activity promotion by DA and the projects. It consists of (1) daily information dissemination and exchange of opinions using a Facebook page, (2) interaction and information sharing through offline events approximately once a year, and (3) a consultative body.

8 Proposed Pilot Projects

52. Pilot Project 1: Stable supply of major vegetables

Objective: To mitigate price fluctuations by stabilizing the supply of major vegetables

Activities: (1) Disperse the vegetable harvesting season by improving production methods such as long-term harvesting and off-season cultivation of tomatoes, cherry tomatoes, green peppers, and introduction of new varieties; (2) introduce high-quality seedlings such as grafted seedlings and share their effectiveness in mitigating price fluctuations and increasing profit with farmers; (3) support the development of potato production areas by building a seed potato propagation system for processing using tissue culture seedlings produced by Benguet State University, and support contract cultivation between potato farmers and major restaurant chains.

53. Pilot Project 2: Promotion of smooth e-trade in the B-to-B e-commerce vegetable wholesale market

Objective: To support B-to-B e-commerce vegetable wholesale markets to promote direct trading between farmers and institutional buyers without contracts.

Activities: (1) Train active farmers' groups that have sold/are interested in selling vegetables at EC sites on more reliable packaging and labeling and other requirements; (2) match up interested farmer groups with modern distributors; and (3) facilitate the development of a support policy on demand and supply adjustment functions of electronic wholesale markets.

54. Pilot Project 3: Soft-aspect support for vegetable cold chain construction

Objective: To increase farmers' income by shipping vegetables at more dispersed times through a cold chain system and by lengthening the shelf life of leafy vegetables through pre-cooling.

Activities: (1) Collect and analyze related information and create a draft "Cold Chain Development Assistance Guidelines" that include shipping plans; (2) carry out shipping trials and collect related data; and (3) develop the above-mentioned guidelines.

55. Pilot Project 4: Minimizing loss by improved packaging of vegetables in the wholesale supply chain

Objective: (1) To verify the economic feasibility of using stackable plastic crates with handles (SPlaCs) in a certain supply chain and quantify the minimization of vegetable losses by SplaC use as an improved package and (2) to develop a model to disseminate the use of SPlaCs in the entire supply chain from farm to wholesaler in Manila.

Activities: (1) Form groups of the supply chain from disposers to wholesalers in Manila that utilize SplaCs on a trial basis; (2) conduct the verification study for six months, acquire relevant data, and extract lessons learned; (3) form groups in the supply chain from farmers and disposers to wholesalers in Manila that utilize SplaCs on a trial basis; (4) conduct the verification study for six months, acquire relevant data, and extract lessons learned; and (5) make a plan to disseminate SPlaCs in vegetable supply chains through other APTCs nationwide with a budget, and merge the plan with the Roadmap.

56. Pilot Project 5: Strengthening agro-processing businesses for more added value to vegetables

Objective: To strengthen existing agro-processing businesses, identify new agro-processing businesses, and establish guidelines for inclusive FVC support

Activities: (1) Help selected agro-processing businesses expand their businesses through continuous consultations; (2) identify new potential processing businesses that are promising by surveys and provide support for business start-ups; and (3) create a guideline on how to support agro-processing businesses comprehensively.

57. Pilot Project 6: Promotion of vegetable consumption

Objective: To increase consumption of vegetables

Activities: (1) Identify the key factors for low vegetable consumption in the Philippines and conduct a campaign to raise awareness of vegetable consumption; (2) develop and disseminate recipes for tasty vegetable dishes; and (3) develop vegetable recipes for city dwellers, popularize kitchen gardens, and develop vegetable menus with institutional food suppliers such as restaurants to improve access to vegetables in urban areas.

Part I - Objectives and the Framework

1 Background and Objectives

1.1 Background

In the Philippines, 25% of its population is engaged in the agriculture sector[1]. However, the share of agriculture in its GDP is only 9.3%, hinting at low productivity of the sector[2]. The Philippine government had restricted rice import, but it has decided to shift to rice trade governed by market force through relaxing the restrictions. As a result, the profitability of rice is expected to decrease in the long term. Thus, the government has shifted its policy toward improving agricultural productivity and increasing farm income through strengthening competitiveness by switching to horticulture and high value-added crops.

In recent years in the Philippines, the purchasing power of the middle class has increased along with economic growth, and the transformation toward a modern supply chain system, such as sale of food items in supermarkets and growth of the food industry, is witnessed. At the same time, the production centers face issues including the following: difficulty among farmers in accessing market information and growing and shipping produce efficiently through farmers' organizations; lack of effective standards on quality and specifications; limited access to agriculture finance; high cost of transportation; lack of communication between producers and consumers; underdeveloped market access roads and cold chain facilities; and limited participation of the private sector. Owing to these issues, the production side has not been able to grasp the changing demand properly, failing to promote agriculture development.

In past Philippine government policies and Japanese cooperation, the support for the establishment of a Food Value Chain (FVC) covering production, processing, distribution, sales, and consumption, with a view to promote private investment, has been limited. During the Japan-Philippines Agricultural Cooperation Dialogue in June 2017, the Philippines proposed FVC improvement as one of the pillars of cooperation expected from Japan. In August 2019, the Philippine government requested Japan for technical cooperation to establish a comprehensive FVC for diversifying and strengthening the competitiveness of horticultural crop production. This request is based on the expectations of the Philippine government after a series of studies and discussions between the Philippines' Department of Agriculture (DA) and the Japan International Cooperation Agency (JICA). The technical cooperation based on the request is the highest-priority agricultural cooperation between the two countries.

In October 2016, the Philippine government identified agriculture as one of the priority

[1] Philippine Statistics Authority, 2018.
[2] FAOSTAT, 2018.

sectors in its long-term development vision "Ambisyon Natin 2040" to become a high- and middle-income country. In February 2017, Philippine Development Plan 2017-2022 set out to expand economic opportunities in agriculture by improving connections between producers and markets through agricultural infrastructure development, realizing economies of scale by organizing small farmers, and capacity building to promote higher value-added agricultural products. In May 2020, under "We Recover as One," a measure to respond to the new normal in light of the COVID-19 pandemic, DA-led efforts started being implemented nationwide to connect production and consumption areas to improve producers' income and consumers' food security. The efforts included the establishment of efficient transportation logistics systems, enhanced agricultural financial access, online trading of agricultural products, and the promotion of higher value-added agricultural products including those with high nutritional value. With the COVID-19-induced restrictions on human mobility that came into effect in March 2020, DA made it a top priority to ensure that people have access to food without shortages. Moreover, DA is experimenting with a system that does not depend on the existing FVC system in order to deliver agricultural products to consumers quickly, reliably, and inexpensively through direct delivery and sales operations. The fact that the government has made inroads into the existing system is of great significance to this project.

1.2 Objectives

The objective of the Project is twofold: to formulate and have stakeholders agree on a draft roadmap for FVC modernization to be undertaken jointly by the public and private sectors (planning phase); and by conducting pilot projects on FVC starting from the target provinces, build the capacity of FVC stakeholders and develop, verify, and update an inclusive FVC model for horticultural crops (implementation phase). In the implementation phase, the FVC model will be shared with FVC stakeholders nationwide and help improve farmers' profitability, thereby contributing to the self-sustaining expansion of a profitable FVC of horticultural crops.

2 Framework for improving the vegetable value chain

2.1 What is market-oriented vegetable value chain improvement?

(1) “Market-Oriented”

As the English name of the Project, “Market-driven Enhancement of Vegetable Value

Chain," clearly indicates, the promotion of the vegetable value chain must, in principle, be market-oriented. In other words, the promotion of such value chain is premised on the distribution of vegetables through markets with a supply-demand adjustment function. The specifications of the Project are as follows: "Food value chain (FVC) promotion can only be realized by accurately communicating market needs to stakeholders (producers, administrative agencies) and maximizing the value of agricultural products through each stage of production, processing, distribution, and sales." It is understood that this is also based on market orientation.

(2) "Inclusive FVC Model"

The specifications of the Project explain the purpose as follows.

After formulating and agreeing on a roadmap for FVC modernization among stakeholders, by implementing pilot activities in the value chain starting from the target provinces, the capacity of those involved in FVC will be improved, an inclusive business model developed, verified, updated, and shared with FVC stakeholders in the country, and an inclusive FVC model for better farmers' income established. Through these, self-sustaining expansion of profitable horticultural crop FVC can be realized.

The two keywords here are "Inclusive Business Model" and "Self-sustaining Expansion."

First, according to the specifications of the Project, the Inclusive Business Model is defined as "a system that enables FVC stakeholders to participate in modern value chains and fairly enjoy the value-added of agricultural products obtained through FVC promotion, effectively combining individual solutions (FVC solutions according to the target FVC situation)." The Inclusive Business Model is also defined as "an effective combination of individual solutions," and can be understood as a model that combines individual efforts to improve the vegetable value chain to produce synergistic effects.

Because various patterns can be envisaged for the combination of individual efforts, it is difficult to envision a complex model that connects everything from upstream to downstream from the beginning. Individual initiatives will be tested to confirm feasibility, and in the process, combinations of multiple initiatives that are likely to produce synergy effects will be considered, and gradually put into practice.

(3) Self-sustaining expansion

Second, the statement that the highly profitable horticultural crop value chain will expand in "self-sustained" ways is examined. This translates into the expansion of profitable horticultural crop value chains not by other dynamics including government intervention and

unfair trade under an oligopoly, but by their internal driving forces under fair market competition. For this purpose, the following two conditions must be satisfied.

One is that the production and distribution activities must meet the demands of the market. "Meeting the demands of the market" means that agricultural products and processed agricultural products of the quantity and quality required by the market are supplied in a timely manner. For example, if a large number of such products that consumers cannot eat all at once flow into the market, the market will react by lowering prices. Conversely, when the supply of quality produce demanded by consumers is in short supply, produce will command a higher price. Consequently, the value chain expands "self-sustainingly." In other words, such expansion will proceed with the supply and demand adjustment function through the market as a driving force.

Another condition is that each of the parties involved should perform the functions required by the market and obtain appropriate profits according to such functions. This is simply the definition of the Inclusive Business Model mentioned in the previous section, "the parties involved fairly enjoy the benefits of the value-added of agricultural products." For example, if someone monopolizes the market and unfairly manipulates prices, it hinders competition, increases costs throughout the value chain, and makes it impossible to earn an appropriate profit commensurate with the role played. If this situation continues, consumers, who are the ultimate payers, will become dissatisfied, and value chain players will be disappointed by the lack of fair business practices and quit their businesses. In the next section, possible approaches to improving the aforementioned market-oriented vegetable value chain are explored.

2.2 Framework for improvement approach

The specifications of the Project refer to a value chain that allows FVC stakeholders to benefit more than the existing system as an "ideal value chain." What kind of improvement approach will be necessary to realize this?

2.2.1 Cost reduction

In the first pattern, the amount of value-added that a product ultimately obtains in the market remains the same as it is today, but the costs incurred in the value chain are reduced, resulting in an increase in the gross profit for those involved. For example, if a distributor currently pays PHP 60/kg for the sum of purchase and transaction costs for vegetables and sells them at PHP 80/kg, their gross profit is PHP 20/kg. If the distributor's efforts reduce the

total cost from PHP 60/kg to PHP 40/kg, the gross profit will rise to PHP 40. Those involved in gathering the information necessary for cost reduction, taking the risk to invest, will reap the benefits of cost reduction.

Consider the following possible question: Will a cost reduction for one party result in a decrease in sales for the party to whom the payment is made? In this case, it is necessary to distinguish between a) those involved in vegetable transactions and b) those who provide materials, equipment, and services to a). Cost reductions targeted at efforts to improve the vegetable value chain are essentially related to the stakeholders of a). Farmers, wholesalers in production areas, wholesalers in consumption areas, and retailers in consumption areas fall into this category. Such cost reductions for the concerned parties lead to increased gross profits and a reduction in the burden on the final payer, the consumer. Regarding b), for example, if a wholesaler in a production area changes the plastic bags used to transport vegetables to plastic boxes, the plastic bag suppliers will reduce their sales, while the plastic box suppliers will increase their sales. This can be interpreted as a shift in superiority and inferiority because of changes in demand in the packaging materials market. Such changes are in the packaging material market and are not direct targets for improving the vegetable value chain.

2.2.2 Increasing the value-added

The second is a pattern in which those involved in the vegetable value chain can benefit more than the existing system by increasing the amount of value-added that a certain product ultimately obtains in the market. For example, say that the quality of vegetables that consumers currently buy at PHP 80/kg has improved, and consumers appreciate this and start paying PHP 120. PHP 40, which is the difference, will be a source of increase in the gross profit of those involved in the value chain if the cost necessary for quality improvement is within it. Alternatively, suppose you start a business that cuts ill-shaped vegetables with a low market rating. In this case, if vegetables with bad shapes are sold as they are, they can only be sold at PHP 30/kg, but by cutting them into cut vegetables, it is conceivable that the price per kilo will be several times higher. As described later, according to the results of the market research conducted in this project, there is a large demand with more than 70% of those intending to purchase cut vegetables in the future, and consumers may find value in them and pay a certain amount. If sufficient profits can be made even after deducting the labor costs and materials required for cutting, this will become a new value-added business that will benefit processors who plan and implement the plan and farmers who produce raw agricultural products.

There are various cases in terms of how the gross profit, which is the total value-added in

the final market minus the cost, is distributed to stakeholders in the value chain. In general, those involved in planning measures to improve value-added within the value chain and taking risks to invest in them will obtain a relatively large return.

The above two pillars support the improvement of the market-oriented vegetable value chain and can be said to be extremely important goals; we would like to add another goal here. This mitigates the fluctuations in market prices.

2.2.3 Mitigation of price volatility

In the vegetable market, more agricultural products than demand sometimes flow into the market, causing a price collapse. Such collapse is large, and a market price crash beyond prediction increases the gambling nature of business. According to the survey, this leaves most of the farmers and distributors in the vegetable value chain very confused. In the worst case, a crash in market prices can lead to a failure to recoup costs, let alone make a profit.

Why is this happening? For comparison, consider the housing materials industry. Since the demand for materials used in housing construction is roughly proportional to the projected number of new housing starts, housing material manufacturers should closely monitor such demand trends for materials, while simultaneously monitoring those of major suppliers. They are also looking at the above, and they are investing in aiming for a manufacturing scale that meets demand, or conversely, they are refraining from investing.

What about vegetables? Vegetable producers are generally small and numerous, making it difficult to grasp overall supply trends. Most pay little attention to the market demand and only consider seasonality when planting. Therefore, oversupply occurs.

Unlike targets that focus on the amount of value-added, such as cost reductions and increases in value-added, alleviation of market price volatility can be seen as a goal that contributes to stable business development. The minimum level of stability is the basis for establishing a business with certain prospects.

At the same time, measures taken to avoid price crashes without oversupply often add more value to the farmers and distributors who adopt them. An effort of using greenhouses at high altitudes and planting during low temperatures, which is difficult for open-field cultivation, aimed at shipments during the off-season when supplies are low is an example. Alternatively, by introducing a refrigerated warehouse where harvested vegetables can be stored for a certain period without losing their freshness, staggering the shipment period will contribute to mitigating price volatility and bring a certain amount of profit to those involved in the value chain.

Recognizing the above three factors as a broad framework for improving the vegetable value chain makes it easier to organize individual issues and measures. In Part 2, we describe the current situation and challenges for each of the various subsectors in detail and organize these individual challenges and ideals into a roadmap in Part 3. We show how the three targets are connected to individual issues and ideal images.

2.3 Tasks and Survey Methods of the Planning Phase

2.3.1 Tasks and Survey Methods

To improve the vegetable value chain of the Philippines, the Project conducted a study in the planning phase centering around the following four strategies.

- Proposing 10 promising provinces based on vegetable production: The top 10 producing provinces and their crops were extracted by adopting a "bird's-eye-view" of Luzon Island's vegetable value chain based on statistical data. This would be the starting point for narrowing down the target areas of the pilot projects.
- Generalizing the pilot project by comparison: The two target provinces where the pilot project will be implemented were decided through a discussion with DA. Thereafter, three to four other provinces in Luzon Island would be selected for a qualitative survey to generalize the experience in target pilot provinces and to result in future expansion.
- Objective analysis of the economic situation through qualitative and quantitative surveys of value chains and market surveys: Formulate a highly effective draft Roadmap by grasping the issues value chain stakeholders face through qualitative surveys and analyzing profitability through quantitative surveys, as well as objectively grasp the economic trends of the consumer market.
- Consider an ideal model of value chain and formulate the Roadmap based on the existing successful model of FVC: Initiatives for the Roadmap will be extracted, for both traditional and modern value chains, taking existing successful model(s) of FVC enhancement as an entry to consider the ideal value chain model, and by understanding the gap between the model and reality.

The activities and survey methods implemented in the planning phase based on the above strategies are explained in the following section. Activities b) to e), g), and part of h) are explained in subsequent chapters, along with the results of the survey.

A. Narrowing down the target area

The top 10 promising provinces have been selected according to the vegetable production volume. From these, six target provinces have been selected using the criteria indicated in Table 1 for conducting the value chain analysis survey. Therefore, Benguet, Quezon, Pangasinan, Camarines Norte, Nueva Ecija, and Nueva Vizcaya were selected

B. Market survey

To grasp the type and scale of vegetables expected to have future potential (i.e., quality, volume, price, and timing) in the Philippines, a market survey was conducted. As households and food business operators, both of which are consumers in the vegetable market, have different needs, the survey was divided into two parts. The market survey was undertaken by engaging the services of a market survey company. An overview of the two surveys is presented in Table 2. Results of the market survey is described in Chapter 6.2.

Table 1: Criteria for selecting target provinces

Criteria	Indicator
1. Accessibility and security	Passable road
	Distance from the capital
	Security-cleared with Philippine National Police/Armed Force of the Philippines
	Active local government unit (LGU) participation
	Low COVID Alert level
2. Availability of needed information	PAO/MAO database on commodities produced
	LGU data on agri-support
3. Substantial volume of target commodities produced	Available farmers producing target commodities (main horticulture crops of the province)
4. Presence of value chain facilities	Markets: public and private
	Commodity trading centers
	Warehouses
	Terminals and transport hubs
	Processing plants

Source: Project team

Table 2: Overview of the market survey

	Consumer (household)	Food business operator
Method	Online quantitative survey	Computer-assisted telephone interview
Target area	Greater Manila	Greater Manila
Sample size	1,000	80
Target population	• Male and female ages between 18 and 69 • Those who usually purchase vegetables	People who are involved in purchasing: • Modern food businesses (supermarkets, restaurants, hotels, etc.) • Traditional food businesses (Sari Sari stores, talipapas, etc.)
Main questions	• Frequency and place of purchase • Selection of production center, things they consider when purchasing, satisfaction of vegetables they purchase • Image of domestically produced vegetables, awareness towards food safety, changes in mindset for vegetable purchase, comparison between price and quality	• Procurement volume, frequency, source, things they consider when purchasing, satisfaction on vegetables they purchase • Image of domestically produced vegetables, awareness towards food safety, changes in mindset for vegetable purchase, comparison between price and quality

Source: Project team

C. Value chain analysis

The value chain analysis aims to clarify the current status of the vegetable value chain, focusing on the economic aspects, and analyzes from farmers to retailers in Manila. In particular, the actual business conditions and competition of traditional wholesalers in both the production and consumption areas have not been clarified so far, thus, the Project attempted to understand the situation. This is because traditional distribution accounts for the majority of vegetable distribution, and the wholesalers are in a position to play a leading role in the traditional distribution in terms of the amount handled.

First, the current situation and problems are grasped through qualitative surveys in which various circumstances are heard from wholesalers and their related stakeholders. After that, a quantitative survey is conducted to collect figures such as sales and expenses, and the profitability of wholesalers is calculated, and the actual state of competition is analyzed. Based on these results, an attempt is made to objectively clarify what position the wholesalers can take in improving the value chain.

Conventionally, value chain analysis, which has often been conducted for similar projects, has examined the added value of each stakeholder as an example, but it has rarely analyzed the profit margin of each business and revealed the competition. As a result, it was difficult to fully utilize the analysis results as objective grounds for improving the value chain. In the value chain analysis of the Project, in contrast, by understanding the competition from the profitability analysis, it is possible to objectively foresee the position that the parties concerned could take to improve the value chain.

Qualitative research and quantitative research were conducted in the following manner.

Qualitative survey

To generalize the pilot projects, coverage of the qualitative survey was extended to the six previously selected provinces. A total of three types of value chains namely, traditional, modern, and processing were included in the survey. Data were collected from the perspective of production, distribution, and infrastructure (including information and communication technology (ICT)). Desktop research, interviews with the DA and Provincial Agriculture Office, and semi-structured questionnaire interviews with farmers and various businesspersons were conducted. In addition, direct observations were made when interviewing in wholesale markets and retail shops. To understand the current situation, issues, needs, information related to technologies, finance, infrastructure, and systems was collected.

Quantitative survey

For the quantitative survey, the provinces of Benguet and Quezon were selected, representing highland and lowland production centers, respectively. Questionnaire surveys were conducted with the farmers and intermediaries in both provinces as well as traders in Metro Manila. To check the profit and loss of farm households, 116 samples were taken for the farmers' survey in which details on production cost and revenue were collected for the top three vegetables each farmer produces. Similarly, to analyze the business feasibility of traders, trading prices and business costs were gathered. Survey methodologies on intermediaries are explained in more detail in section 2.3.2.

D. Introduction of digital technologies for agriculture

To explore the possibility of introducing digital technologies in agriculture for improving the FVC in the Philippines, information was collected to understand the issues surrounding existing initiatives and the current situation of the startups in the Philippine agriculture sector. The current condition of ICT infrastructure in rural areas was also investigated. The results are reported in section 4.2.

E. Formulation of draft Roadmap

Issues regarding highland and lowland vegetables, as well as common issues, were streamlined based on individual issues identified through value chain analysis of the entire supply chain. Thereafter, discussions took place in workshops with stakeholders from DA, Benguet, and Quezon. The details of the draft Roadmap can be found in Chapter 7.

F. Establishing a platform

To improve FVC through the sharing and exchange of information among various FVC stakeholders and for business matching, a platform has been established. The participants of the platform are mainly those that keep on improving FVC who have come across during the value chain survey. A Facebook page named "Ka-Gulay" was also launched for the purpose of daily communication and information sharing. Use of platform is explained in section 7.5.

G. Proposals for pilot projects

The qualitative survey identified many examples of successful cases and potential successful cases of improving FVC. By streamlining these cases and considering the approaches in the draft Roadmap, pilot projects to be undertaken in the implementation phase of the Project have been proposed. Details are explained in Chapter 8.

H. Other tasks

In addition to the tasks above, the Project tried to grasp the requirements for gender mainstreaming. To do so, the World Bank's *Gender Tagging the Agriculture Sector Projects in the Philippines, Analysis to Identify and Analyze Project-Relevant Gender Gaps* was referred to for five components of empowerment (production, resource, income, leadership, and time). Issues were identified from these perspectives, and the approach to be adopted in the Project was considered. Based on these preliminary analyses, specific information was collected through a qualitative survey for needs analysis.

2.3.2 Quantitative survey of intermediaries

Classification of intermediaries targeted in the quantitative survey

Intermediaries in traditional value chain is categorized based on the qualitative survey. In the production areas in Benguet, there are two main actors: disposers who intermediate trading between supply farmers and buyers, and truck-wholesalers who transport vegetables from the rural public markets to urban consumption areas.[3] Data on disposers were intensively

[3] Although truck-wholesalers have competitors such as *purchasers* and *wholesaler cum retailers* in rural public

collected because they have essential roles in enhancing farmers' market participation as they function as marketing representatives of farmers whom they have close kinship. In the wholesale market of the production area in Quezon Province, it can be categorized into wholesalers who are responsible for wholesale functions for consumption areas as seen in developing countries in general, and wholesaler-cum-retailers who also serve as retailers. In addition, in Quezon Province, there are also intermediaries operating outside the wholesale market of the production area, and since they are mainly responsible for collecting the produces, they are classified as traders. In consumption areas, the survey focused on large-scale wholesale marketplaces as an entry point to traditional value chains from rural areas. Wholesalers in wholesale markets who receive vegetables from rural areas were classified as *hub wholesalers* and those who buy vegetables from them as *sub-wholesalers*. The typical classification of intermediaries in the traditional value chain is illustrated in Figure 1.

Process of the quantitative survey and the sample size

A total of 72 samples were obtained for the intermediaries. For the survey in production areas, the focus was on rural public marketplaces, a center for transactions in vegetable production areas. In Benguet Province, a field survey was conducted using questionnaires designed to distinguish between the disposers and trucks/wholesalers in marketplaces. Although the sampling method was not randomized since any registration system of intermediaries in the three marketplaces (BAPTC, La Trinidad Vegetable Trading Center, and Buguias) did not function well, intermediaries of small to large business sizes were selected so that the samples represented the characteristics of intermediaries in the areas. Finally, data were collected from 32 intermediaries in Benguet Province.

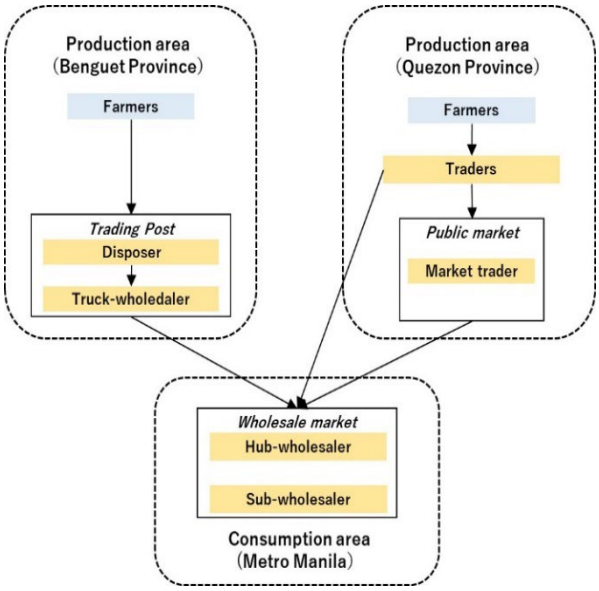


Figure 1: Classification of intermediaries in value chains

Source: Project Team

For the survey in Quezon Province, 21 samples were collected. Of the 21 intermediaries, there are five

markets, the competitors were omitted from the survey design because of their scarcity.

wholesalers (or wholesale cum retailers) and 16 intermediaries. Particularly, the 16 intermediaries were first selected from a list of intermediaries, which was obtained from a previous survey of farmers. The samples were then carefully selected to cover all sizes of businesses and the survey was conducted in Dolores and Sariaya.

For the survey in the wholesale markets of Metro Manila, the entry point of fresh vegetables to consumption areas, 19 wholesalers were surveyed in major markets representing the scene. Owing to the complexity of urban marketing channels,[4] wholesalers' business types could not be ascertained before the quantitative survey. Thus, after the survey, they were categorized into 12 hub wholesalers and seven sub-wholesalers.

Testing method for competitiveness of intermediaries and survey questions

Identifying who is the competitive actor and who is not among the traditional distributors is a clue to improving the value chain. Therefore, in the Project, a focus was placed on major intermediaries in traditional distribution and examined their competitiveness from an economic perspective. In particular, under the assumption of perfect competition among many intermediaries in the market, the extent of competition for each intermediary type was clarified by using individual data on price and cost collected from the field survey. If many intermediaries compete with each other as price takers, the market can be regarded as a competitive situation when the marginal cost is equal to the marginal revenue; there is no rent left to buyers and sellers in a situation of perfect competition. A simple economic analysis of intermediaries' competitiveness at different stages of the traditional value chain allows the identification of intermediary types where intervention should be made to enhance the value chain.

The net margin ratios (NMR) were calculated by estimating the marginal cost and revenue for each individual intermediary. In practice, NMR can be calculated as $NMR^i = \left(P^i_{sell} - P^i_{buy} - C^i\right)/P^i_{buy}$, where P^i_{sell} and P^i_{buy} are the selling and buying prices of intermediary i, respectively, C^i is the marginal cost proxied by the unit cost in the trading business cycle. Marginal revenue can be calculated as the difference between buying and selling prices, that is, gross margins, calculated as $P^i_{sell} - P^i_{buy}$. The marginal cost includes not only simple unit costs, such as packaging costs, but also labor costs and asset and capital costs from the viewpoint of their long-term business cycle.[5] For example, the costs include

[4] There are Balintawak Market and Divisoria Market. In addition, there are more wholesale markets on the downstream side such as Markina Market, Mega Q Mart, and Novaliches Market.

[5] The assumption fits the survey areas because many intermediaries have sustained their trading business for more than 10 years.

labor costs for owners and family members, consignment fees for outsourcing processing and packaging vegetables, transportation costs, depreciation or rental costs for assets, and capital costs of investments or borrowing working capital.

Using the indicator, NMR, it can be determined that some types of intermediaries are *sufficiently competitive* when statistical tests confirm the average NMR is zero, that is, the intermediaries do not obtain excess profit above marginal costs. Because a sufficient sample size is needed to conduct the statistical tests, specific types of intermediaries are targeted: disposers in Benguet Province, intermediaries in Quezon Province, and hub wholesalers in Metro Manila are used as main actors. In addition, the test results for intermediaries are reported for provincial level (Benguet, Quezon, and Metro Manila).[6] As with other interpretations for the statistical tests, in the case NMR is clearly above zero, the intermediaries are considered to be not sufficiently competitive because they do not reinvest the excess profits into useful assets for the future. NMR in the opposite direction implies that intermediaries face excessive competition and have a low possibility of sustaining their business.[7]

The interview questionnaire for intermediaries included the following questions (time taken, ca. 30 minutes).

- Attributes of intermediaries (gender, age, educational attainment, years of business experience, etc.)
- Questions for identifying types of intermediaries (ownership of stores, client information on transactions)
- Prices and quantities of the five highest-sales vegetables in the last year[8]
- Forms of transactions (frequency of trading, settlement methods, periods for payments)
- Labor costs (owners, family labors, wage labors)
- Sales administrative expenses (consignment fees for outsourcing processing or packaging vegetables, office supply costs, business license fee, etc.)
- Capital costs (amount of investments and borrowing, interest rates, etc.)
- Depreciation or rental costs for assets (vehicles for transportation, stalls, PC, etc.)

[6] The minimum sample size for t-test with significance level of 5% and power of 90% is nine. Intuitively, the null hypothesis can be rejected correctly with probability of 90% if 10% error for estimating the true value of NMR is allowed when the requirement for sample size is fulfilled. For specific groups of intermediaries in which the sample size is less than eight (they were truck-wholesalers in Benguet Province and sub-wholesalers in Metro Manila), the statistical test cannot be conducted but summary statistics of their business conditions are reported.

[7] Sample size required for them is somewhat smaller (the minimum sample size is eight for keeping statistical power at the same level).

[8] If the respondent trades more than six types of vegetables, he or she is asked about the total procurement and sales values for the remaining types of vegetables excluding the five best-selling vegetables.

Part II - Assessment of Current Vegetable Value Chains

3 Current Situations of Vegetable Value Chain

3.1 Traditional channels

Table 3 lists major marketplaces in the traditional value chains observed in production areas. One or two wholesale markets are located in most production provinces. There are mainly three categories of retailers giving access to the consumers. The study identified talipapa, or small-scaled vegetable retailers, Sari Sari stores, or small-scaled grocery shops, Kolong-Kolong or Habal-habal, newly emerged, mobile vegetable shops on three-wheeler motorbikes. Sari Sari stores used to deal in the sale of dry or packed foods. During the COVID-19 pandemic, they began to sell fresh vegetables and fish to neighboring residents, who were quarantined at home. [9] Similarly, three-wheeler bike shops selling vegetables emerged in response to customers' demands during the pandemic. [10] Wholesale market in a production area as distribution infrastructures / facilities are also mentioned in "4.1.3 Distribution Facilities" later.

Table 3: Major Marketplaces in Traditional Value Chain

Market	Role
Wholesale market in a production area	Public wholesale markets established in provinces by support of DA (e.g., Sentrong Pamilihan Ng Produktong Agriculturura, Benguet Agri-Pinoy Trading Center)
Public market (city)	Public market managed by cities (e.g., Sentrong Pamilihang ng Lugsod ng Lucena)
Public market (municipality)	Public markets managed by municipalities (e.g., Pamilihan Bayan ng Sariaya)
Talipapa	Small-scale vegetable shops on the community level
Sari Sari Store	Small grocery shops are currently selling fresh vegetables and fish. They used to sell mainly dried and packed food but began to sell fresh products under the COVID-19 pandemic.
Three-wheeled bike shop	Mobile vegetable shops with a three-wheeled bike. Shops carry vegetables on the sidecar and sell them, e.g., Kolong-Kolong in Nueva Vizcaya or Habal-Habal in Camarines Norte.

Source: Project Team

[9] From an interview with the owner of a Sari Sari store in Dolores, Quezon Province on 9 March 2022
[10] From an interview with the owner of a Sari Sari store in, Bayonbon Public Market, Nueva Vizcaya Province on 11 April 2022

3.1.1 Highland vegetable production areas

(1) Vegetable farmers

1) Main crops and growing season

In the two highland vegetable production provinces that are the target of the study, most of the area is mountainous with altitudes between 500 m and 2,000 m above sea level. Vegetable production areas account for 74% of the total farming area in Benguet Province, and for less than 30% in Nueva Vizcaya Province, where fruit trees production is predominant. Figure 2 shows percentage of area planted for the 10 main crops in each province.

Benguet Province is known as the "Salad Bowl of the Philippines." A large volume of cool-season vegetables, such as leafy greens, fruits and vegetables, in addition to potato, cabbage, and carrot are grown here, and sold all over the country. In Nueva Vizcaya Province, tropical fruits such as mango, banana, and coconut are the main agricultural products, as well as many medium-warm season vegetables such as squash, onion, and tomato, which usually grow in a warmer climate condition.

The growing season for these crops is determined by climatic conditions, availability of water resources and the characteristics of the varieties cultivated. Figure 3 shows the climatic conditions and cropping seasons for the three main crops in each province. Please note that

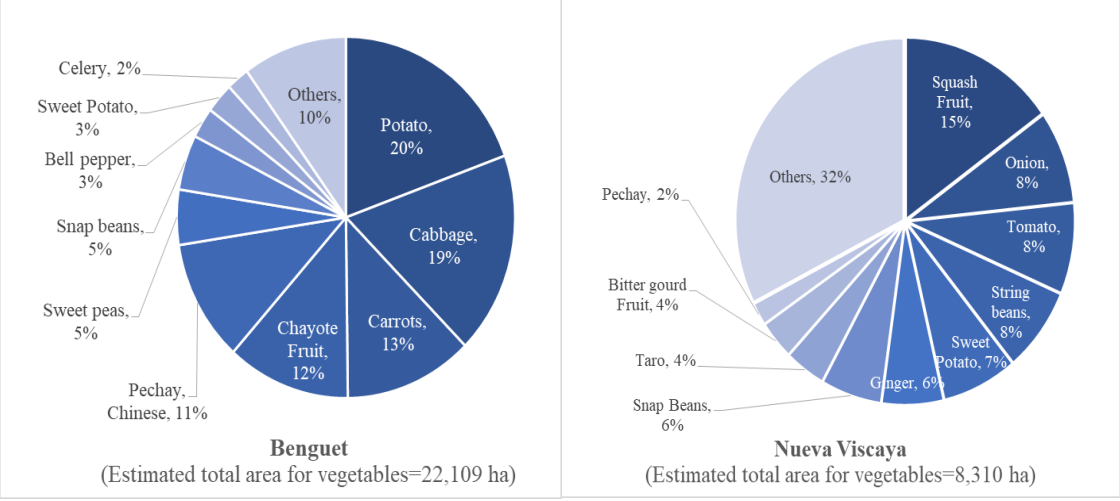


Figure 2: Percentage of area planted to 10 major crops by the highland provinces (% area under vegetables)

Source: Prepared by the Project Team based on Other Crops: Area Planted/Harvested, by Region and by Province, by Semester, 2010-2020, psa.gov.ph (Accessed September 2021).

Nueva Vizcaya is considered an upland vegetable production area in this project. Therefore, Figure 3 includes information on tomato, cabbage, and cauliflower cultivation, as these were grown by many of the farmers interviewed in the qualitative survey.

The rainy season is between May and October, and farmers in both provinces use mountain spring water for irrigation. However, farmers in Benguet can grow cool-season vegetables two to three times a year because of the low average annual temperature (below 20°C), whereas those in Nueva Vizcaya grow vegetables mainly from October to January, which is the dry season having cooler temperatures. The rainy season, from April to September, has more rainfall with high average temperatures (nearly 30°C). Thus, farmers grow vegetables such as tomato, string beans, snap beans and Baguio beans, which are tolerant to high temperatures and drought. In the high-altitude areas, cabbage, cauliflower and celery can be grown. The varieties of all grown vegetables are medium to early maturing, with good taste and transportability, and popular in the market. Table 4 shows the vegetable varieties grown in both provinces and their characteristics.

Although the two highland vegetable production provinces have relatively abundant water resources, famers prefer to grow medium- or early-maturing varieties that are pest- and disease-resistant, because of high irrigation costs and occasional water shortages. Farmers use hybrid (F1) varieties for the crops which are grown from seeds, such as cabbage, carrot, squash and tomato, and purchase seeds from local supply shops before every cropping season. However, in the case of potato and onion cultivation, the farmers raise tubers or seeds themselves for the next cropping season. For potato, a German origin variety called “Granola” has been grown in large quantities in Benguet. However, its yield has been declining because

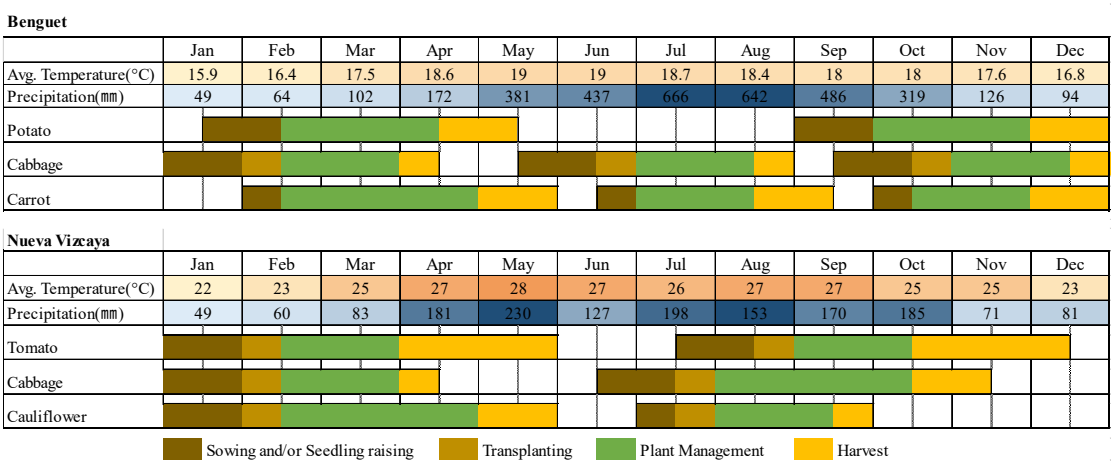


Figure 3: Climate conditions and cropping seasons of main crops in the highland provinces

Source: Project Team based on Climate-data org (https://en.climate-data.org/) and qualitative research results.

Table 4: Varieties and characteristics used in production of the main crops in the highland vegetable production areas

Crop	Variety name (Company)	Potential yield (ton/ha)	Earliness (Maturity)	Characteristics
Potato	Granola	15-20	Early-medium maturing (75-90 DAS[a])	Susceptible to late blight and leaf miner.
Cabbage	Wonder Ball (Seminis)	60～85	Early matuaring (68-70 DAT[b])	Excellent internal structure having good compactness. and Long field holding ability.
Carrot	Fukutomi F1 (Allied Botanical)	70	Early-medium maturing (100-110 DAS)	Intermediate resistant to blight and alternaria.
Tomato	Diamante Max F1 (East-West)	50	Early maturing (60-65DAT)	Intermediate resistance to Tomato leaf curl virus and bacterial wilt with excellent transportability and storability.
Cauliflower	Kabayan F1 (East-West)	75	Early maturing (60-65DAT)	None resistance, high yielding .

Note : All varietise are produced in both Benguet and Nueva Viscaya.

[a] Days After Sowing

[b] Days After Transplanting

Source: Prepared by the Project Team with reference to Teresita Diccion-Masangcay, BSU - NPRCRTC,"Sustaining the Promotion of Late Blight Resistant Potato Varieties in the Philippines : An Overview", 3rd AsiaBlight International Conference Beijing, China October 25-27, 2019, Commercial Crop Variety Database (https://nsic.buplant.da.gov.ph/ccvd/index.php)

of a decrease in resistance to late blight disease and leaf miners (pest) caused by continuous cropping. To address this issue, the Northern Philippines Root Crops Research and Training Center Benguet State University (BSU-NPRCRTC) has been developing several varieties of pest and disease-resistant cultivars since 2015, and has initiated production of potato seeds together with cooperating farmers and cooperatives.

2) Cultivation method

In Benguet and Nueva Vizcaya, the slopes in the farmland are steep, and vegetables are either planted on terraced fields or directly on the slopes (Figure 4). Some plots have a very narrow width of about 2 m, which makes agricultural work difficult. The average farm area in Benguet is 1.4 ha, and all farmers cultivate three or more kinds of vegetables, including potato.[11] In Nueva Vizcaya, two to three types of vegetables were cultivated on 1.2 ha of farmland.

Figure 4: Farmland on slopes

Source: Project Team

[11] Qualitative survey between March and April 2022

Table 5 summarizes the cultivation methods for the five most-cultivated vegetables, according to the results of the qualitative survey. In both provinces, all the farmers grow their own seedlings, except for potato, carrot, and green bean (Baguio beans) farming. In Benguet, about 30% of seedlings are raised using pots or nursery trays. In Nueva Vizcaya, most seedlings are raised in open fields. Potato seed tubers are either purchased from local agricultural input suppliers, or renewed from seed tubers obtained several years ago, germinated for four to five months and planted in the field. Regarding fertilizer management, in both provinces, farmers use large amount of chicken manure, in combination with some chemical fertilizer. Some farmers also use unfermented raw chicken manure. All farmers use agrochemicals to control pests and diseases, but some farmers cultivating potato and cabbage crops implement weeding by hand, rather than using herbicides.

Table 6 summarizes the farmers' field preparation, production facility usage, irrigation methods, storage, and packaging methods.

Table 5: Outline of cultivation method of major vegetables in highland area (Number of respondents)

Province	Major vegetables	No. of farmers	Raising seedlings			Soil fertility management			Agrochemical application	
			Self-raising	Pot / Tray	Open field	Organic matter	Chicken manure	Amount of	Pets and diseases	Weed
Benguet	Potato	16	11	--	--	16	16	2,940	16	9
	Cabbage	11	9	3	6	11	11	3,520	11	7
	Carrot	9	0	--	--	9	9	2,780	9	6
	Celery	4	3	0	3	4	4	2,190	4	3
	Chinese cabbage	3	3	3	0	3	3	1,420	3	1
Nueva Vizcaya	Tomato	8	8	1	7	8	8	2,520	8	8
	Cabbage	7	7	0	7	7	7	2,480	7	6
	Cauliflower	6	6	0	6	6	6	3,330	6	5
	Baguio beans	5	0	--	--	5	5	1,770	5	5
	Celery	2	2	0	2	2	2	630	2	2

Note: Sixteen farmers in Benguet and 12 farmers in Nueva Vizcaya were surveyed.

Source: Elaborated by the Project Team based on the qualitative survey

In both provinces, most farmers use agricultural machinery for field preparation, and few use only human power to prepare the fields. Many farmers use small hand tractors that are rented from neighboring farmers, relatives, and LGU. Farmers who own production facilities could not be identified in Nueva Vizcaya; in Benguet, these facilities are mainly used for raising seedlings. The facilities for seedlings include net houses or sun shades made of wood. More than 80% of farmers irrigate their vegetables. Sprinklers are widely used because farmers mostly cultivate leafy vegetables and root crops, but about 70% stated that they do not have sufficient water for irrigation. Farmers who own storage were not identified in Nueva Vizcaya, but this figure was about 30% for Benguet. About 30% of farmers in Benguet and 90% in Nueva Vizcaya package their vegetables before shipping. The main shipping destinations in Benguet are wholesale markets. Some farmers bring their products directly to disposers waiting at the market, and in other cases, buyers come to the farm to collect harvested products. According to the qualitative survey, there was no clear differences between the Buguias and Atok municipalities, and 9 farmers ship their products to the market in La Trinidad, and 5 farmers to BAPTC. In Nueva Vizcaya, all the farmers surveyed ship their crops to the Nueva Vizcaya Agricultural Terminal (NVAT). The method of shipping differs depending on the area and the farmer. Some farmers bring their products to the temporary storage hut on the main road, and middlemen take them to NVAT by truck. Some farmers bring the products to the main road by motorbike, and ship to NVAT by hired truck.

3) Actual situation of agricultural management

Table 6: Usage of agricultural equipment and facilities, and post-harvest packaging in highland areas (Number of respondents)

Province	No of farmers	Ave. altitude (m)	Ave. farm size (ha /farm)	Field preparation			Usage of greenhouse		Irrigation		Storage	Packaging		
				Hand tractor [a]	Hand tractor / man power	Man power	Nursery	Veg production	Sprinkler	Drip	Storage facility	In the bag [b]	In the box	Bag / box
Benguet	16	1,828	1.4	12	3	1	6	3	13	2	5	3	4[c]	2
Nueva Vizcaya	12	1,047	1.2	7	3	2	0	0	11	1	0	4	0	8[d]

a: Hand tractor or power tiller
b: Plastic bag 2, Net bag/sack 1 (Benguet). Plastic bag 1, Net bag/sack 3 (Nueva Vizcaya).
c: Open box 3, Closed box 1
d: Six out of eight farmers use plastic bags.
Source: Elaborated by the Project Team based on the qualitative survey.

Agriculture is the main economic activity in Benguet and Nueva Vizcaya and vegetable cultivation is the major means of livelihood for farmers, especially in the highland areas. However, owing to the collapse of sales prices and the decline in yields caused by pests and diseases, it is not always possible for farmers to generate enough income every year to feed their families, and agricultural management is unstable. This sub-section presents the results of balance (income and expenditure) and profits from vegetable production as a part of the quantitative survey conducted in Benguet Province, in order to understand the actual situation in the highland vegetable production areas.

A. Income from vegetable production

For the quantitative survey in Benguet Province, a total of 72 farmers were interviewed from the Buguias and Atok municipalities (25 and 47 farmers respectively). They answered questions regarding their production expenditure and sale of main crops in 2021–2022.

Of the 72 farmers interviewed, more than 60% make a living solely from vegetable production, while 36% (23 farmers) have other sources of income.

The interviewed farmers grow vegetables two or three times a year, with some of them growing the same crops in succession. However, it is also common for them to rotate two or three different crops. The major vegetables interviewed farmers growing are; cabbage, potato, radish, carrot, Chinese cabbage and lettuce. Other vegetables grown in Buguias and Atok municipalities include broccoli, cauliflower, snap beans and sweet peeper; however, according to the provincial statistics, production area of these vegetables are about 2% or less out of whole vegetable grown areas. The vegetable-wise profitability is discussed in the next section, and an overview of the municipalities is presented here. Table 7 shows the area of farmland per farmer and the balance and the income from annual vegetable production by municipality. Please note that, according to the farmer’s interviews, almost 100% of the vegetables are sold, and the percentage for self-consumption was unclear. Therefore, the balance and income were calculated based on farmers' expenditure and sales revenue figures, not taking into account the portion for subsistence use.

Although the area of farmland per farmer is slightly smaller in Buguias, no significant

Table 7: Farmland area, balance, and income on vegetable production in Benguet Province

	No. of farmers	Farmland area (ha)	Gross profit (PHP)	Mgmt & prod costs (PHP)	Farm income per farmer (PHP)	Farm income per hectare (PHP/ha)
Buguias	25	0.38	219,193	171,473	47,720	125,264
Atok	47	0.45	247,078	114,836	132,242	295,724
Total/Average	72	0.41	233,135	143,155	89,981	217,310

Note: As the values for gross profits and management and production costs were highly skewed, an average value was used from the survey farmers' responses removing 10% of each of the upper and lower outliers.

Source: Project Team based on the quantitative survey

difference is seen between the two municipalities; the average area was about 0.4 ha. This figure is relatively small because most farmland is located on narrow sloping land areas. Annual gross profit varies slightly between municipalities, ranging from PHP 220,000 to 250,000, with an average of about PHP 230,000.

However, management and production costs such as those for agricultural facilities, inputs and land rent is approximately PHP 60,000 higher in Atok, resulting in an average difference in farm income (net profit) of approximately PHP 80,000– with PHP 50,000 in Buguias town and about PHP 130,000 in Atok.

According to the Congressional Policy and Budget Research Department (CPBRD) of the Philippines, the income required to purchase food for a family of five is, on average, PHP 8,392.50 per month (PHP 1,678.50 per person); the annual requirement is thus PHP 100,000.[12] By this standard, the income of a vegetable farmer in Buguias is not enough to feed his family.

One of the reasons for the difference in net profit is attributed to high production costs; the farmers in Buguias spent about 1.6 times more on farm inputs such as fertilizers and pesticides and twice more on employment during the busy farming season than those in Atok. Another factor could be that many farmers were losing money owing to the low selling price of their main crops like cabbage and potato, when compared to the transport costs. In fact, Atok town is closer to La Trinidad, where the largest provincial wholesale market is located, and to Manila as well, which is a major vegetable consumption center. This is why transport costs are lower, and vegetable production is more profitable for the farmers in Atok than those in Buguias.

[12] Congressional Policy and Budget Research Department, "Poverty Statistics Update First Semester 2021", https://cpbrd.congress.gov.ph/images/PDF%20Attachments/Facts%20in%20Figures/FF2022-07_Poverty_Stats_Update_1st_Sem_2021.pdf (Accessed 15 July 2022)

B. Profitability by crop type

As mentioned above, the distance from the market relates to the profitability of the vegetable production, and the crops grown can be a factor in the differences in farm incomes. Table 8 shows the percentage of crops grown by the interviewed farmers and their average yield in each municipality.

The crop types differ by municipality: in Buguias, cabbage and potato accounted for more than 70% of the crops grown by the interviewed farmers, followed by carrot, Chinese cabbage, and other crops such as celery. On the other hand, in Atok town, radish is the most commonly grown crop, followed by cabbage, carrot, and lettuce (Romaine variety). The average unit yield of cabbage is above the Philippines national average of 20.9 t/ha in 2021; those for the other crops are slightly lower, and can be considered as standards.[13]

To understand the differences in the balance and the net profit by crop type, depicts the management and production costs, and net profit per hectare by crop type, as well as the total gross income based on the figures from the 72 farm households interviewed. It should be noted that, owing to the large dispersion of the farmers' response sites, the average value is considered after removing 10% of the upper and lower outliers.

In the production of cabbage and potato, management and production costs account for 60%–70% of the gross profit. Thus, the net profit from the production and sale of these crops is small. For Chinese cabbage, the gross profit was about PHP 130,000, while management and production costs were around PHP 160,000, resulting in a deficit. In comparison, cultivation of radish and carrot was more profitable, because management and production costs are low and net profit accounts for 60%–70% of the gross profit. This situation is the same for both Buguias and Atok.

Table 8: Percentage of cropping and average yield by crop type in the surveyed areas in Benguet Province

	Cabbage	Potato	Radish	Carrot	Chinese Cabbage	Lettuce	Others
Buguias	37%	39%	2%	10%	7%	0%	5%
Atok	25%	15%	27%	16%	9%	7%	1%
Avarage percentage	30%	25%	16%	14%	8%	4%	3%
Average yield (ton/ha)	23.90	14.09	24.03	18.31	18.31	13.31	-

Note: The average value was taken from the survey farmers' responses removing 10% of each of the upper and lower outliers.

Source: Project Team based on the quantitative survey

[13] Philippine Statistics Authority (psa.gov.ph) (17 September 2021)

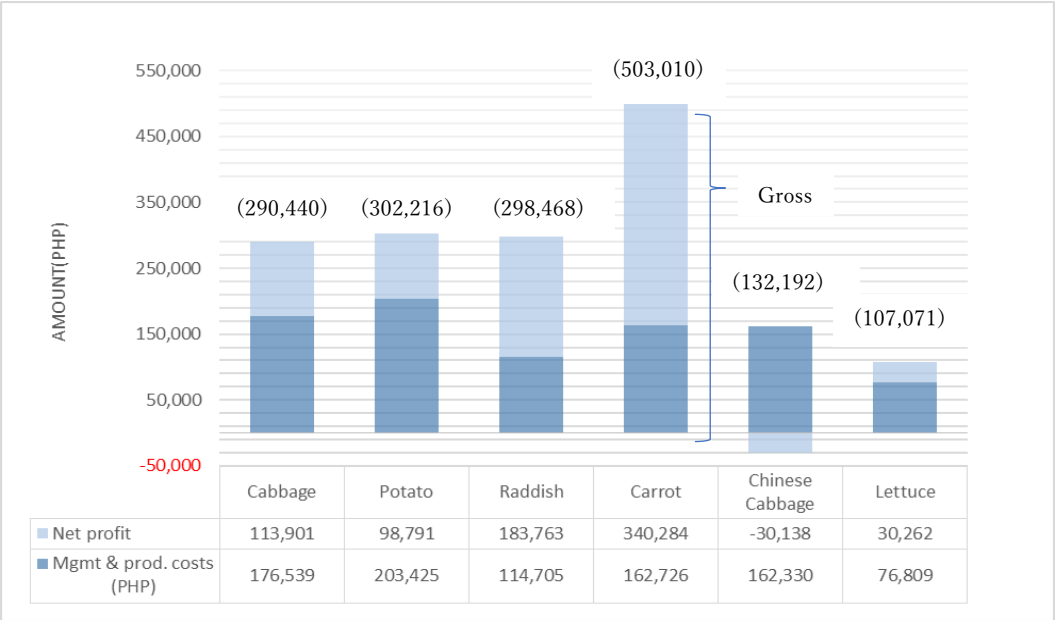


Figure 5: Management and production costs, net profit and gross profit (in brackets) by main crops grown in Benguet Province

Source: Prepared by the Project Team based on the results of the quantitative survey

The results of this survey suggest that the production of radish and carrot would increase farmers' incomes. However, the production of those crops cannot be recommended yet, as the result only represents the situation in 2021–2022. In addition, the selling prices would fall after increasing the production and shipment, unless the market demand increases simultaneously.

Even cabbage and potato, which are currently unprofitable, could improve their profitability by introducing varieties suitable for processing, such as for coleslaw and French fries, as the food service industry develops in the market. Farmers choose vegetables that are adapted to their natural environment; however, crop types, varieties, and growing seasons should be selected with an understanding of the long-term market prices and needs as well.

4) External support (technical support, local agricultural input suppliers, credit services)

Because of the limited number of extension workers from local governments, on-farm technical assistance is often provided by agrochemical companies and local input suppliers. This is confirmed by the qualitative survey undertaken. The input suppliers have a large selection of seeds, chemical fertilizers, agrochemicals and agricultural tools (Figure 6), and

Table 9: Technical support and financial sources in highland areas (Number of responses)

Province	No. of farmers	Technical support					Financial source			Repayment	
		Extension worker	Agrochemic supplier / Input	Neighboring farmers			Farmers' ...	Bank /	Relatives / Friends	Period	Interest (%)
Benguet	16	5	12	1			6	9		4-12 months or after harvest	5-8
Nueva Vizcaya	12	9	7	4			10	1		4-6 months	2-18

Source: Elaborated by the Project Team based on qualitative survey.

have acquired knowledge of application techniques from agrochemical companies and seed companies. They also offer loans that can be repaid following the harvest, and in some cases, they add about PHP 3-5 to the input cost when a farmer purchases inputs at the shop.[14] According to the qualitative survey, financial sources and interest rates vary among provinces (Table 9). Disposers at the markets also provide information on planting time, varieties, post-harvest techniques and credit services.

Figure 6: Rich assortment of local agro-input supplier

Source: Project Team

(2) Distributors in the production areas

Figure 7 shows the supply chain of highland vegetables in Benguet Province, one of the major production areas of highland vegetables in the Philippines. La Trinidad Vegetable Trading Post (LTVTP) and Benguet Agri-Pinoy Trading Center (BAPTC), the two major marketplaces in the province, play a significant role in supplying highland vegetables to consumption areas such as Metro Manila and other islands.

1) Benguet Agri-Pinoy Trading Center

The BAPTC is operated by a staff of 67 members. The operation body, with a Chief of Operation Officer as a representative, manages training centers, provides necessary services to users, records trading data, and provides facility maintenance without intervening in actual trading. Market facilitators, locally called disposers, as well as buyer/purchasers (or truck

[14] From an interview in Atok Municipality, Benguet Province

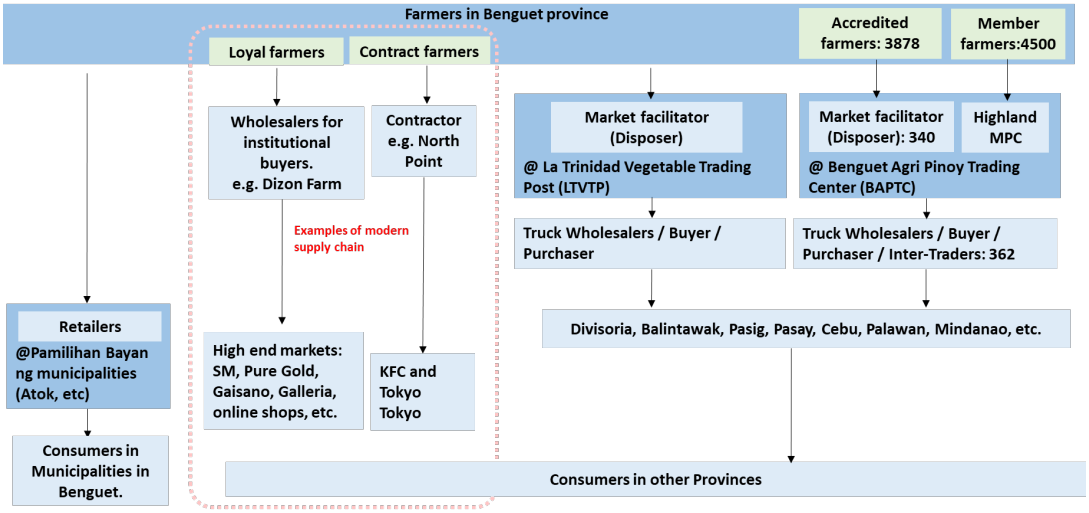


Figure 7: Supply Chain in Benguet Province

Source: Project Team

Note: "Accredited farmers" in the Figure 7 are farmers who can receive benefits and services by applying to BAPTC as "Accredited farmers". For example, (1) they can participate in training, seminars, and workshops provided by BAPTC and external organizations, (2) they can receive support when forming farmer organizations and cooperatives, (3) they can raise awareness of distributors who are behind on payments, (4) they can participate in programs such as contract farming, and activities related to the formation of contract farming through BAPTC. To apply as an accredited farmer, an applier has to submit (1) an application form, (2) a copy of your ID, and (3) two photographs of applicant's face.

wholesalers) are major trading players in the market.

The BAPTC is officially managed by the operational committee, which is composed of the DA, Benguet State University (BSU), the provincial mayor of Benguet, provincial legislators, La Trinidad municipality mayor, representatives of farmers, and the chief of operation officer. Initially, the BAPTC stakeholders aimed to form a semi-autonomous organization with representatives of farmers' groups, such as Sentrong Pamilihan Foundation in Quezon Province, while the current committee, with various political statuses, has less flexible decision-making powers. For this reason, the stakeholders in BAPTC plan to reform the organizational mechanism toward the original plan.[15]

The BAPTC discloses daily market information such as average negotiated prices of vegetables through its Facebook page, although the accessibility to the information is still limited, especially for farmers in non-internet areas, such as Buguias.[16]

The BAPTC also provides a storage facility for potatoes, chayotes, and peppers. It has cold storage as well, but it is not functioning. Instead, it is used for regular storage, temporary selling spaces, and even sleeping spaces. A BAPTC staff member stated that the cold storage

[15] From an interview with BAPTC staff (17 March 2022)
[16] From an interview with BAPTC staff (17 March 2022)

was built without any feasibility study.[17]

Figure 8 shows the annual volume of income and outflow of vegetables in the BAPTC for the past five years, as well as monthly for 2021. The market transacts approximately 170 million kg of vegetables per year. The wholesale market, beginning from its opening in December 2015 and active operation in June 2017, has steadily increased its transaction volume as a result of intensive promotion activities between 2017 and 2018. In 2020, during the COVID-19 outbreak in the country, the BAPTC continued to operate, despite most other marketplaces suspending their operations. The continuous operation during the COVID-19 pandemic invited more truck wholesalers; thus, a greater inflow volume of vegetables from farmers. In 2020 and 2021, the inflow and outflow volume dropped slightly because other neighboring marketplaces such as LTVTP resumed operations.

As for monthly inflow and outflow volumes, both tend to increase during March, July, and December, and drop in January and February, and in August and November. Between August and October, the increase in rainfall and typhoons decrease the harvest amount, but the demand tends to recover in December toward the Christmas season.[18]

Figure 9 shows the monthly transacted volume and average price of five major vegetables, i.e., cabbage, potato, pechay (Chinese cabbage), carrot, and white radish, at the BAPTC in 2021. The graph indicates significant price fluctuation throughout the year, namely, above eight times for cabbage, five times for potato, seven times for pechay, four times for carrot,

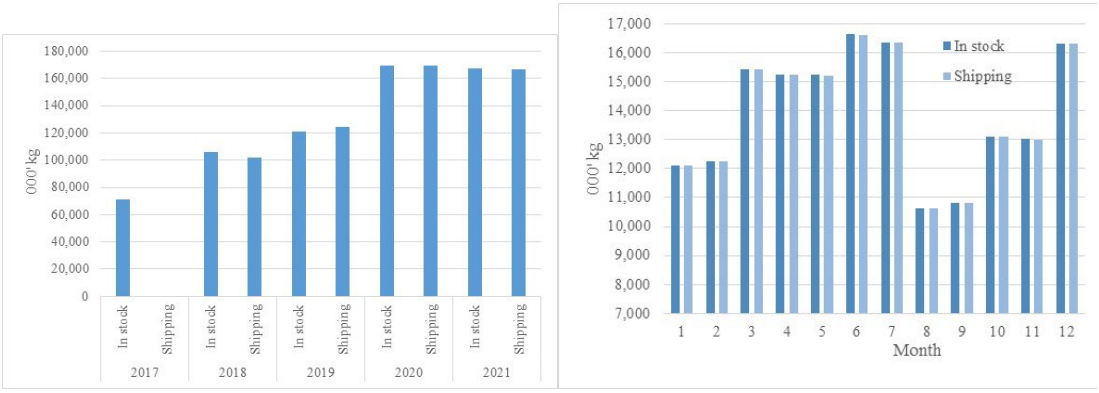


Figure 8: In-stock and shipping volume in the past five years (left) and monthly inflow and outflow in 2021 (Right) Unit: thousand kg

Note: The shipping volume is 2017 was not recorded.
Source: Project Team

[17] From an interview from BAPTC staff (17 March 2022)
[18] From an interview with BAPTC staff (4 July 2022)

and five times for radish. Some vegetables have several peaks in their price throughout the year.

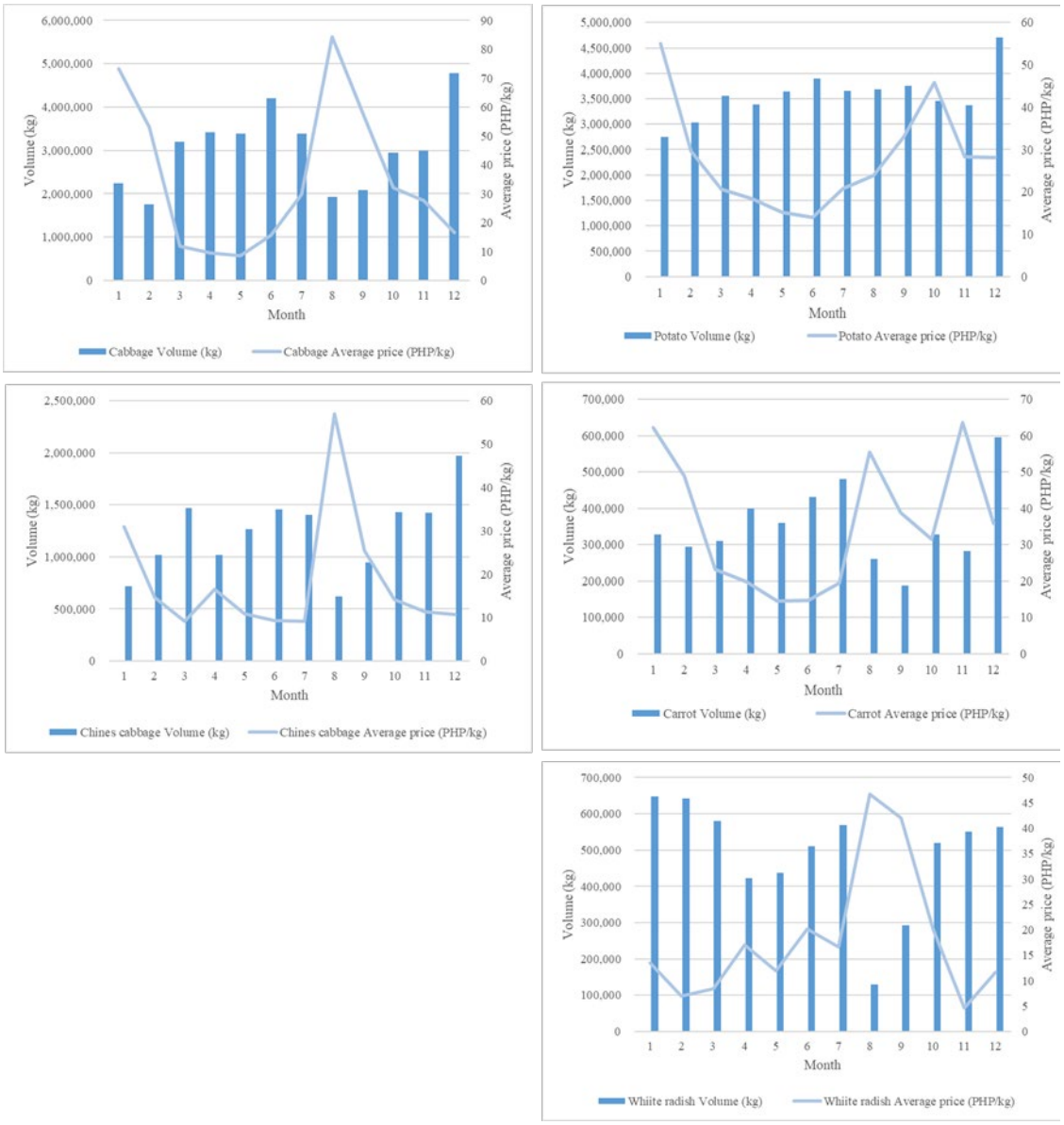


Figure 9: Monthly Transacted Volumes of Five Major Vegetables at BAPTC (kg) and Their Average Monthly Prices (PHP/kg)

Source: Project Team based on data from BAPTC

Table 10: Stakeholders in marketplaces

Stakeholder	Role
Disposer/market facilitator	Locally known as disposers. On behalf of the farmers, they bargain over prices and packaging of vegetables with buyers.
Truck wholesaler	Buys and consolidates vegetables from market facilitators. Usually have their own truck.
Purchaser	Buys and consolidates vegetables from market facilitators on behalf of wholesalers in Manila or other provinces.
Packer/Washer	Being paid daily or per truckload to render services on the packing, washing, sorting, cleaning, and trimming of delivered vegetables.
Porter	Being paid daily or per truckload to render services on the transporting of packed, sorted, cleaned, and trimmed vegetables.
Inter-Trader	Buys and consolidates vegetables from BAPTC and sell them to other APTC's or other markets outlets outside the region and vice versa.

Source: Project Team based on "Benguet Agri-Pinoy Trading Center, BAPTC Accredited Partners / Stakeholders, As of September 2021"

2) Stakeholders in Marketplaces in the Production Areas

Table 10 lists the major stakeholders involved in transaction of vegetables in the two marketplaces, and Table 11 shows the number of each stakeholder in the BAPTC. This section reports the business circumstances of the key stakeholders, market facilitators (disposers), and truck wholesalers.

A. Disposer/Market facilitator

The survey reveals that market facilitators/disposers play a significant role in both marketplaces. Market facilitators, who are mostly women, control quality, receive and circulate daily market information, and connect producers and downstream players with produce, money, and information.

Most highland vegetables, after being harvested, are delivered to a trading place (locally called Stall) in a part of the market (Bay) by either the farmers themselves or farmers' groups.[19] Middle persons who directly purchase vegetables from farmers were hardly observed there. Most of them are either relatives or acquaintances of the farmers. One such facilitator stated

[19] There are three Bays (market building), Bay 1, Bay 2, and Bay 3. Each Bay has 68 trading places (Stall) with a respective number.

that she sells vegetables received from around 20 farmers in Bugians and other neighboring towns.

Market facilitators/disposers negotiate vegetable prices with truck wholesalers or other wholesalers. They refer to price information from other stakeholders in the BAPTC or other marketplaces, and not to market information from wholesale markets in Manila, such as Divisoria.

Normally, market facilitators/disposers add PHP 0.5 to 1, or at the most PHP 3, per kg as their service charge from farmers, while they add around 10% of sales for a truck wholesaler. Once the transaction is dealt with, they reimburse the sales by cash on the same day or the next day, after deduction of commission and other operational costs such as labor fees for sorting and packing.

Table 11: Number of Stakeholders in BAPTC

Group			Individuals	
	Accredited groups	Number of members		
Organic farmers	14	1,214	Farmers	3,878
GAP farmers	5	417	Disposers/Market facilitators	340
Conventional farmers	126	29,786	Wholesalers	345
Wholesalers	29	4,123	Inter traders	17
Packer/Porter	3	241	Packer/Porter	1,181
Inter trader	8	271	Washer	123
			Drivers	141
			Others	55

Source: Benguet Agri-Pinoy Trading Center, BAPTC-accredited partners and stakeholders as of September 2021

Table 12: Number of Stakeholders in LTVTP

Type	Number
Disposer/Market facilitator	400-500
Truck wholesaler	100
Porter	1,000
Packer	1,000

Source: Interview with AMAD staff in Benguet (March 2022)

In the trading area (stall), sorting and grading is done, but the grading indicators issued by the government or researchers are hardly used. Instead, market facilitators are involved in sorting and grading, both in BAPTC and LTVTP. For instance, they regard dark green cabbage as “Good” or first class, and whiter ones as “medium” or second class. Packers trim outer leaves as instructed by the facilitator and pack them into a plastic bag of 10 kg each. Each cabbage ranked “Good” is wrapped in paper, except the one on top, which is wrapped in a plastic bag to easily identify the class.[20] The grading indicator is conventional and depends on market facilitators' experience without a standardized indicator. Most of the vegetables, after

[20] From an interview with a market facilitator at BAPTC (21 February and 14 March 2022).

sorting and grading, are packed in plastic bags. Some vegetables, such as romaine lettuce, broccoli, and cauliflower, are packed with second-hand corrugated cardboard because it is disposable.[21] An informant stated that it might be difficult to return plastic crates after delivery to a downstream player. Occasionally, truck wholesalers bring fertilizers back to Benguet after unloading vegetables. In this case, plastic crates occupy much space in the truck, which also discourages their use.[22]

Notably, market facilitators spend significant time and labor on removing outer leaves, wrapping the "Good" class of vegetables with a paper, packing with a plastic bag and weighing the packed products. The leaves that are removed tend to get wasted. An official guideline on vegetable waste control does not identify responsible personnel or officials for waste management, which is, thus, shouldered by each stakeholder. If the farmer brings vegetables in, the farmer is supposed to handle the residue.

B. Truck wholesalers

Most truck wholesalers and inter-traders own 10-wheeled trucks (20 to 24 Mt capacity) with a wing body[23] and they deliver purchased vegetables from the BAPTC or LTVIP to major wholesale markets in Manila, such as Divisoria or Balintawak, as well as other provinces and islands. In the past, they used to collect vegetables directly from farmers on the street, but now they efficiently collect produce from market facilitators and disposers.

In Benguet Province, approximately 130 trucks are operational. The owners belong to the BAPTC truck wholesaler association or the LTVTP wholesalers' association. Truck wholesalers usually purchase vegetables from several disposers, to fill their truck's capacity. Once each negotiation is complete, porters load the vegetables into a truck.

A truck wholesaler stated that he owns four large-scale trucks, and three of these operate between the BAPTC and Divisoria in Manila, while the fourth runs between the BAPTC and Balintawak. In this way, his trucks transport about 23 Mt/day of highland vegetables such as cabbages, cayotes, potatoes, radish, carrots, and Chinese cabbages.[24]

Market facilitators and deposers oversee the loading by workers, and record the number and weight of each plastic bag, and the unit of price. Then, they provide an invoice with this information, along with the commission (PHP 2 to 5/kg) and settle the payment with cash.

[21] According to an interview with a truck wholesaler at BAPTC, 10% of cabbage and 50% of broccoli and cauliflower would be wasted with a plastic bag (14 March 2022).
[22] From an interview with a truck wholesaler at BAPTC (14 March 2022).
[23] A type of truck called a wing body because it looks like a bird spreading the wings when the sides of the cargo bay are opened. Because loading and unloading are possible from both sides, the carrier can be thoroughly used. Long and thin goods can also be put in and out easily.
[24] From an interview with a market facilitator at BAPTC (14 March 2022).

They prefer cash-based transaction since famers require immediate cash reimbursement.[25]

Purchasers, as shown in Table 10, who negotiate the vegetable transactions with market facilitators/disposers on behalf of wholesalers in Manila, also arrange for transportation between the production and consumption areas. Some purchasers negotiate vegetable transactions using their alternate names. These deals with unidentified purchasers occasionally lead to unpaid credits. In 2002, approximately PHP 28 million credits were not paid to 35 market facilitators and disposers, compared to PHP 12 million in 2004. The disposers attempted to take countermeasures through a local legislator, but the issue remains unresolved even now.[26]

C. Wholesaler/Retailer

Municipalities and town-running marketplaces are operated in Benguet Province. Typically, retailers, or those who play both, the roles of retailer and wholesaler (wholesaler/retailer) are involved in vegetable transactions in these public marketplaces.

In the Atok public market, for instance, 20 retailers (14 vegetable retailers out of 20) formed the Sayangan Market Vendors Association. The vegetable retailers at the market purchase produce delivered by farmers every Wednesday. Prior to the delivery, both parties negotiate the price of vegetables. They may renegotiate the price at the market if the quality of the vegetables does not meet the buyer's requirement. The municipality charges PHP 182 per month for market use, and users pay the fee at the accounting unit in the municipality hall. Daily sales for vegetable retailers vary from PHP 700 to 3,000, and the net margin is approximately 10% of sales.[27] In the market, organic vegetable shops are operated as well, but they do not use the official organic labels.

3) Result of Qualitative Survey in Benguet Province

This section reports the price fluctuations, cost, packing method, sorting and grading, fairness in pricing, and market information sources based on the results of the qualitative survey, targeting distributors in Benguet Province.

[25] From an interview with a market facilitator and truck wholesaler at LTVIP (14 March 2022).
[26] From an interview with a market facilitator and highland multipurpose cooperative (17 March 2022).
[27] From an interview with a retailer at Atok Market (16 March 2022).

A. Price fluctuation

The price of most vegetables fluctuate dynamically. The price gap between the maximum and minimum purchasing prices of cabbage, potato, and carrot is significant. The price gap between the maximum and minimum purchasing/selling prices of potatoes, for instance, has nearly doubled (Figure 10).

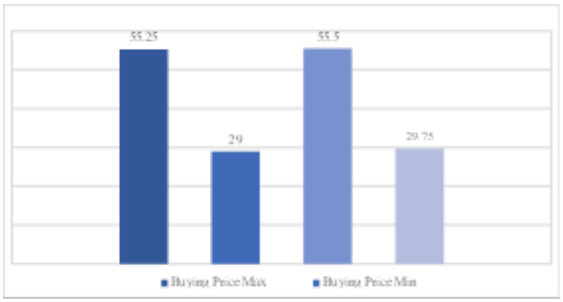


Figure 10: Maximum and minimum buying prices of potato in 2021

Source: Project Team

B. Cost

Labor costs were around 70% of the total cost of all target distributors (Figure 11). The labor cost includes sorting and grading at a marketplace, and washing, packing, or weighing. Consumable expenses, plastic bags, cardboard boxes, crates, papers, follows labor costs (for detailed cost structure by stakeholder, see the next section)

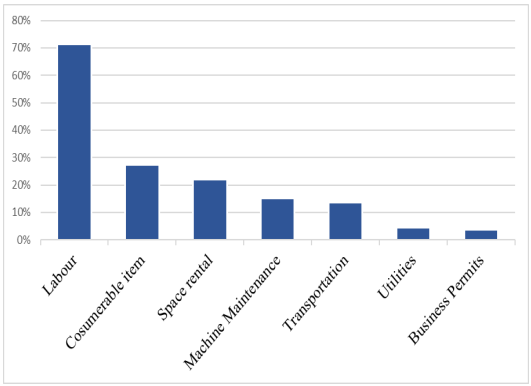


Figure 11: Cost structure of distributors (average, %)

Source: Project Team

C. Package

The survey indicates that plastic bags are used by 38% of the total respondents, followed by plastic crates, by 29%, mostly for tomatoes[28] (Figure 12). Second-hand cardboard boxes are typically used for broccoli, cauliflower and romaine lettuce. In the case of cabbages, distributors in the BAPTC usually pack 10 kg of cabbage in a plastic bag. Cabbages deemed first class or in the "Good" category are wrapped with a paper to absorb moisture from outlier leaves, in order to maintain quality. Wrapping paper is of

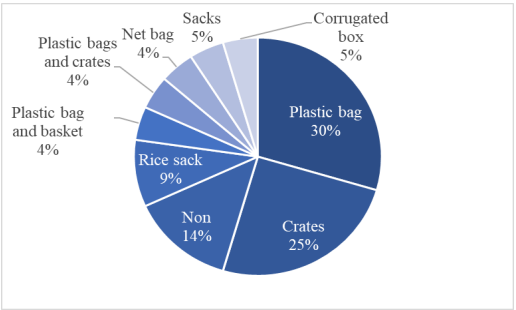


Figure 12: Package

Source: Project Team

[28] Tomatoes are easily spilled when crushed under their own weight, so they have traditionally been traded in wooden boxes and bamboo baskets called *kain*. Therefore, it is considered a natural progress to have shifted to use of plastic boxes.

three types, that is a) a small piece of old school textbooks, b) a large piece of old school textbooks, and c) Korean newspapers; each with respective unit prices. Some distributers distinguish vegetables packed with a plastic bag for Manila, from those with a net bag for Davao city or Parawan.[29]

D. Sorting and grading

Most vegetables are sorted by size, color, shape and damage through experience (Figure 13). After sorting, some of vegetables are graded "Good" "Medium" or "Reject." The Good class of cabbage is wrapped with a paper and filled into a 10-kg plastic bag, as mentioned above. The official grading guidelines by the Philippines Nation Standard are not referred to.[30] In the case of the "Good" cabbages, A wholesaler roughly scribbles "Good" on the plastic bag with a maker pen.

E. Fairness in pricing

Most of informants have no negative opinion on pricing through negotiation, and regard the prices as fair (Figure 14). They add a cost of estimated loss to the price, as mentioned above.

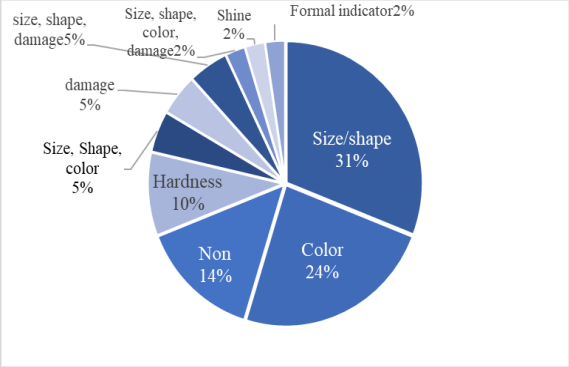


Figure 13: Sorting and Grading

Source: Project Team

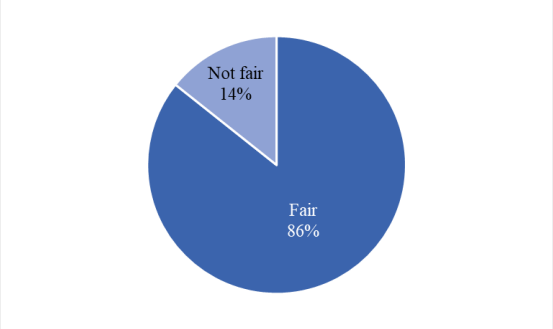


Figure 14: Fairness in pricing

Source: Project Team

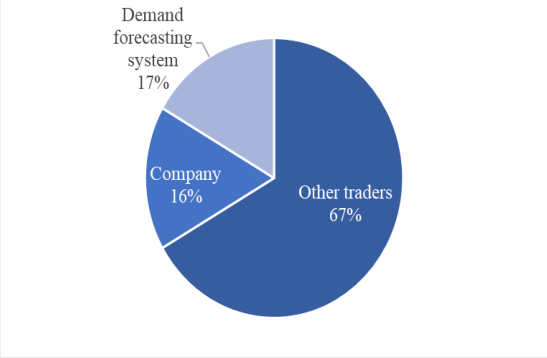


Figure 15: Source of market information

Source: Project Team

[29] From an interview with a shop staff of a wrapping paper shop (14 March 2022)

[30] The Philippines National Standard with other related governmental agencies and academics drafted a grading standard of each vegetable although it is hardly used in practice.

F. Price information source

The main price information is sourced from other distributors. The BAPTC or other marketplaces update daily price information on Facebook, but the information is primarily for the archives and not to be referenced in daily price negotiations (Figure 15).

Table 13: Basic information on intermediaries in Benguet (average values)

	Disposers	Other intermediaries in market	Total
Gender (1: all male; 0: all female)	0.2	0.5	0.3
Age	48.4	44.4	47.0
Educational attainment (years)	9.8	10.6	10.1
Business experience (years)	18.0	15.1	17.0
N. of tradable vegetable	3.7	3.7	3.7
Monthly sales value (PHP)	809,744	1,018,189	881,898
N. of sample size	17	9	26

Note: Educational attainment is indicated as follows: elementary school = 6 years; junior high school = 9 years; high school = 12 years; university = 16 years; and graduated school = 18 years.
Source: Project Team

4) Competitiveness of rural marketing intermediaries in Benguet Province

Data of 26 intermediaries out of 32 were used for the quantitative analysis, after cleaning for missing data.[31] Of the 26 intermediaries, data for 17 is obtained from disposers.[32] The remaining nine comprise one purchaser, one truck wholesaler, and four wholesale cum retailers, although data for the other three cannot be categorized clearly. In the analysis of this section, data for the remaining nine responders are summarized, and the disposers are categorized into "other intermediaries in market."

Basic information of sampled intermediaries for the analysis is illustrated in Table 13. As a main characteristic of the sample, the proportion of female intermediaries sampled is fairly high. Nearly 70% of the disposers are female. Some differences between disposers and other intermediaries in the market are as follows: the age of disposers is relatively high; disposers' have more business experience; and the level of educational attainment of disposers is lower. Meanwhile, both types of intermediaries buy and sell almost the same number of vegetables (approximately four kinds of vegetables).

[31] Of the sample obtained in Benguet Province, after excluding one sample with missing data, further five samples are excluded. The omitted samples' NMRs are out of range from total population of NMRs composed of samples in Benguet, Quezon, and Manila. (In practice, the samples with over 29% and under -40% NMRs are omitted)

[32] For the classification of disposers, some exceptional disposers are included in the sample, who sell vegetables to consumers.

Monthly sale values are also investigated to demonstrate the scale of the intermediaries' business: sales by disposers in one month is about PHP 0.81 million (about JPY 2 million) and less than that of other intermediaries by PHP 0.2 million (about JPY 0.5 million).[33]

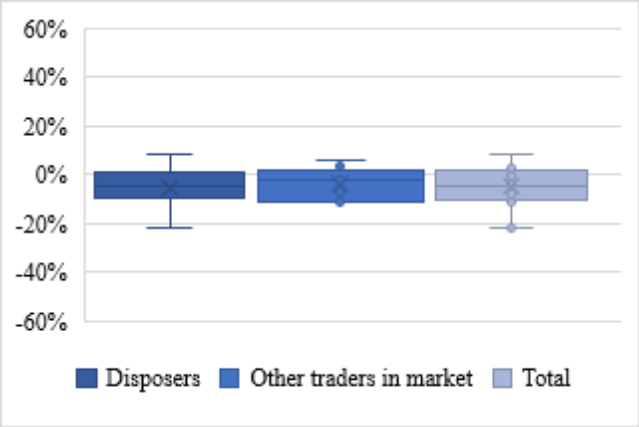


Figure 16: Distribution of net margin ratios of intermediaries in Benguet (%)

Source: Project Team

From calculations of intermediaries' competitiveness as shown in Table 14, it can be seen that disposers face over-competitive surroundings, which probably leads to them losing their business sustainability. The average NMR of the 17 disposers is about -5.3% and lower than 0, with statistical significance as in Figure 16. This means they competed excessively with each other. However, the other intermediaries in the market compete appropriately because the null hypothesis cannot be statistically rejected where NMR is zero (their average NMR is -3.6 %). When the samples of disposers and the other traders in the market are combined, the average NMR is -4.7% and statistically lower than zero, that is, revealing an over competitive situation in the case of the disposers as well.

For detailed analysis, we show the composition of intermediaries' unit costs in Table 15. Labor costs account for the majority of the unit costs (about 76.5%) followed by depreciation and rental costs of assets (15.4% for disposers and 28.7% for the other traders in market). In the labor costs for disposers, payments for hired labor are a significantly heavy burden for both types of intermediaries. The hired labor mainly execute tasks such as sorting, grading, packing, and weighing of vegetables and various transport jobs. If the costs are reduced to zero, the NMR of disposers would increase to 1.5%.

[33] PHP 1.00 = JPY 2.45. The same exchange rate is applied throughout this section.

Table 14: Summary statistics of traders' competitiveness in Benguet (%, average values)

	Disposers	Other traders in market	Total
Gross margin ratio	9.9%	10.2%	10.0%
Cost ratio	15.2%	13.8%	14.8%
Net margin ratio	-5.3%	-3.6%	-4.7%
Sample size	17	9	26

Note: The gross margin ratio is calculated as the proportional value of difference between buying prices and selling prices. If a trader has several commodities, we use both procurement values and sales values instead of unit prices. The cost ratio is calculated as the ratio of total unit cost to procurement value. The net margin ratio is the ratio of the values of selling prices excluding buying prices and the unit costs to buying prices. For calculating the net margin ratio in practice, we subtract the cost ratio from the gross margin ratio.

Source: Project Team

Table 15: Compositions of unit costs covered by traders in Benguet (%, average values)

Cost type	Type of labor costs	Disposers	Other traders in market	Total
Labor costs		76.5%	65.6%	72.7%
	Owner	20.2%	20.6%	20.3%
	Family member	7.3%	9.7%	8.1%
	Waged labor	72.5%	69.7%	71.5%
Service costs without hired labor		7.5%	5.2%	6.7%
Asset costs (depreciation costs of assets if owned, otherwise rental costs)		15.4%	28.7%	20.0%
Capital costs		0.6%	0.5%	0.5%

Source: Project Team

3.1.2 Lowland vegetable production areas

(1) Vegetable farmers

1) Main crops and growing season

The four target provinces in the lowland vegetable production areas are located at altitudes between 0 and 200 m above sea level. The average annual temperature is above 25°C and rises to nearly 35°C before the rainy season, and tropical crops, especially fruit trees, are widely grown. Of the total farmland area in each province, vegetable production areas account for 32% in Pangasinan and 20% in Nueva Ecija, and around 2 or 3% in Quezon and Camarines Norte. Figure 17 shows the percentage of area planted to 10 main crops in each province.

In the four lowland vegetable-growing provinces, farmers mostly grow warm-season

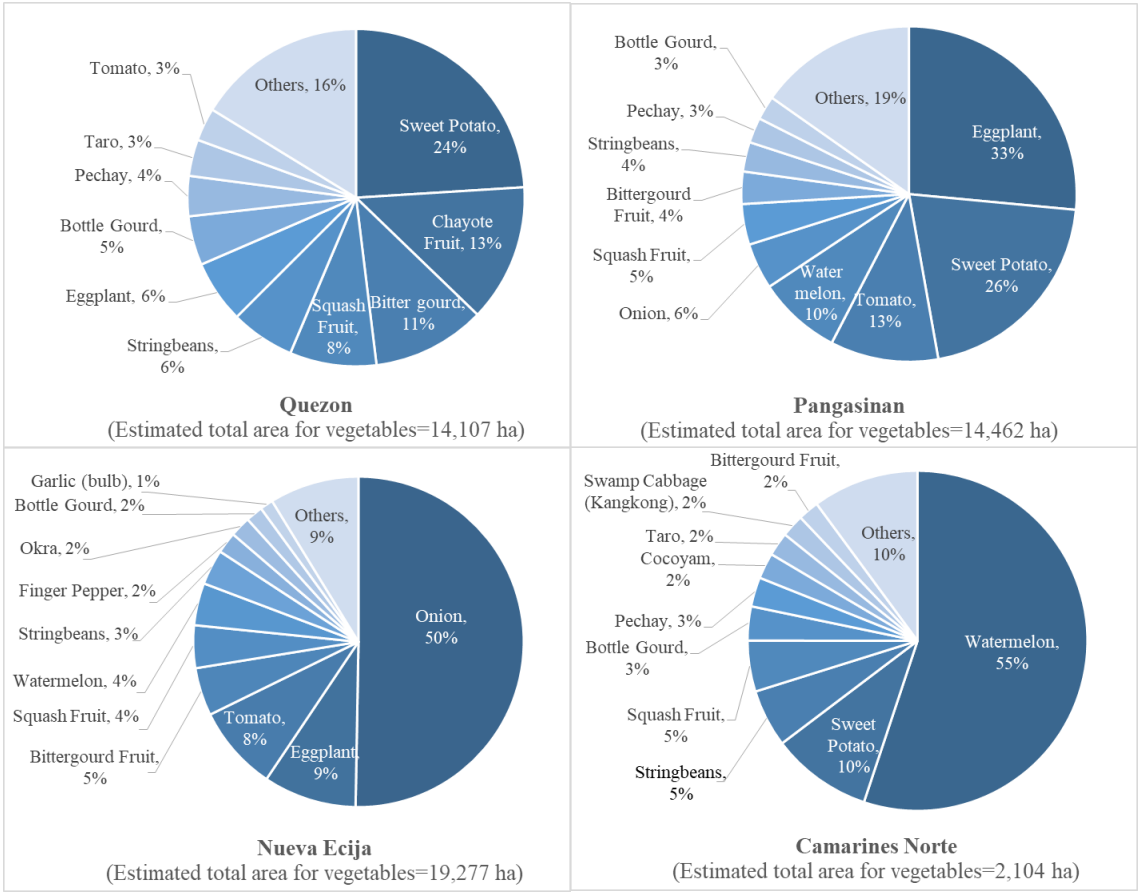


Figure 17: Percentage of areas cultivating 10 major crops in the lowland provinces (% area under vegetables)

Source: prepared by the Project Team based on Other Crops: Area Planted/Harvested, by Region and by Province, by Semester, 2010–2020, psa.gov.ph (Accessed September 2021)

vegetables such as sweet potato, eggplant, tomato, bitter gourd (*Amparaya*) and string beans (*Pole sitao*) which are relatively resistant to heat and drought. This is because the average annual temperature is around 30°C, although the cropping proportions differ. In addition, *chayote* (or *sayote*), *pechay* (Brassica Rapa) and bottle gourd are also commonly grown in Quezon and Pangasinan. Nueva Ecija has flatlands in low altitude areas where onions are produced, and this province is famous for being one of the country's leading suppliers of onions, which accounts for 50% of all the provincial vegetable cropping area. In Camarines Norte, approximately 80% of the provincial farmland is planted with coconut trees with which watermelons are grown as an intercropping, which accounts for 55% of the vegetable cropping area, followed by sweet potato and squash.

With the exception of Camarines Norte, the main crops, namely bitter ground, string beans, and eggplant, are generally grown at the same time of the year in the three provinces with lowland vegetable production areas. However, in Nueva Ecija, tomatoes are often produced with irrigation during the dry season, whereas in Quezon, they are grown only by farmers with irrigation facilities, or sometimes during the rainy season.

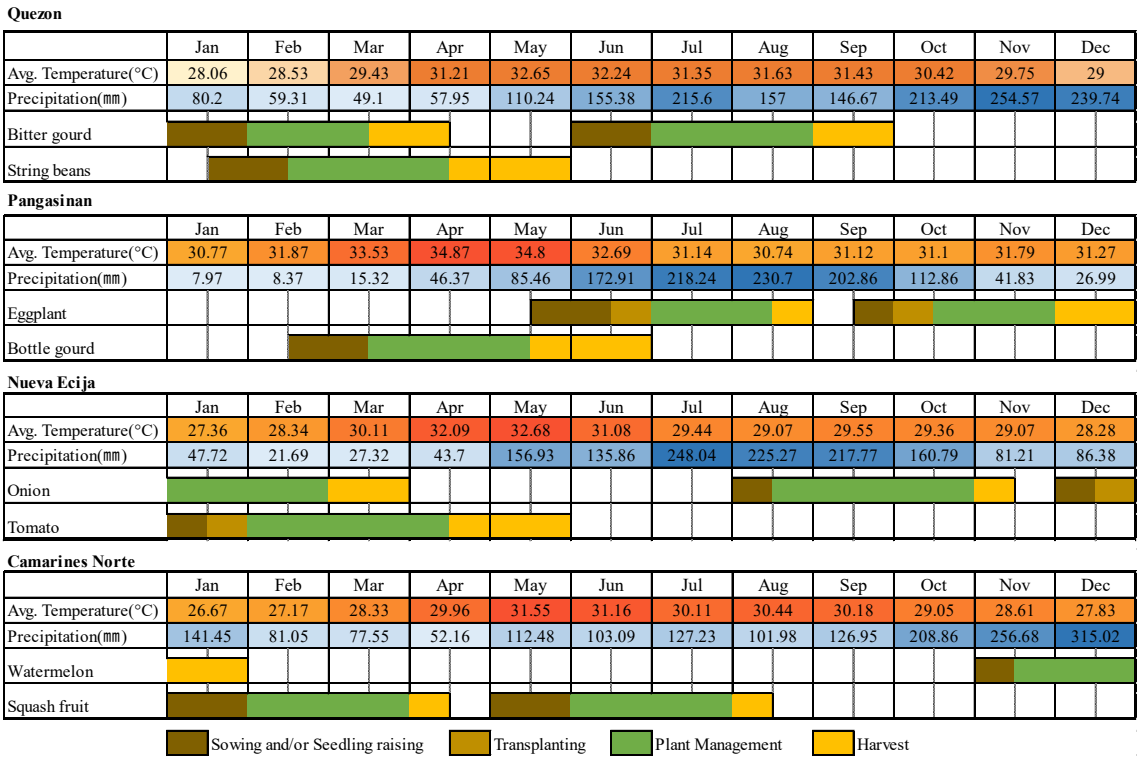


Figure 18: Climate conditions and cropping seasons of main crops in the lowland provinces

Source: Project Team based on Climate-data org (https://en.climate-data.org/) and qualitative research results

Onions, which are grown only in Nueva Ecija, can be harvested after a growing season of 90-100 days. However, its cropping season is limited to the coolest time of the dry season because this crop is sensitive to heat. In Camarines Norte, the rainy and dry seasons are different from those in the other three provinces. The highest amount of rainfall occurs between October and January, which is a period with cooler temperatures; thus, vegetable production is concentrated during this period.

As mentioned above, although the vegetable-growing seasons vary by province, the farmers generally use the same varieties in the lowland vegetable production areas.

Table 16 shows the vegetable varieties grown in the four provinces and their characteristics.

Table 16: Varieties and characteristics of vegetables produced in the lowland provinces

Crop	Variety name (Company)	Potential yield (ton/ha)	Earliness (Maturity)	Characteristics
Bitter gourd	Mestisa F1 (East-West)	15-20	Early maturing (30-35 DAT[a])	A high yielding, intermediate resistance to Cucurbit aphid-borne yellows virus
String beans	Makisig (East-West)	35-40	Early maturing (45-50 DAS[b])	Open pollinatedc, Plant vigor, pod length is about 60-65cm
Eggplant	Morena F1 (East-West)	30	Early maturing (60-65DAT)	A high yielding, intermediate resistance to Bacteria
Bottle gourd	Mayumi F1 (East-West)	15-20	Early maturing (45-50DAT)	A high yielding with medium size cylindrical fruits
Onion	Red Dragon (Ramgo Int.)	20-30	Early maturing (80-85DAT)	Open pollinated[c], with tolerant to bulb rot, leaf miner
Tomato	Diamante Max F1 (East-West)	50	Early maturing (60-65DAT)	Intermediate resistance to Tomato leaf curl virus and bacterial wilt
Squash	Pia F1 (East-West)	10-15	Early maturing (60-65DAT)	Intermediate resistance to Squash leaf curl virus

a Days After Transplanting
b Days After Sowing
c Varieties with certain characteristics fixed by natural selection or artificial selection according to local soil and climatic conditions; unlike hybrid varieties, they can be self-seeded for several years without significant quality deterioration and decrease in yield (Reference: Sakata Seeds, Inc.hhttps://corporate.sakataseed.co.jp/about-us/seed-business/variety.html)

Source: Prepared by the Project Team with reference to Commercial Crop Variety Database (https://nsic.buplant.da.gov.ph/ccvd/index.php)

In lowland vegetable production areas, early maturing varieties are preferred with regard to water conservation in all crops because of water shortage due to high temperatures and dry weather conditions. Pest-resistant varieties are also preferred because of the high frequency of pests and disease outbreaks. However, as highly resistant varieties are either unaffordable or unavailable, intermediate resistant varieties are often used.

Many seed varieties of string beans and onion are open-pollinated, and farms can be self-seeded for several years. However, according to the qualitative survey results, only a few farmers take seeds from their own produce in the four provinces. As vegetables are basically grown for cash, seed is purchased from material shops each time to ensure a specific yield and quality.

2) Cultivation method

According to the qualitative survey results, the farmland in four lowland provinces was 2.2 to 4.6 ha/farmer and larger than that of highland provinces. Many of them grow both rice and vegetables. In Camarines Norte, many farmers grow rice and vegetables in the same field; in other provinces, they mostly grow rice and vegetables in adjacent fields. Like in the highlands, farmers grow more than three types of vegetables but with more diverse combinations.

Table 17 shows an overview of the cultivation methods for the five major vegetables in the qualitative survey. Farmers grow seedlings in pots, and seedling trays are limited, and only for Solanaceae (tomato, eggplant) and Cucurbitaceae (bitter gourd, bottle gourd, loofah). Seeds of pumpkin, watermelon, and onion are directly sown without raising seedlings, which is unlike the Japanese cultivation method. Three bitter gourd farmers make their own grafted seedlings, and some purchase the grafted seedlings. However, tomato farmers do not use grafted seedlings, which are conventional in Japan. This is probably because tomatoes cultivated in Quezon and Nueva Vizcaya are the determinate type (var. Diamante Max) and not the long-harvesting type (indeterminate type). Five pumpkin farmers use self-produced seeds. Compared to the highlands, many types of organic matter are applied in addition to chemical fertilizers. Farmers use various types of organic fertilizers such as sawdust-based vermicompost, chicken manure, sugar cane compost, “Bagassa,” and “Humus Plus.” As for agrochemicals, most farmers use agrochemicals for pest, disease, and weed control. However, in Quezon Province, relatively few farmers use herbicides.

Table 17: Outline of cultivation methods of major vegetables in lowland areas (Number of respondents)

Province	Major vegetables	No of farmers	Raising seedlings			Soil fertility management				Agrochemical application	
			Self-raising	Pot / Tray	Open field	Organic matter	Vermicast	Chicken manure	Others [b]	Pests and diseases	Weed [a]
Quezon	Tomato	8	7	2	5	6	3	1	Vermi+CM 1	8	3
	Eggplant	7	6	3	3	6	2	3	Vermi+CM 3	7	1
	Pechay	5	2	0	2	3	1	2	Vermi+CM 2	5	3
	Water-melon	5	0	--	--	1	1	0	--	3	2
	Bitter gourd	4	3	2	1	3	1	0	--	4	1
Panga-sinan	Eggplant	6	1	1	0	2	0	3	Other material 1	6	4
	Bitter gourd	6	3	3	0	3	1	1	Other material 1	6	4
	Bottle gourd	5	2	2	0	3	0	1	Other material 1	4	3
	Chili pepper	5	0	--	--	3	0	2	--	5	3
	Okra	3	0	--	--	1	0	0	Other material 1	3	3
Nueva Ecija	Onion	9	0	--	--	8	2	5	Vermi+CM 2 Other material 3	9	8
	String bean	9	0	--	--	6	1	0	Vermi+CM 1 Other material 1	9	8
	Bitter gourd	7	2	2	0	6	0	5	Other material 1	7	5
	Tomato	4	3	1	2	4	1	2	Vermi+CM 1 Other material 1	4	4
	Loofah	3	1	1	0	3	1	0	Vermi+CM 1 Other material 1	3	3
Camarines Norte	Squash	9	0	--	--	9	0	9	--	8	7
	Bitter gourd	8	0	--	--	8	0	8	--	8	6
	String bean	8	0	--	--	5	0	5	--	8	8
	Bottle gourd	7	0	--	--	7	0	7	--	7	6
	Eggplant	4	1	0	1	4	0	4	--	4	4

Note: 16 farmers in Quezon and 12 farmers in other provinces were interviewed.
a: Including farmers using both herbicide and manual weeding.
b: Including "Humus Plus" and "Bagassa" (sugar cane residue). CM: chicken manure
Source: Elaborated by the Project Team based on the qualitative survey

Table 18 summarizes the farming methods from field preparation to packaging. In Quezon and Pangasinan, many farmers use tractors for field preparation; in the other two provinces, many use animal traction. None of the farmers use agricultural facilities such as greenhouses in the fields, and only around 10% use them for raising seedlings. Regarding irrigation methods in Quezon, 13 out of 16 farmers irrigate manually using watering cans, while, in the other three provinces, most farmers apply furrow irrigation by pumping up groundwater. In the lowlands, most farmers also grow rice and share the pump and water sources for vegetable cultivation, which is called "communal irrigation." Farmers who answered that water for irrigation is not sufficient during the dry season were five in Quezon, seven in Nueva Ecija, two in Camarines Norte, and none in Pangaasinan. This is probably due to the relatively high groundwater level in Pangasinan.[34] Few farmers have storage facilities for post-harvest, and almost all farmers ship their vegetables in plastic bags. Most of the shipping methods in the lowlands are to sell to buyers who come to collect vegetables in the field. Their shipping destinations include wholesale markets in both the area and neighboring provinces, and modern distributors in cities. In many cases, the buyers undertake the harvesting work, which can also solve the problem of labor shortages at the harvesting time.

Table 18: Use of agricultural equipment, facilities, and post-harvest packaging in lowland areas (Number of respondents)

Province	No of farmers	Ave. altitude (m)	Ave. farm size (ha/farm)	Field preparation			Usage of green-house		Irrigation				Storage	Packaging	
				Hand tractor [a]	Animal traction [b]	Man power	Nursery	Veg production	Furrow	Basin	Drip	Watering can	Storage facility	In the bag [c]	In the box [d]
Quezon	16	137	2.8	11	1	5	3	0	0	2	0	13	2	12	2
Pangasinan	12	78	4.6	8	3	0	1	0	12	0	0	0	2	12	0
Nueva Ecija	12	107	2.7	6	6	0	0	0	10	0	2	0	3	12	0
Camarines Norte	12	55	2.2	3	9	0	3	0	11	0	0	1	0	12	0

a: Including farmers who cultivate by both hand tractor and manpower
b: Some use hand tractor and manpower in addition to animal traction.
c: Including the cases packaging in the bag and then in the box. Both plastic bags and sacks are used in Nueva Ecija and Camarines Norte, while only plastic bags are used in other two provinces.
d: Including both open box and closed box
Source: Elaborated by the Project Team based on the qualitative survey

[34] Observation in the field in March 2022

3) Actual situation of agricultural management

In lowland vegetable-growing areas many farmers are engaged in not only vegetable production but also multiple farming, including livestock rearing, rice and fruit production such as coconut trees, except for onion farmers in Nueva Ecija. Although the hot and dry climate conditions limit the possible cropping season, farmers plant multiple vegetables. Such methods enable the farmers to reduce the negative impact on household income in the event of a poor harvest of a particular crop or a collapse in sales prices. This sub-section presents the results of balance (income and expenditure) and profits from vegetable production as a part of the quantitative survey conducted in Quezon Province to understand the actual situation in lowland vegetable production areas.

A. Income from vegetable production

In the quantitative survey in Quezon Province, a total of 44 farmers were interviewed in the municipalities of Dolores and Sariaya, 18 and 26 farmers respectively. They gave their expenditure and the amounts and expenses related to sales on the production of main crops in 2021–2022.

Of the 44 interviewed farmers, 35 (about 80% of the total number) have a source of income other than vegetable production; livestock farming is the most common among which many farmers are engaged in pig farming, followed by rice and coconut production and a few farmers are engaged in industries outside agriculture.

The interviewed farmers grow crops once or twice a year, with three or more crops being planted at the same time or overlapping for a certain period. The major vegetables grown by the interviewed farmers are; string beans, eggplant, tomato, hot pepper, squash, bitter gourd, pechay, cabbage and sweet potato. Other vegetables grown in Dolores and Sariaya municipalities are quite diverse, such as bottle gourd, cucumber and lady's finger; however, according to the provincial statistics, their production area are about 4% or less out of whole vegetable grown area, except cucumber in Dolores (19%). The vegetable-wise profitability is discussed in the next session, and an overview of the municipalities is presented here. Table 19 shows the area of farmland per farmer and the balance and the income from annual vegetable production by municipality. In the same way as Benguet Province, almost 100% of the vegetables are sold according to the interviewed farmers, and the percentage of self-consumption was unclear. Therefore, the balance and income were calculated based on the

Table 19: Farmland area, balance, and income on vegetable production in Quezon Province

	No. of farmers	Farmland area (ha)	Gross profit (PHP)	Mgmt & prod costs (PHP)	Farm income per farmer (PHP)	Farm income per hectare (PHP/ha)
Dolores	18	1.30	135,493	117,324	18,169	13,976
Sariaya	26	2.21	940,070	266,614	673,456	304,731
Total/Average	44	1.80	547,264	193,347	335,162	412,774

Note: As the values for gross profits and management and production costs were highly skewed, an average value was used from the survey farmers' responses removing 10% of each of the upper and lower outliers.

Source: Project Team based on the quantitative survey

figures of farmers' expenditure and sales revenue, not taking into account the portion for subsistence use.

The average area of farmland was reported as 1.3 ha in Dolores and 2.2 ha in Saliaya. The numbers of farmers who own and rent farmland are almost the same: 27 and 28 farmers respectively. Moreover, 10 farmers grow vegetables on both owned and rented land.

The gross profit and management and production costs are different by province. In Doroles, the gross profit from vegetable production is approximately PHP 140,000, but the management and production costs are also about the same amount, around PHP 120,000, and the net profit, namely farmer income, is lower at around PHP 18,000. In contrast, in Sariaya, gross profit is PHP 940,000 and management and production costs are around PHP 270,000, resulting in a farm income of PHP 670,000.

Two reasons can be suggested for this difference in profitability: (i) Sales method of harvests and (ii) Crop types which farmers grow. Regarding (i) Sales method of harvests, in Dolores, middlemen and traders often come directly to the fields to buy produce, whereas, in Sariaya, the Sentrong Pamilihan wholesale market is located, which makes it easier for farmers to obtain information on prices and sales conditions. Therefore, farmers in Sariaya have opportunities to plan the timing of sales based on market information and to know the best-selling crops and quality standards. Moreover, they can reflect on their future vegetable production. With regard to the crop types in (2), many farmers in Dolores have chosen string beans and eggplant because those crops can be grown rainfed and are adaptable to the local environment. However, the sales prices of these crops are often low despite the high cost of pesticides. In fact, many farmers were losing money on these two crops because input costs exceeded sales. Contrarily, many farmers in Sariaya grow relatively profitable crops such as

tomato and bitter gourd.

B. Profitability by crop type

As indicated above, the crop type is considered one of the important factors in determining the amount of farmers' income. Table 20 shows the percentage of crops grown by the interviewed farmers and their average yield in each municipality.

The crop types grown in each municipality differ. In Dolores, string beans and eggplant account for more than 30% of the total, followed by hot peppers and sweet peppers, the latter of which is included in the "Others" category. In Sariaya, tomatoes are grown in large quantities, followed by pechay, squash, bitter gourd and cabbage. Other crops include around eight different crops, such as radish and bottle gourd.

The average yields of string beans, tomato and bitter gourd are higher as a whole than the national estimated yields of 2.7 t/ha, 7.3 t/ha and 13.2 t/ha respectively. In contrast, those of eggplant and cabbage are lower than the national estimated yield: 23.8 t/ha and 20.9 t/ha respectively.[35] Additionally, the yields of hot pepper, squash, pechay and sweet potato, which are not comparable with recent data, are low.

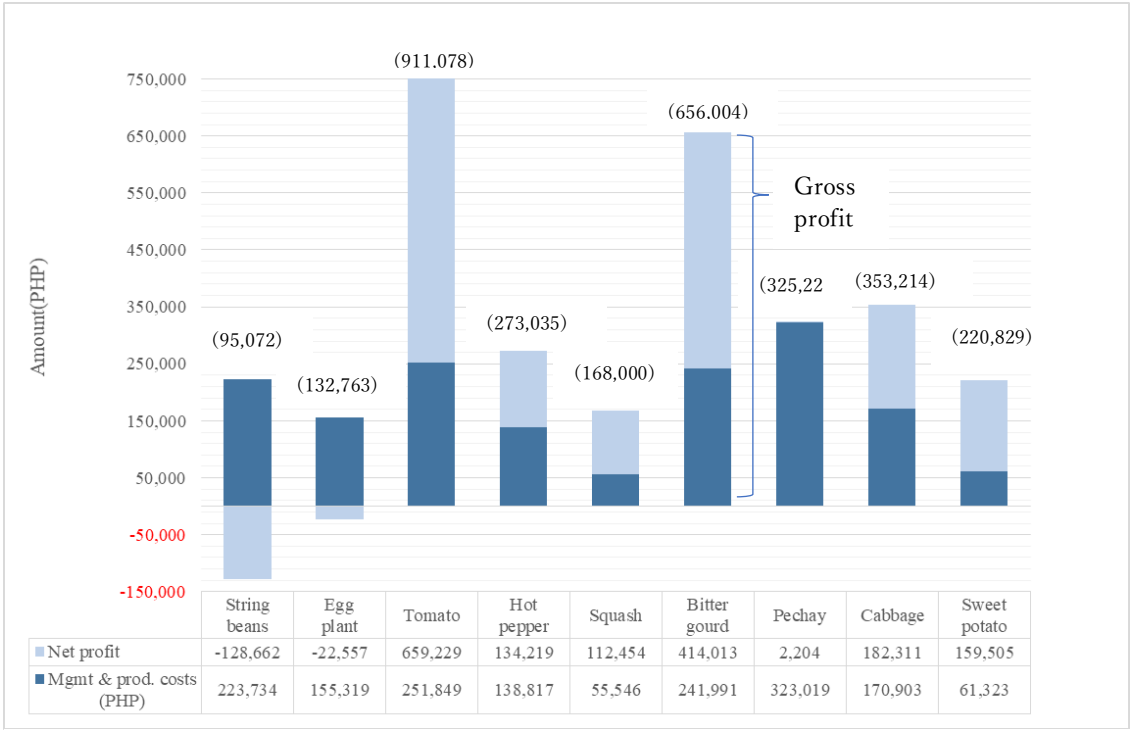
Table 20: Percentage of cropping and average yield by crop type in the surveyed areas in Quezon Province

	String beans	Eggplant	Tomato	Hot pepper	Squash	Bitter gourd	Pechay	Cabbage	Sweet potato	Others
Dolores	38%	32%	0%	9%	4%	2%	0%	0%	0%	15%
Sariaya	4%	4%	22%	4%	9%	9%	11%	9%	9%	18%
Avarage percentage	18%	16%	13%	6%	7%	6%	6%	5%	5%	17%
Average yield (ton/ha)	9.17	8.28	30.98	7.97	6.78	12.64	12.64	17.50	10.60	-

Note: The average value was taken from the survey farmers' responses removing 10% of each of the upper and lower outliers.

Source: Prepared by the Project Team based on the results of the quantitative survey

[35] Philippine Statistics Authority (psa.gov.ph; accessed 17 September 2021)



	String beans	Egg plant	Tomato	Hot pepper	Squash	Bitter gourd	Pechay	Cabbage	Sweet potato
Net profit	-128,662	-22,557	659,229	134,219	112,454	414,013	2,204	182,311	159,505
Mgmt & prod. costs (PHP)	223,734	155,319	251,849	138,817	55,546	241,991	323,019	170,903	61,323

Figure 19: Management and production costs, net profit and gross profit (in brackets) by main crops grown in Quezon Province

Source: Prepared by the Project Team based on the results of the quantitative survey

Figure 19 shows management and production costs per hectare and farmer income (profit) for the eight main crops grown by interviewed farmers in Quezon Province, as well as their combined gross profit. It should be noted that, owing to the large dispersion of the farmers' response sites, the average value is used after removing 10% of each of the upper and lower outliers.

Management and production costs exceeded gross profit for string beans and eggplant, resulting in losses of approximately PHP 130,000 and PHP 220,000 respectively. Pechay also resulted in almost no net profit. This was due to the collapse of farm gate prices and a low yield, as shown in Figure 19. Additionally, management and production costs, especially pesticide and labor costs, increased owing to many pests and diseases.

Tomato and bitter gourd, which had high yields, generated net profit as they generated gross profit of approximately PHP 910,000 and PHP 660,000, respectively. The proportion of management and production costs was less than one-third of sales. Despite the high profitability in this survey, tomatoes are susceptible to pests and diseases, require significant labor for harvesting, and occasionally experience price crashes. In this respect, bitter gourd does not require as much labor as tomatoes and market prices are less volatile than other crops.

Hence this crop can be recommended to contribute to improved agricultural management if harvested over a long period by using high-yielding varieties and grafted seedlings.

Cabbage was profitable because it is rarely grown in lowland areas, and the interviewed cabbage farmers in Quezon grow and ship it through contract farming, although the yield was slightly lower than the national average. The cabbage varieties that can be grown in lowland areas are generally cheaper in the market because of their different shape from those grown in the highlands. However, the varieties adaptable to the lowland areas are known to have a good taste and can be expected to generate a stable income if farmers can sell them under contract with specific companies or traders.

In addition, sweet potato, one of the signature products of Quezon Province, is highly profitable because production costs, such as inputs, are lower than for other crops. However, as the unit price itself is low, rather than being a main food or cash crop, it should be a complementary crop in the intercropping as a relief income source. Thus, it is desirable to promote resilient farming management by producing a diverse combination of crops or engaging in other economic activities, which can compensate for a collapse in the sales price of certain crops, as already practiced by farmers in Quezon Province.

4) External support (technical support, local agricultural input supplier, and credit services)

A certain number of respondents received technical assistance from extension workers (Table 21), but the actual situation was different among provinces. In Quezon and Pangasinan, the number of extension workers and activity costs are limited, and technical information is provided mainly by seeds or agrochemical companies. However, in Nueva Ecija and Camarines Norte, farmers regularly receive technical assistance from extension workers. This depends on the number of extension workers. For example, in the Kayaba municipality of Nueva Ecija, there are 27 experienced extension workers in 28 barangays, while in the Asingan municipality of Pangasinan, there are only seven extension workers in 21 barangays. In Nueva Ecija, the SM foundation of a major shopping mall, SM group, supports the extension program of MAO. In some cases, a few farmers have technical support from private assistant services.

Most local input suppliers do not sell agricultural tools but sell a wide selection of seeds and agrochemicals. They also provide information on how to use seeds and agrochemicals, as

Table 21: Technical support and financial sources in lowland areas (No. of responses)

Province	No. of farmers	Technical support			Financial source		Repayment	
		Extension worker	Input supplier/ Agrochem.	Neighboring farmers	Farmers' association	Bank/ Friends / Relatives	Period	Interest (%)
Quezon	16	15	7	1	7	4	3-12 months	2-6
Pangasinan	12	7	8	0	0	7	After harvest	0
Nueva Ecija	12	11	8	3	3	4	3-6 months	2-20
Camarines Norte	12	10	8	3	1	2	3-6 months or after harvest	2-6

Source: Elaborated by the Project Team based on the qualitative survey

in the highlands. About half of the farmers in Quezon use the credit services of microfinance institutions, banks, and farmers' cooperatives. However, access to credit services is limited in the other three provinces, and farmers instead use their own savings and support from relatives. Loans provided by local input suppliers are also limited.

(2) Distributors in production areas (lowland vegetables)

Table 22 summarizes distributors of lowland vegetables in the provinces of Quezon, Pangasinan, Nueva Vizcaya, Nueva Ecija, and Camarines Norte.

1) Quezon Province

Figure 20 draws the traditional supply chain in Quezon Province, and Table 23 summarizes major distributors in the province. Sentrong Pamilihan market is one of the major wholesale markets in the province and supplies vegetables produced in the province not only to Quezon but also to other provinces such as Marinduque Province. The market is managed by SPPAQFI.

Sentrong Pamilihan ng Lugsod ng Lucena is another major marketplace run by Lucena City, where wholesalers and retailers operate their business. The market receives lowland vegetables from Sentrong Pamilihan wholesale market and highland vegetables from Benguet Province via inter-traders, and then supplies them to consumers and retailers in the province. In addition, town-operated wholesale and retail markets, including Pamilihang Bayan ng Candelaria, Sariaya, Tiaong, and Dolores, supply vegetables to consumers and retailers in the area.

Table 22: Major wholesale markets in target production areas of lowland vegetables

Province	Wholesale markets	Location	Owner	Management	Transacting organization	No. of distributers	Transacted value per year (PHP)	Transacted volume (Mt)
Quezon	Sentrong Pamilihan wholesale market	Sariaya	DA	Sentrong Pamilihan Ng Produktong Agricultura Sa Quezon Foundation Inc	- SPPAQFI - Market facilitator	1,000	N.A.	150-250 per day
Pangasinan	Pangasinan Agri-Pinoy Trading Center	Urdaneta	DA and provincial government	City	- 2 Farmers associations -Wholesaler	300	N.A.	N.A.
Nueva Vizcaya	Nueva Vizcaya Agricultural Terminal	Bambang	DA and Provincial government	Nueva Vizcaya Agricultural Terminal Inc. (Joint company with province and private organizations)	- NVAT Market Unit - Market facilitators	320	62 million (2021)	2,503 (2021)
Nueva Ecija	Sanguitan Vegetable Wholesale Market	Cabanatuan	City	City Market Unit	N.A	19 wholesalers	N.A.	N.A.
Nueva Ecija	Nueva Ecija. Nueva Ecija Agri-Pinoy Trading Center[36]	Cabanatuan	DA and Provincial government	Nueva Vizcaya Agricultural Terminal Inc	N.A	2 wholesalers	N.A.	N.A.
Camarines Norte	Camarines Norte Agri-Pinoy Trading Center	Talisay city	DA and Provincial government	Labo Progressive Multi-purpose Cooperative	Labo Progressive Multi-purpose Cooperative		7.4 million (2021)	0.3 Mt daily

Note: N.A. in the transacting organization indicates that only individual market facilitators operate in a marketplace.

Source: interviews with each marketplace and provided materials

[36] Only two wholesale companies use the marketplace.

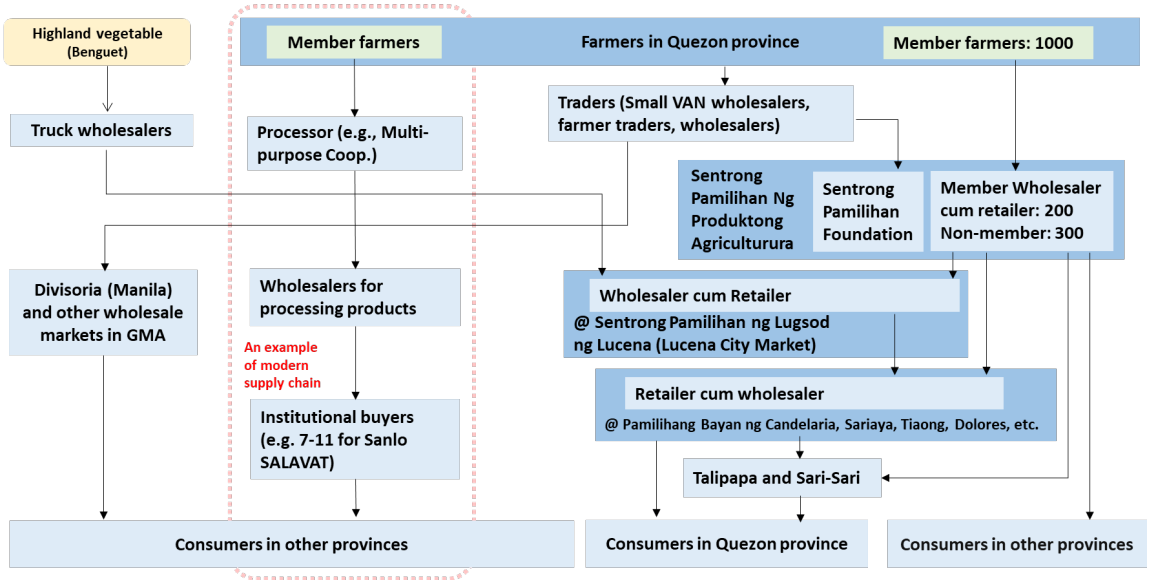


Figure 20: Supply Chain in Quezon Province

Source: Project Team

Table 23: Major stakeholders in Quezon Province

Stakeholder	Role
Trader (cum producers)	Buying produce directly from farmers near the farm gate and selling it to public marketplaces
Sentrong Pamilihan Ng Produktong Agricultura Sa Quezon Foundation Inc.	Management body of Sentrong Pamilihan Ng Produktong Agricultura
Wholesaler cum retailer	Having a stall in wet markets
Multi-purpose Cooperative	Cooperatives for producing, processing, and selling produce, and providing financing to farmers
Wholesalers for processing	Re-packing, branding, and selling produce to retailers
Institutional buyers	Supermarkets, moll, convenience stores, etc.
Talipapa	Small vegetable shops at the community level
Sari Sari store	Small grocery shops currently selling fresh vegetables and fish

Source: Project Team

Figure 21 shows monthly transacted volume and average price of five major vegetables at Sentrong Pamilihan Ng Produktong Agricultura. The monthly prices of vegetables fluctuate, responding to the transacted volume. The gap between the maximum and minimum price is three times for beans (yard long beans), five times or above for tomatoes, three times for bitter gourds, 1.5 times for dishcloth gourds, and five times for eggplants.

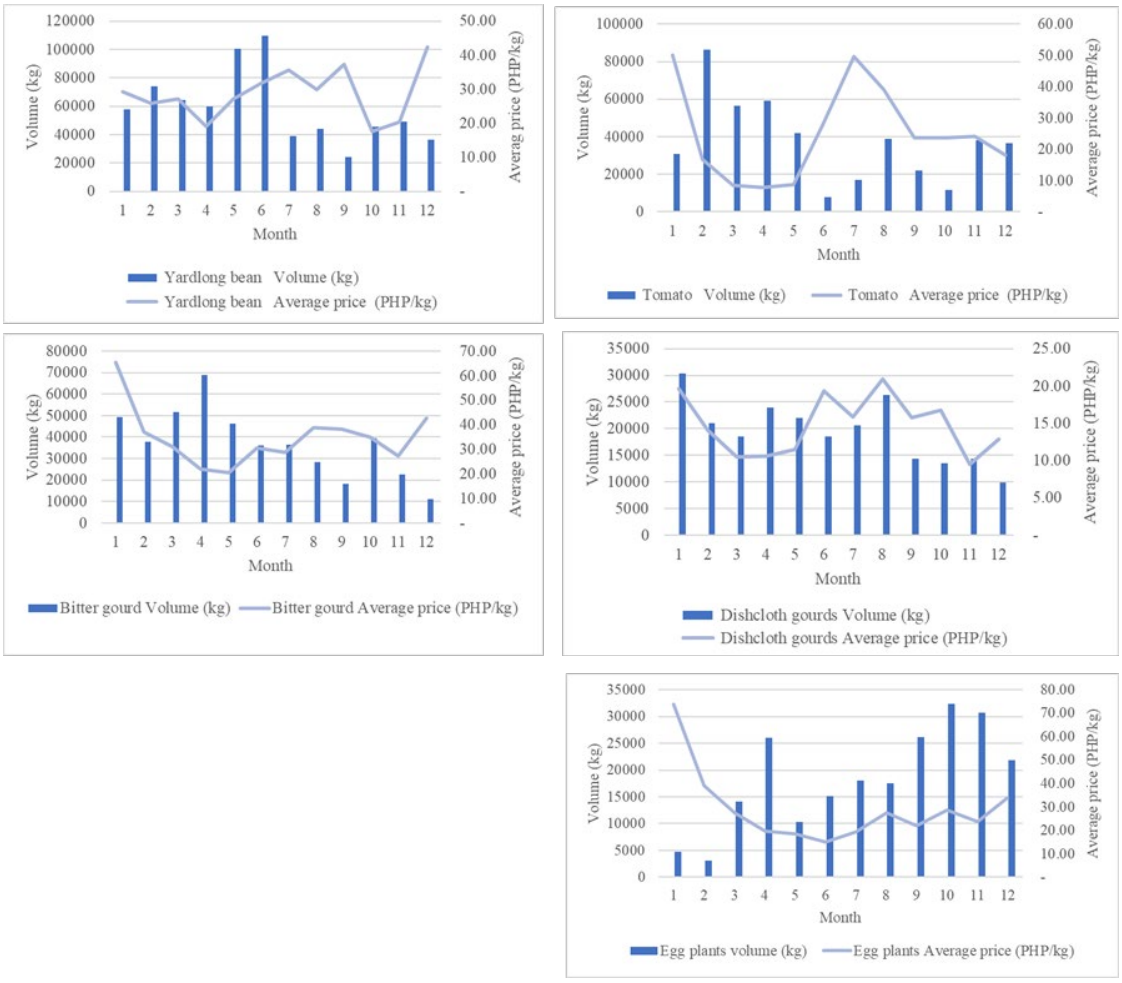


Figure 21: Transacted volume (kg) and average prices (PHP/kg) of five major vegetables in Sentrong Pamilihan Ng Produktong Agricultura

Source: Project Team, based on the data from SPPAQFI

A. Sentrong Pamilihan Ng Produktong Agricultura Sa Quezon Foundation Inc. (SPPAQFI)

The operational structure in the wholesale market in Quezon Province differs from that of BAPTC. SPPAQFI provides a fair and effective trading arena to its members (both farmers and wholesalers). The transaction flow of vegetables starts from member farmers to the foundation, then goes to member wholesalers.[37] As of May 2022, 46 regular staff operate the market with the revenue from member fees, commissions for transactions, rental charges for

[37] Approximately 1,000 wholesalers participate in trading there, and some 350 out of them borrow a space from the market and transact produce independently.

Table 24: Transaction flow of SPPAQFI

Collection	A member farmer sorts his or her vegetables in accordance with the SPPAQFI standards, then packs them in a plastic bag (10 kg per bag). A field staff registers vegetable data with a barcode reader and seals the barcode label on each plastic bag.
Pricing	A wholesaler requests SPPAQFI for the date of purchasing vegetables and their volume, and negotiates prices with a market staff member. In principle, SPPAQFI refers to the average of prices at three different markets in the provinces of Laguna and Batangas.
Selling agreement and payment	A field staff member provides a sales slip with the barcode data to both a farmer and a wholesaler. The wholesaler pays cash to a cashier at the market, and the farmer receives the payment on the same day.

Source: interview with SPPAQFI (10 March 2022)

marketplaces.

SPPAQFI offers a package of services to members, including a) selling support for vegetables, b) transportation by truck, c) financial support, d) technical assistance for vegetable production, e) organizing training and seminars, f) saving assistance (Forced Saving),[38] g) micro-savings, h) group deposit,[39] i) scholarships, and j) application support for agricultural insurance.

Regarding a) selling support, the foundation teaches the grading methodology to member farmers, employing the standard of grading, namely Good, Average, and Reject. In harvesting, foundation field staff and farmers decide the transaction time. If a farmer requests a transportation service, the foundation provides its truck on the day. Once the foundation receives vegetables from a farmer, the data (member farmer's name, vegetable, volume, price) are entered into the digital tracking system called ESL system,[40] which registers the data as a barcode for tracking. Table 24 shows the transaction flow managed by the foundation. The ESL system installed by the JICA project in 2012 still functions well despite it occasionally causing technical errors.[41] In addition, the foundation discloses the daily prices of vegetables on its Facebook page and operating the EC smartphone application.

B. Wholesaler/retailer at public marketplaces

This section reports on the status quo of wholesaler/retailers and retailers at public markets, based on the results of the qualitative survey.

[38] The foundation saves 55 cents per kg from sales to member accounts so that member farmers enjoy automatic savings.
[39] The deposit is used for emergency support or paying expenses for members.
[40] A Japan-based company, E-supportlink, Ltd. Introduced a barcode tracking system in the JICA project in 2012.
[41] E-supportlink, Ltd. plans to introduce a more flexible digital tracking system there. (22 June 2022)

A city-owned market, Sentrong Pamilihang ng Lugsod ng Lucena, is managed by 53 city staff. Approximately 700 wholesalers/retailers, and retailers use the market, and some 200 traders, 10% wholesalers and 90% retailers, out of 700 transact vegetables. A user pays PHP 1,500 per selling unit (4m^2). Most lowland vegetables are locally supplied, while highland vegetables come from Benguet.[42] Vegetables from the market, as well as the Sentrong Pamilihan Ng Produktong Agricultura Market are then distributed to the municipality-level markets at Candelaria, Sariaya, Tiaong, and Dolores.

At the public market in the Candelaria municipality, two wholesalers/retailers trade in vegetables, mainly from the lowlands. One of them uses cold storage, and if necessary, cooler boxes with ice cubes are used. The wholesaler/retailer has regular customers who recognize its high quality. The wholesaler/retailer minimizes vegetable loss to about 5%, by using cold storage. The 5% is added to the selling price of each vegetable. Damaged parts of vegetables are processed into cut vegetables.[43]

A wholesaler/retailer at the public market of Sariaya municipality owns a three-wheeled bike and carries purchased vegetables from Sentrong Pamilihan Ng Produktong Agricultura to the market. For instance, if 10 kg of cabbage is purchased at the price of PHP 400, its retailing price turns out to be double the price at most, PHP 600/10 kg. Typically, he purchases 40 kg of cabbage per day, and 10 kg is sold by himself; the remaining 30 kg is sold to retailers at the market for PHP 500. Before retailing, he removes damaged leaves of cabbage (2.5 kg, or 25% out of 10 kg bag) and sells the remaining 7.5 kg.[44] Taking the loss into consideration, he sells one kg of cabbage at the price of PHP 60/kg. A cabbage would be smaller after removing damaged leaves, but they prefer smaller and non-damaged cabbages to damaged ones.[45]

The COVID-19 pandemic significantly reduced the number of consumers in most public markets. What is worse, the manager at the public market of Tiong stated that the market lost about 60% of consumers owing to the pandemic and an increase in the petrol price. The number of inflow vegetables also dropped accordingly, and most retailers are have not recovered the dealing amount. The increase in small shops such as talipapa and Sari Sari stores began to display vegetables also led to decreased consumers at the public marketplaces.[46]

C. Small-scale grocery shops

As mentioned, in contrast to the decrease of consumers at public marketplaces, small-scale

[42] From an interview with a staff member of the Lucena market (7 March 2022)
[43] From an interview with a wholesaler/retailer at the Candelaria public market (8 March 2022)
[44] In the case of cabbage, a 10-kg plastic bag is a popular unit there.
[45] From an interview with a wholesaler/retailer at the Sariaya public market (8 March 2022)
[46] From an interview with a market manager at the Tiaong public market (8 March 2022)

grocery shops began to supply vegetables to consumers during the pandemic.

The owner of such a grocery store at Dolores has sold fresh vegetables and fish since 2020. She had to invest approximately PHP 30,000 to install shelves, a refrigerator, and fish tanks to accommodate new produce. She orders vegetables from three-wheeled bikes with a short message on a mobile phone, and the ordered vegetables mostly arrive at her shop around 6 a.m. The popular vegetables including morning glory, pechay, eggplant, onion, and garlic, are mostly sold in the morning.[47] The number of these Sari Sari stores has been increasing in other towns such as Candelaria and Tiaong, which have become competition to the public markets.

2) Pangasinan Province

Figure 22 shows the supply chain observed in the province of Pangasinan.[48] The Pangasinan Agri-Pinoy Trading Center (PAPTC) is the main trading area in the production area. In the next downstream, Urdaneta Agri-Pinoy Trading Post (UAPTP), Villasis Trading Post and the public market are aligned. At the end of the chain, small-scale retailers, grocery shops, and three-wheeled bikes distribute vegetables to consumers, as seen in the supply chain of Quezon Province.

Pangasinan is a leading producing area of onions. Thus, the two crop-specific facilities

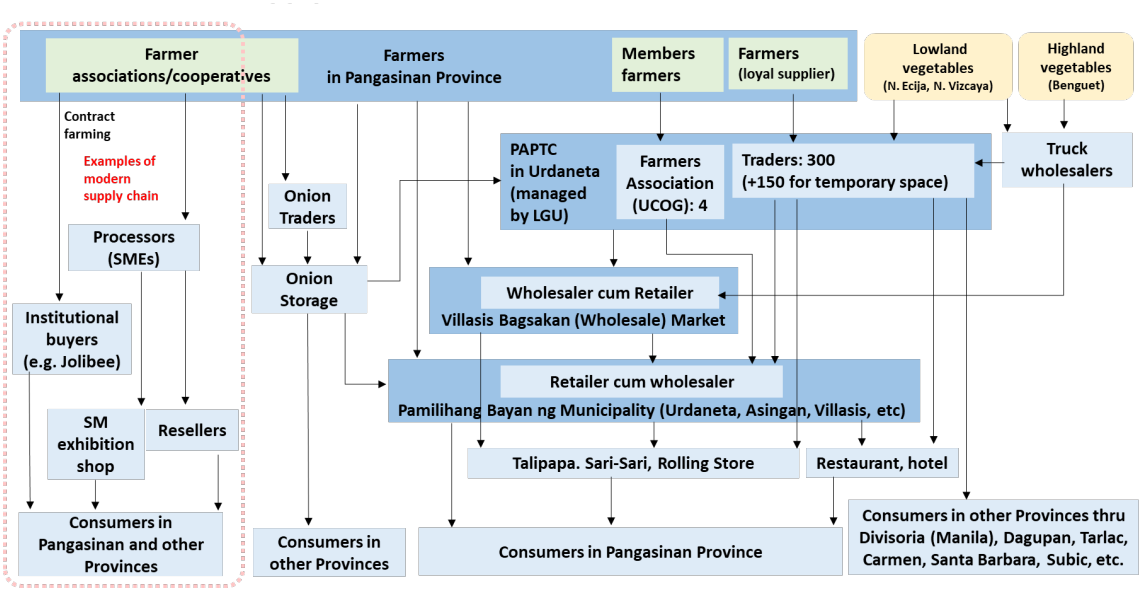


Figure 22: Supply chain of Pangasinan Province

Source: Project Team

[47] From an interview with s shop owner in Dolores (9 March 2022).
[48] The modern supply chain including processors and first food companies are included in the chain.

channel with collecting places and cold storage operate to store onions from the province and Nueva Vizcaya Province.

This section describes the status quo of wholesalers and farmers' associations related to PAPTC. In PAPTC, about 300 wholesalers and four trading corporations operate their businesses. The numbers of operational stakeholders vary according to the season, and between July and October, approximately 150 wholesalers trade vegetables at the marketplace.

A. Wholesalers

Wholesalers[49] have regular suppliers (farmers), and provide agricultural inputs or financial support prior to cropping. In harvesting, they conduct harvesting, sorting, packaging and delivery to PAPTC on behalf of the farmers. The wholesalers, who are more knowledgeable about the appropriate time of harvest and post-harvest handling, even make a cropping plan (selection of vegetables to be cultivated)[50] for those farmers. When they make the payment to the farmers, the wholesalers deduct the cost of agricultural inputs, financial support, and other expenditures. The merits and demerits of the "enclosure of farmers" offset each other. As an advantage, farmers are fully supported from cropping planning to selling. By contrast, the market channels, and therefore the opportunity to diversify their income sources, would be limited by the enclosure.

Those wholesalers sell their vegetables to truck wholesalers in the province and from Manila. The price is negotiated between both parties without intervention by PAPTC market management, which only monitors the daily prices.

A clear grading standard, including a guideline or format, was not observed at PAPTC. Through negotiation between sellers and buyers, the high quality vegetables is denoted by a premium price. In the case of bitter guard, the Good-rated produce was priced at PHP 50/kg, PHP 35-40/kg for Medium, and PHP 15-20/kg for Reject. Most vegetables are packed in plastic bags, either 10 kg or 20 kg per bag, except tomatoes which are packed in a plastic crate.[51, 52]

Back payment cases by truck wholesalers were reported, but the PAPTC did not intervene to solve the cases. As in other market places in Quezon and Benguet, wholesalers prefer cash

[49] Traders in PAPTC play a similar role as market facilitator seen in Benguet, but they are also engaged in harvesting support, transportation, collection, and financial support. Thus, this type of trader is categorized as a wholesale, instead of a market facilitator.
[50] From an interview with a DA officer at the Pangasinan Provincial Office (21 May 2022)
[51] From an interview with a wholesaler at PAPTC (21 March 2022)
[52] Tomatoes are easily spilled when crushed under their own weight, so they have traditionally been traded in wooden boxes and bamboo baskets called *kain*. Therefore, it is considered a natural progress that has shifted to use of plastic boxes.

transactions to pay farmers, which discourages them from employing a digitalized payment system.[53]

B. Pangasinan Vegetable Growers Association

PAPTC offers a free trading area to the Pangasinan Vegetable Growers Association (PVGA), which is composed of four agricultural cooperatives. The day-to-day management of the trading area is handled by the Urdaneta City Organic Farming Rice Corn Vegetable Growers Association (UCOG), an umbrella organization of PVGA. Farmers who belong to PVGA can sell their vegetables in the trading places with a fee of five percent of sales. Some farmers prefer to supply their produce to cooperatives, while other farmers still prefer the wholesalers to minimize their risk.[54]

Farmers using the PVGA's trading place sort their vegetables and pack them into plastic bags except for tomatoes, which are packed in plastic crates, and deliver them to PAPTC by themselves. The prices of vegetables are determined by the market staff of UCOG, who consider supply-demand circumstances and the prices of other wholesalers. The staff reported that around PHP 5/kg would fluctuate, responding to supply-demand. While no official grading indicators are applied, the stakeholders there prioritize uniformity in the size, color, and shapes of vegetables. If packed vegetables have no such uniformity, the staff may repack them at the trading place.[55]

[53] From an interview with a DA officer at the Pangansinam Provincial Office (21 May 2022)
[54] From an interview with a DA officer at the Pangansinam Provincial Office (21 May 2022)
[55] From an interview with a representative of Urdaneta City Organic Farming Rice Corn, Vegetable Growers Association (21 March 2022).

3) Nueva Vizcaya Province

Figure 23 shows the supply chain observed in Nueva Vizcaya Province.[56]

The Nueva Vizcaya Agricultural Terminal (NVAT) plays a key role as a market hub in the production area. Approximately 60% of vegetables come to NVATI from inside the province, and the rest is delivered from highland provinces such as Benguet. After NVAT, vegetables are delivered to public markets, then to end-users in the province, or distributed to other provinces and Metro Manila. In 2021, NVATI transacted 2,503.77 Mt of vegetables with a value of PHP 62,347,105.[57] The NVAT updates regular price data on its Facebook page, although the accessibility of the information is still low owing to a lack of Internet coverage in the province.

The following section states the business circumstances of major stakeholders at NVAT, i.e., market facilitators and Nueva Vizcaya Agricultural Terminal Inc. (NVATI), first. Then, mobile shops with three-wheeled bikes are described as key retailers.

A. Market Facilitators, and Nueva Vizcaya Agricultural Terminal Inc. (NVATI)

Most farmers who supply vegetables to NVAT are financially supported by market facilitators. Once market facilitators receive vegetables from those farmers, they negotiate the volume and price of them with a truck wholesaler; the negotiation typically ends with a commission of around PHP 10–40/kg. A facilitator settles payments to farmers by cash as soon

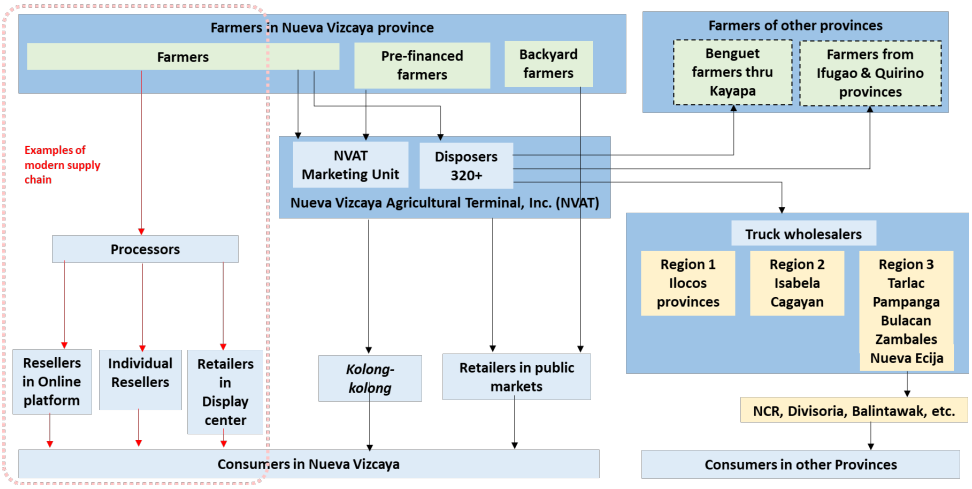


Figure 23: Supply chain in Nueva Vizcaya Province

Source: Project Team

[56] Some examples of modern supply chain via processors are also included in the figure.
[57] From a material provided by Nueva Vizcaya Agricultural Terminal, Inc., 2021

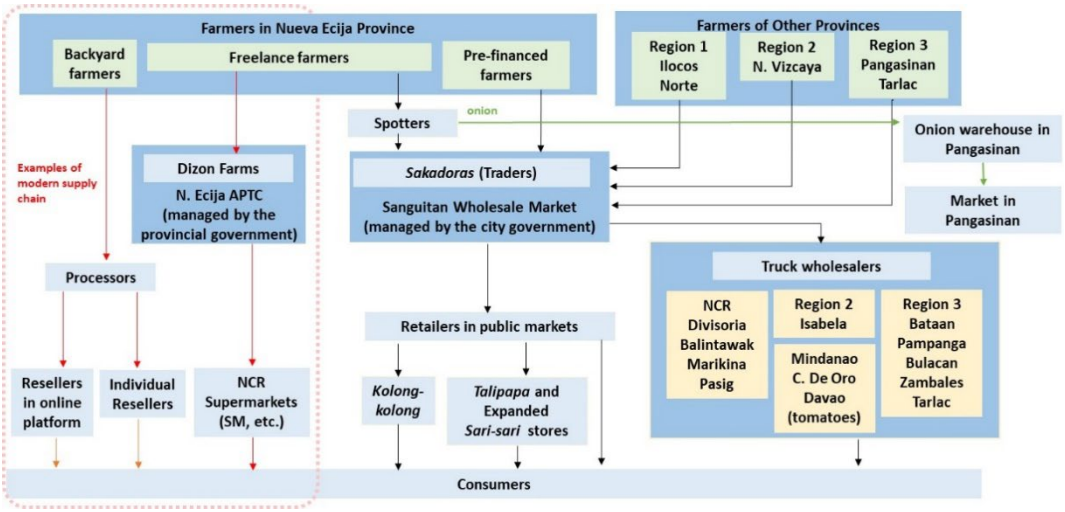


Figure 24: Supply chain in Nueva Ecija Province

Source: Project Team

as the negotiation with truck wholesalers is complete.[58]

NVATI is a joint venture cooperation funded by the private sector (81%) and governmental agencies (19%) such as DA, the province, and municipalities. A marketing unit internalized in the NVATI functions as a market facilitator, although the section charges PHP 1/kg to a farmer after a transaction. The unit cannot monitor market data (inflow and outflow volume and price) because of a lack of human resources.[59]

B. Mobile retailers with three-wheeled bikes

Mobile vegetables shops with three-wheeled bikes, locally called Kolong Kolong, emerged during the pandemic to deliver fresh vegetables to consumers. They move around and sell vegetables from a three-wheeled bike that carries vegetables on simple wooden shelves. Initially, the municipality office tried to regulate the mobile shops, but this type of retail shop was permitted later. The business is still operational as of March 2022.[60]

4) Nueva Ecija Province

Figure 24 shows the supply chain observed in the province of Nueva Ecija.[61] Nueva Ecija Agri-Pinoy Trading Center (NEAPTC) established by DA and the provincial government, and Sanguitan Vegetable Wholesale Market in the provincial capital, Cabanatuan, are the two

[58] From an interview with an NEAPTC officer (28 March 2022)
[59] From an interview with an NEAPTC officer (28 March 2022)
[60] From an interview with an NEAPTC officer (28 March 2022)
[61] Some players of modern supply chains such as Dizon Farms are included in the figure.

leading marketplaces in the province. Public markets and small retailers supply vegetables to consumers in the province downstream in the chain, after the two marketplaces,

A. Nueva Ecija Agri-Pinoy Trading Center

Nueva Ecija Agri-Pinoy Trading Center (NEAPC) started its operation in 2015 to function as a substitute marketplace for Sanguitan Vegetable Wholesale Market, but currently only two private wholesale companies do business there. NEAPC is equipped with solar-powered cold storage as well as trucks. The initial plan was to transfer stakeholders who use the Sanguitan Vegetable Wholesale Market to NEAPC; however, the transfer plan was neither approved nor implemented owing to the political rift between the municipality office and provincial government. During the COVID-19 pandemic, the provincial government invited Dizon Farms[62] in March 2020 and KLT Fruits in April 2022 to NEAPC.[63]

B. Wholesalers at Sanguitan Vegetable Wholesale Market and Spotters

Wholesalers, locally called sakadoras, purchase vegetables delivered from farmers at Sanguitan Vegetable Wholesale Market and then sell them to a truck wholesaler there. Notably, collectors, locally called spotters, wait on the street for farmers, who bring their vegetables and try to purchase the produce before the farmers enter the market. Farmers can choose their buyers, either sakodoras or spotters. Once a sakadora purchases vegetables at the market, they deliver them to the public markets, or markets in other provinces such as Blakang or Pampanga, or Metro Manila.[64]

5) Camarines Norte Province

Figure 25 shows the supply chain observed in Camarines Norte Province.[65] One of the main wholesale markets in the province, Camarines Norte Agri-Pinoy Trading Center: (CNAPTC), is managed by Labo Progressive Multi-purpose Cooperative (LPMPC). Apart from the channel (from other provinces and farmers from the province to CNAPTC), the public marketplaces receive vegetables directly from farmers in the province and other provinces although the provincial government mandates that all vegetable transactions in the province shall be conducted at APTC. The CNAPTC, with sufficient trading space and parking areas, is located in Talisay City, closely accessible to highways. Nevertheless, the marketplace is not fully used.[66]

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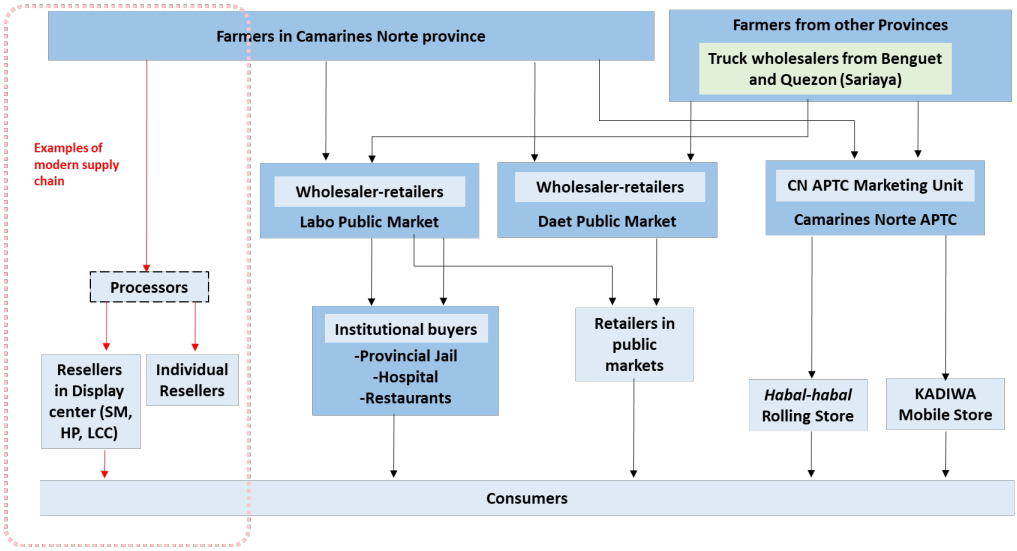
[62] A large-scale wholesaler who sells produces to major supermarkets in Metro Manila.
[63] From an interview with an NEAPC staff member (5 April 2022)
[64] From an interview at Sanguitan Vegetable Wholesale Market (5 April 2022)
[65] A case of processors is included in the chain.
[66] From an interview at CNAPTC (18th April 2022)

Figure 25: Supply chain in Camarines Norte Province



Source: Project Team

A. Labo Progressive Multi-Purpose Cooperative and Camarines Norte Agri-Pinoy Trading Center

Starting in 2020, LPMPC has operated CNAPTC where no other market facilitator is engaged in its transactions. In the initial operational plan, CNAPTC was supposed to transact 50 Mt of vegetables per day, but currently, the marketplace accommodates only about 300 kg/day. As seen in most other wholesale markets, member farmers bring their produce there and then sorting/grading, weighing, and packaging are done. The management body issues the sale slips, and invoicing and payment is completed. In sorting and grading, the vegetables are categorized into Good, Semi-Good, and Reject, based on size, shape, and color, but not based on formal indicators.[67]

The price of each vegetable is determined by LPMPC's market officers, referring to prices at Daet Market, and Town Market, as well as information from other APTCs. The market charge PHP 1 per kg of vegetables, and 25 cents are paid to farmers who bring the vegetables. Three major buyers, i.e., Habal-habal, KADIWA shop[68] funded by DA (about 50 kg per day), and other public markets (Daet and Lobo) by members of LPMPC,[69] purchase vegetables there. In addition, CNAPTC sells vegetables to the school lunch program of the Department

[67] From an interview at CNAPTC (18 April 2022)
[68] DA supported farmers on procuring small trucks and in a mobile market via KADIWA shop.
[69] This is not actual selling because the leftover vegetables are distributed to the markets.

of Education.[70]

B. Daet Market

Daet Market accommodates 988 shops, including 152 vegetables wholesale/retail and retail shops. In addition, 121 mobile shops are allowed to operate in the market. The public market receives both lowland and highland vegetables from other provinces as well, and invites a number of buyers from neighboring towns, unlike CNAPTC.

The market with various types of sellers and buyers is always overcrowded with a lack of security control, which leads to problems such as stealing. A spread of forged PHP 1,000 currency notes is another one of the serious security issues.[71]

6) Results of Qualitative Survey in Five Target Provinces (lowland vegetables)

This section reports the current situation of price fluctuation, cost, package, sorting/grading, fairness in pricing, and market information sources in the five target provinces where lowland vegetables are produced, based on the qualitative survey conducted by the Project Team.

A. Price fluctuation

As seen in Benguet Province, the survey reveals significant gaps between maximum and minimum pricing in purchasing and selling of major lowland vegetables, i.e., onions, eggplant, tomatoes, and squash (Figure 26).

B. Cost

Among operational costs, labor cost is the largest, above 50% for most stakeholders, followed by consumable costs, and transportation (Figure 27).

C. kage

Plastic bags (55%) and crates (32%) are mainly used for packaging. The crates are used only for tomatoes or other highly perishable vegetables (Figure 28).

D. Sorting and grading

As seen in Benguet Province, most of the vegetables are sorted based on size, shape, color, and damage (Figure 29). The simple grades, such as Good, Semi-Good, and Reject are also employed in several markets in the target provinces.

E. Fairness in pricing

Notably, above 90 % of target distributors were satisfied with pricing fairness, as also seen

[70] From an interview at CNAPTC (18 April 2022)
[71] From an interview at Daet Market (18 April 2022)

in Benguet Province. A few, around 3%, referred to the DA and APTC's information (Figure 30).

F. Market information source

Market information is mainly sourced from other stakeholders, as seen in Benguet while only a few informants (about 2%) referred to price information provided by DA or APTC (Figure 31).

Figure 26: Price gap between maximum and minimum buying/selling of onion in 2021

Source: Project Team

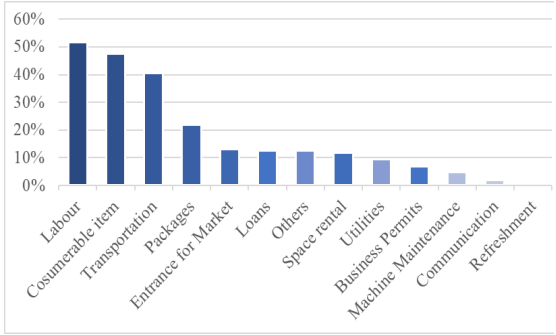


Figure 27: Adsf Cost structure in Distributors (average)

Source: Project Team

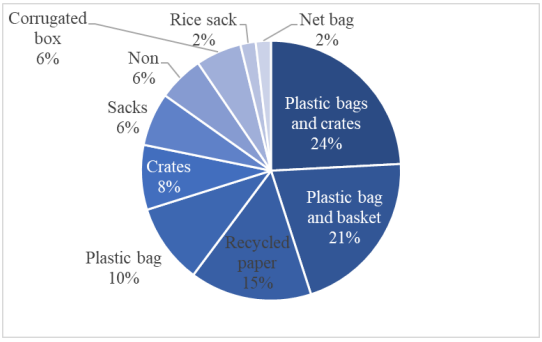


Figure 28: Package

Source: Project Team

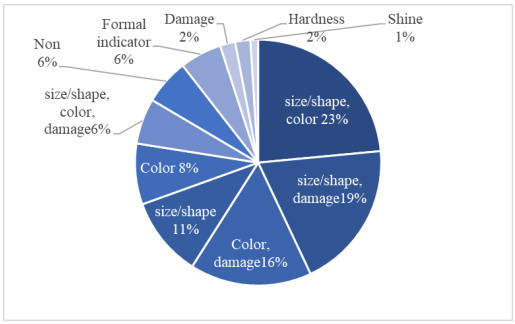


Figure 29: Sorting and Grading

Source: Project Team

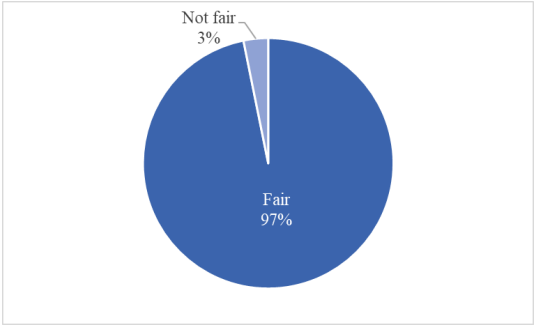


Figure 30: Fairness in pricing

Source: Project Team

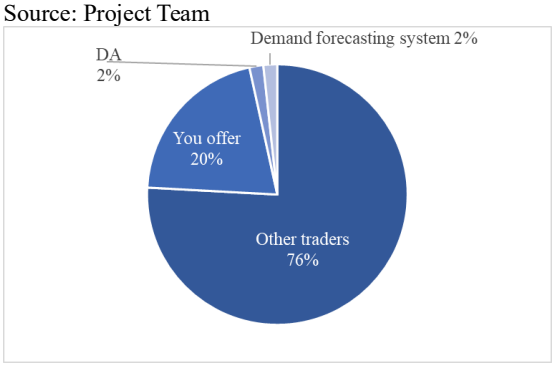


Figure 31: Sources of market information

Source: Project Team

7) Competitiveness of rural intermediaries in Quezon Province

Data of 19 intermediaries out of 21 were used for quantitative analysis after cleaning incomplete data.[72] Of 19 intermediaries, the data were obtained from 14 local traders who mainly assemble vegetables around the farmland (referred to as traders in this section). The remaining five intermediaries are wholesaler-cum-retailers, who transfer the vegetables to other public markets (referred to as market traders in this section). First, the basic information of sampled intermediaries in Quezon Province is shown in Table 25.

Table 25: Basic information on intermediaries in Quezon Province (average values)

	Traders	Market traders	Total
Gender (1: all male; 0: all female)	0.4	0.0	0.3
Age	44.4	55.4	47.3
Educational attainment (years)	10.3	10.2	10.3
Business experience (years)	11.5	25.0	15.0
No. of tradable vegetables	4.8	5.6	5.0
Monthly sales value (PHP)	534,475	321,948	478,547
Sample size	14	5	19

Note: Educational attainment is indicated as follows: elementary school = 6 years; junior high school = 9 years; high school = 12 years; university = 16 years; and graduated school = 18 years

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Source: Project Team based on the quantitative survey

[72] The data cleaning was conducted in the same way as in the case of Benguet Province.

For both types of intermediaries, the ratio of women is higher than that of men as well in the case of Benguet Province, average 68%. The average age of the total samples is 47 years; traders are younger (about 45 years old) than market traders. The average years of educational attainment is about 10 years. Although years of business experience as intermediaries is 15 years on average, market traders tend to have longer experience than traders. Both types of intermediary trade five types of vegetables on average. The monthly sales values of the samples were investigated to know the business scale of the intermediaries in Quezon Province. The table also shows that the business scale of the traders is larger than the market traders: the average sales value of market traders in a month is about PHP 0.32 million (about JPY 0.8 million); that of traders is about PHP 0.53 million (about JPY 1.3 million).[73] Therefore, traders are the leading actors in lower vegetable production areas. Meanwhile, the business scale of the traders is half the size in the case of Benguet Province.

Figure 32: Distribution of net margin ratios of intermediaries in Quezon Province (%)

Source: prepared by the Project Team based on the quantitative survey

The traders' competitiveness is shown in Table 26; the 14 traders compete appropriately with each other. Therefore, a hypothesis that local traders profit excessively by suppressing farmers cannot be supported by evidence. The average NMR of the traders is about -5.3% and equals 0 in the statistical test as illustrated in Figure 32, although the variation seems to be fairly large. However, the competitiveness of the market traders cannot be tested owing to the small sample size. Finally, when both samples are combined as one intermediary group, the average NMR is -8.5% and is also statistically confirmed as being in a competitive situation.

[73] PHP 1.00 = JPY 2.45. The same exchange rate is applied throughout this section.

Table 26: Summary statistics of intermediaries' competitiveness in Quezon Province (%, average values)

	Traders	Market traders	Total
Gross margin ratio	31.0%	20.7%	28.3%
Cost ratio	36.4%	38.0%	36.8%
Net margin ratio	-5.3%	-17.4%	-8.5%
Sample size	14	5	19

Source: Project Team based on the quantitative survey

Table 27: Compositions of unit costs covered by intermediaries in Quezon Province (%, average values)

Cost type	Type of labor costs	Traders	Market traders	Total
Labor costs		60.6%	54.8%	59.1%
	Owner	33.7%	45.9%	36.9%
	Family member	8.1%	30.4%	14.0%
	Waged labor	58.1%	23.6%	49.1%
Service costs without hired labor		27.4%	20.3%	25.6%
Asset costs (depreciation costs of assets if owned, otherwise rental costs)		11.5%	24.7%	15.0%
Capital costs		0.4%	0.2%	0.4%

Source: prepared by the Project Team based on the quantitative survey

For detailed analysis, the composition of local traders' unit costs is shown in Table 27. The majority of unit costs consists of labor costs, an average of 59.1%. However, the level is slightly lower by about 10% than those in the case of Benguet Province. Instead, the ratio of service costs is 25.6% on average, which is higher by 20% than the case in Benguet Province. Since the service costs are considered to be those of various services provided by local public markets, e.g., Sentrong Pamilihan Ng Produktong Agriculturura, it can be inferred that transforming intermediaries' cost compositions by public interventions would improve the market conditions in rural Quezon.

3.1.3 Consumption areas (GMA)

(1) Wholesalers

The supply chain in consumption areas is complicated and intricately layered compared to that of production areas. Vegetables pass through extended chains to end-users from Divisoria and Balintawak, which are the two leading wholesale markets in Metro Manila. Figure 33 shows the supply chain structure with major actors, including hub-wholesalers, wholesalers, and retailers.

This section outlines how vegetables are transacted in Divisoria and Balintawak markets, followed by various business cases of hub, and sub-wholesalers and retailers. The Divizoria and other markets as distribution facilities are also mentioned in "4.1.3 Distribution Facilities" later.

1) Divisoria Wholesale Market

The Divisoria wholesale market[74] is a major wholesale market in Metro Manila. The market was formed as a part of the Chinese town under the Spanish colonial era, and has gradually grown as a trading hub, not only in Manila but throughout the country as well. Currently, the market plays a role in the major wholesale market in supplying foods and other produces to residences in Metro Manila. In the market, vegetable wholesale shops are

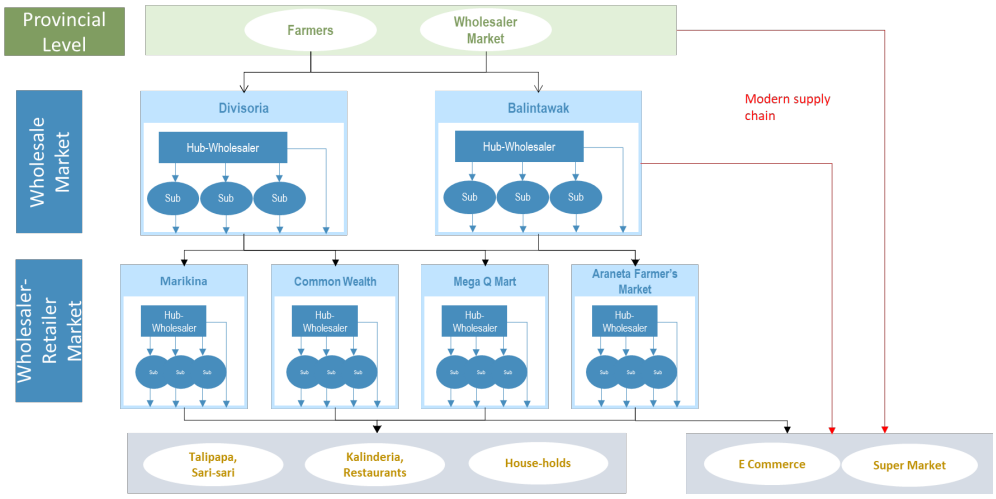

Figure 33: Supply chain in Metro Manila

Source: Project Team

[74] The traders in Divisoria Market were not cooperative to the survey, which made it difficult to obtain in-depth information.

established in specific zones such as Asuncion, Zabala, Sto Cristo, and Zaragosa. Approximately 500 wholesale shops[75] run their business in these zones; the Manila metropolitan city oversees the operations and collects service charges from these shops. Moreover, the Department of Public Order and Safety oversees the traffic since most transactions take place on the streets.

Most highland vegetables from BAPTC in Benguet Province, for instance, and lowland vegetables from PAPTC in Pangasinan Province are carried by a large truck to either C.M. Recto Street or Carmen Planas Street near the Divisoria. The transaction for these vegetables is conducted on these streets, which fall outside the boundary of the market.

Unloading is regulated at two times per day: between 1 a.m. and 5 a.m., and between 6 p.m. and 8 p.m. In 2016, most obstacles and tentative stand shops occupying the streets were removed, and only truck wholesalers' vehicles were permitted to enter the streets. A wholesaler transships the vegetables received from truck wholesalers to a truck parked in other parts of the market, which eventually proceeds to Manila or other areas.

2) Wholesalers in Divisoria Market

A wholesaler reported that, while he transacted tomato, eggplant, and bitter gourd in the past, currently he only trades squash.[76] He gave up trading tomato because the vegetable is highly perishable and requires sensitive handling. Around 10 to 15 truck wholesalers deliver 6,000–10,000 kg of squash per day from Apayao Province. The purchasing price is about PHP 15–29/kg, and the selling price is PHP 20–25/kg. Unloaded squashes are repacked into other bags, over visual grading on size and shape. Payments to a truck wholesaler and sub-wholesalers are settled by cash on the same day.

3) Balintawak Wholesale Market

Balintawak wholesale market is located in Epifanio de los Santos Avenue in Queson City, which is one of the busiest streets in Metro Manila. The entire plot is privately owned, and the market is composed of several divisions, such as Cloverleaf, Julianna, Gaiety, and Riverview.

The division of Cloverleaf, for instance, invites vegetables carried from all over Luzon. For this reason, most areas of the market are overcrowded. The unloading time is regulated twice a day, from midnight to early morning and during the evening, similar to the Divisoria wholesale market.

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[75] From an interview with a city officer who guided the market (16 March 2022)
[76] From an interview with a wholesaler at Divisoria Market (16 March 2022)

4) Farmer/Wholesaler in Balintawak Market

A wholesaler who works in the market also owns a farmland in Bulacan Province.[77] He belongs to a farmers' association and delivers vegetables produced by other member farmers. For shipping, he and his family members hire workers who harvest, sort, grade and eventually pack vegetables. He produces and sells tomato, bitter gourd, sweet potato, pea, chilly, pechay, bottle gourd, and cucumber. They are graded based on size and shape and have different price categories. As for bitter gourd, for instance, the first class is PHP 65/kg, second is PHP 40P/kg, and third is PHP 20/kg. The price of the first class occasionally skyrockets to PHP 200/kg; few customers purchase vegetables in the third class category.

The trader transacts vegetables with about 20 buyers. He receives orders by phone and estimates a vegetable's price in advance, although the final transacted price is determined at the market by referring to other information sources.[78] In the past, a trader would have a deal with a supermarket, but would cancel the transaction owing to a delay in payment from an intermediator. In principle, he requires cash payment on the transaction day, but allows credit payment for two weeks to one month for a reliable trader. Additionally, he uses digital payment systems, such as G-Cash, for his transactions. He reconfirms the quality of the vegetables after they arrive in Balintawak and re-packs them if any damage or quality deterioration is identified.[79]

His main buyers, sub-wholesalers, deliver his vegetables to Metro Manila or other cities, such as Paranaque, Pasig, Antipolo, or Cainta. He sells the produce to wholesalers inside the Balintawak market. Many other farmers' associations sell their produce there, which makes the prices highly competitive.

5) Hub and Sub Wholesale Markets

After Divisoria and Balintawak Wholesale Markets, the vegetables are distributed to the so-called hub or sub wholesale markets, such as Malikina market, Commonwealth market, Mega Q mart, and Arameta Farmers Market. This section introduces some wholesalers in these markets.

A. Wholesaler/retailer in Malikina Market

A wholesaler/retailer transacts both highland and lowland vegetables, either daily or every

[77] From an interview with a farmer/wholesaler at his farm in Bulacan Province (5 July 2022)
[78] From an interview with a farmer/wholesaler at his farm in Bulacan Province (5 July 2022)

second day.[80] An intermediator engages in transaction when purchasing vegetables from the Divisoria Wholesale Market. The respondent purchases vegetables directly from production areas, but the quality of those vegetables is not necessarily acceptable. Sometimes, when the purchase contains low quality vegetables, the respondent cuts these vegetables, and retails them as cut vegetables. However, some consumers, such as neighboring restaurants, avoid buying such vegetables owing to their low quality.[81]

B. Wholesaler in Arameta Farmers Market

A wholesaler transacts highland vegetables to retailers. Before the COVID-19 pandemic, the respondent would manage a restaurant; currently, operations and sale of vegetables to EC sites and other wholesalers in the Arameta Market are suspended. Typically, the wholesaler buys vegetables once a week and sells them throughout the week using a storage room in the shop. The respondent directly purchases vegetables from BAPTC, with a fixed rate-contract with a carrier, including a driver charge, toll, and parking. Owing to the fixed rate carrier, the current increase in petrol fee does not affect the expense. The selling price is determined by computing purchase price, labor cost, and transportation fee.[82]

6) Competitiveness of traders in NCR (Manila Metropolitan)

The data for 17 out of 19 traders' were used for quantitative analysis after

Table 28: Basic information on traders in Manila (average values)

	Hub-wholesalers	Sub-wholesalers	Total
Gender (1: all male; 0: all female)	0.4	0.3	0.4
Age	36.4	46.1	39.8
Educational attainment (years)	13.2	13.3	13.2
Business experience (years)	14.0	15.8	14.7
No. of tradable vegetables	4.5	8.8	6.0
Monthly sales value (PHP)	2,566,936	320,767	1,774,171
Sample size	11	6	17

Note: Educational attainment is indicated as follows: elementary school = 6 years; junior high school = 9 years; high school = 12 years; university = 16 years; and graduated school = 18 years.

Source: Project Team based on the quantitative survey

[80] Depending on the freshness of vegetables, the frequency of trading might be less.
[81] From an interview at Malikina market (21 March 2022)
[82] From an interview at Araneta Market (18 March 2022)

cleaning out the missing data.[83] These data are from 11 hub-wholesalers and six sub-wholesalers. The basic information of the intermediaries sampled for the analysis is illustrated in Table 28. Here are a few findings: the ratio of male in all wholesalers is an average of 41%, which is higher than that of rural areas.

Especially, the male share in hub-wholesalers is high (average 46%); age of wholesalers is an average of 40 years, which is seven years younger than that in rural areas. Specifically, the age of hub-wholesalers is about 36 years and seems to be lower than that of sub-wholesalers. In addition, years of educational attainments is 13 years and exceeds that of rural areas by three years.

Table 29: Summary statistics of traders' competitiveness in Manila (%, average values)

	Hub-wholesalers	Sub-wholesalers	Total
Gross margin ratio	25.2%	38.7%	30.0%
Cost ratio	17.3%	38.1%	24.6%
Net margin ratio	7.9%	0.5%	5.3%
Sample size	11	6	17

Source: Project Team based on the quantitative survey

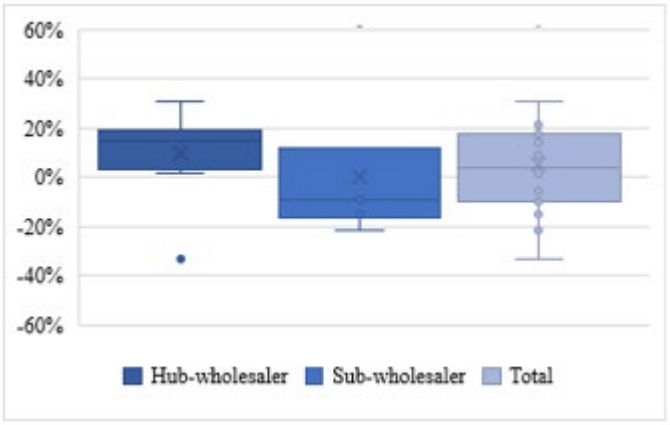

Figure 34: Distribution of net margin ratios of traders around vegetable consumption area in Manila (%)

Source: Project Team based on the quantitative survey

On the other hand, business experience as traders tends to be shorter than rural areas, with an average of 14.7 years for the total number of traders and 14.1 years for hub-wholesalers. The number of tradable commodities for hub- and sub-wholesalers are 4.5 and 8.8, respectively, although the level for the former is the same as that for rural areas.

It coincides with an observation that sub-wholesalers often sell vegetables to consumers, similar to retailing. Furthermore, monthly sales values are investigated to know the business scale of the wholesalers: the average sales value of hub-wholesalers in a month is about PHP 2.57 million (about JPY 6.3 million); that of sub-wholesalers is about PHP 0.32 million (about JPY 0.8 million).[84] Therefore, hub-wholesalers who usually receive various vegetables from

[83] The data cleaning is conducted in the same way as in the case of Benguet Province.
[84] PHP 1.00 = JPY 2.45. The same exchange rate is applied throughout this section.

nearly all areas in the Philippines show the biggest business scale among intermediaries on traditional value chains.

Because of traders' competitiveness as shown in Table 29, hub-wholesalers compete with each other. The average NMR of the 11 hub-wholesalers is about 7.9% and equals to 0 with the statistical test as illustrated in Figure 34. Moreover, the competitiveness of sub-wholesalers cannot be tested because of the small sample size. Finally, when the samples of hub- and sub-wholesalers are combined, the average NMR is 5.3%, statistically confirming a competitive situation.

For detailed analysis, both wholesalers' unit costs were broken down into each element in Table 30. The majority of unit costs is occupied by labor costs, with an average of 56%, while the level is slightly lower than for those in rural areas. Moreover, ratios of service and capital costs are clearly higher than those in rural areas. The latter costs are required for cash settlement in the survey area. It can be considered that settlement by wholesalers would work well for establishing wholesale markets in Luzon Island.

Table 30: Compositions of unit costs covered by traders in Manila (%, average values)

	Type of labor costs	Hub-wholesalers	Sub-wholesalers	Total
Labor costs		53.8%	60.3%	56.1%
	Owner	23.2%	31.8%	25.9%
	Family member	4.0%	12.3%	6.6%
	Waged labor	72.8%	56.0%	67.5%
Service costs without hired labor		32.0%	33.7%	32.6%
Asset costs (depreciation costs of assets if owned, otherwise rental costs)		11.5%	4.4%	9.0%
Capital costs		2.6%	1.6%	2.2%

Source: Project Team based on the quantitative survey

(2) Retailers and Restaurants

In contrast to wholesalers in production area, retailers in Metro Manila, who directly deal with consumers, do not necessarily belong to traditional and modern value chains. Instead, they use both channels. Therefore, retailer activities are described here without dividing them into modern and traditional channels.

The actors who directly contact consumers can be classified into traditional and modern actors on the basis of their origin. Traditional retailers include (1) retailers in the wholesaler market, (2) retailers in the retailer market, and (3) small-scale vegetable stores called *Talipapa* scattered outside the market.[85] They mainly procure the produce from wholesalers belonging to traditional channels. Because they are small businesses, are privately owned, and rely on outside sources for funding, they cannot secure vegetables through modern channels, such as contract farming. The traditional actor of the eatery is the *Karenderia*[86] that Filipinos use on a daily basis. Additionally, some vegetables are procured from traditional wholesalers and retailers.

Modern retailers include supermarkets[87] and convenience stores. Supermarkets primarily source vegetables through non-traditional channels while they partially procure vegetables in limited supply from wholesalers and other suppliers of traditional distribution. Modern restaurants include (1) restaurants for high- and middle-income groups and foreigners, (2) restaurant chains, including fast food restaurants, and (3)

Table 31: Sources of vegetables for retailers and restaurants in Metro Manila

	Actor	Traditional Channels	Modern Channels
1)	Retailers in Wholesaler Markets Retailers in Retailer Market Small-Scale Vegetable Stores (*Talipapa*) Street sellers and ambulant sellers	YES	NO
2)	Small-Scale Eateries (*Karenderia*)	YES	NO
3)	Supermarkets	YES	DEPENDS
4)	Restaurants Restaurant Chains including fast food restaurants Hotels	YES	YES

Note: YES means they are procuring vegetables through this channel, NO means they are not, DEPENDS means they are sometimes doing so, and sometimes they are not.
Source: Interviews with related stakeholders by the Project Team

[85] *Talipapa* is a vegetable retailer managed by individuals.
[86] *Karenderia* is an eatery mainly managed by individuals.
[87] The Project Team visited and directly observed stores such as Puregold, Robinsons, SM Market, Rustan's, Walter Mart, Metro, Land Mark, and Xentro Mall for the study.

hotels. They procure vegetables from both traditional and modern channels, depending on the type and scale of their business (Table 31).

1) Retailers in Retailer and Wholesaler Markets and Small-Scale Vegetable Stores

Traditional retailers in the retailer/wholesaler markets and small-scale vegetable stores outside the market procure vegetables in plastic bags from wholesalers, and discarded the plastic packaging before displaying them for sale in their stores.[88] However, there are mobile vendors who sell the produce on three-wheeled motorcycles,[89] street sellers, or ambulant sellers, signifying that traditional retailers do not necessarily have fixed stores. Those with stores sell the produce to middle- and high-income groups, while mobile vendors sell it to lower-income groups.

A. Variety

Retailers in Metro Manila handle both highland and lowland vegetables, while wholesalers in traditional wholesaler markets are tied to the market of origin and divided into highland or lowland vegetables.[90] Additionally, many stores provide cut vegetables, meeting the needs of urban consumers who have limited time for cooking. Cut vegetables are a mixture of several vegetables and are usually sold in sachets in culinary combinations such as *pinakbet* (a lowland vegetable dish)[91] and *chopsuey* (a highland vegetable dish).[92] Retailers specializing in the sale of cut vegetables devote about half of their sales floor to such vegetables.[93]

B. Procurement

Retailers procure vegetables from wholesalers, mainly at wholesale markets, such as Divizoria and Balintawak.[94] Vegetables purchased from wholesalers are transported to stores in small trucks across different markets and to carts within the same market. Procurement at the wholesaler market is done in person or through a dealer. Some retailers procure vegetables from other retailers, indicating that there can be an additional layer of transaction in the value chain.[95] This is the same procurement model as in a wholesaler market, where sub-wholesalers

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[88] During the lockdown to prevent the spread of COVID-19, small grocery stores (*Sari Sari Stores*), which were relatively accessible, started selling vegetables and fruits.
[89] During the lockdown, ambulant sellers by three-wheeled motorcycles also emerged.
[90] Interview with a retailer in Marikina Market, which is a retailer market (21 March 2022)
[91] Stir-fried vegetables such as garlic, onion, ginger, eggplant, bitter gourd, okra, green beans, tomatoes, and squash with pork and salted mysid shrimp as seasoning
[92] Stir-fried pork with vegetables such as chayote, broccoli, cabbage, carrots, onions with thickened sauce
[93] Direct observation by the Project Team (February–July 2022)
[94] Interview with a retailer in Marikina Market (21 March 2022)
[95] Interview with a retailer in Marikina Market (21March 2022)

who do not have the means for procurement rely on hub-wholesalers who have the ability to procure vegetables from outside of the market.

In contrast, retailers go directly to the wholesaler market on the production side and purchase from disposers/market facilitators and truck wholesalers. They procure vegetables themselves or through their family members. This is a more efficient procurement mechanism, which bypasses the multilayered transaction stages at the retailer market in the consumption area while using traditional distribution.

C. Price

The buying price depends on the wholesale market price, which in turn depends on the supply and demand situation during that time of the year. Price fluctuations can be as large as an 8-fold difference between the highest and lowest prices.[96] Retail prices are changed daily accordingly. As for the selling price, interviewed retailers have stated that "they can buy vegetables at the same price anywhere in this retail market," suggesting the possibility of price uniformity among these retailers.[97] It is unclear whether this is because hub- and sub-retailers in a supply relationship need to avoid competition, or whether this is simply an arrangement to suppress competition between retailers. This is not the case in small-scale vegetable stores outside the market.

Nonetheless, the results of the quantitative survey of distributors in Metro Manila, as already reported, demonstrate that the hub-wholesalers are sufficiently competitive.

D. Quality

The results of interviews with wholesalers[98] indicate that retailers for middle- and high-income groups, such as retailers in wholesaler markets and those in retailer markets and and small-scale vegetable stores, mainly purchase vegetables that wholesalers classify as Class A products.[99] In contrast, retailers for low-income groups, such as street sellers, purchase grade B and C products.[100] Although transactions are implemented based on these grades, quality varies even among the A-grade products. Additionally, some wholesalers intentionally mix different grades of vegetables into Grade A bags so that it is difficult to identify them. This makes transactions inefficient because buyers need to judge the quality of the vegetables based on their experiences and observations and surmise accordingly. It is then necessary to establish

[96] Interview with a wholesaler in Balintawak Market, which is a wholesaler market (17 March 2022)
[97] Interview with a retailer in Marikina Market, which is a retailer market (21 March 2022)
[98] Interview with a wholesaler in Balintawak Market, which is a wholesaler market (17 March 2022)
[99] In the wholesale and retail markets in Metro Manila, vegetables are sorted by grade: Grade A, Grade B, and Grade C.
[100] Interview with a wholesaler in Balintawak Market (17 March 2022)

a relationship with a reliable wholesaler. If the quality of procurement cannot be guaranteed, attempts to ensure quality at the storefront will lead to the hassle of re-sorting the vegetables and, in the worst case, discarding them.

The quality of vegetables placed on store shelves is diverse at different stores from the Japanese viewpoint. Retailers do not sell all procured vegetables on the same day as that of purchase, but rather purchase them regularly and sell them out over several days.[101] Therefore, the quality of vegetables declines with time after procurement. It could not be confirmed that discounts are given as freshness declines, which is a different arrangement from the one used for perishable foods, such as seafood and meat, where prices decline on an hourly basis due to rapid decline in freshness. In the case of vegetables, those or parts of the vegetables that are old and could still be edible are processed into cut vegetables so that the decline in quality cannot be discerned and consumers can easily pick them up.[102] However, as the owner of a small-scale eatery stated, "I don't buy cut vegetables because they are not fresh enough," it can be assumed that it is generally known that cut vegetables lose their freshness.[103]

2) Small-Scale Eateries (*Karenderia*)

A traditional small-scale eatery (*Karenderia*) as a typical restaurant is a small-scale restaurant set up on the roadside near the market. It consists of cooking, dining, and cashier areas. They have 10 or fewer seats. These eateries procure vegetables from nearby traditional wholesaler and retailer markets.[104]

A. Variety

Typical Filipino dishes, such as *pinakbet*, *chopsuey*, and *pancit guisado*[105], are often served with rice. These dishes are a combination of vegetables, meat, and seafood; they are an effortless way to consume vegetables. However, many restaurants do not have any vegetable dishes on their menus; they have only meat and seafood dishes and no vegetable accompaniments. Therefore, the small-scale eateries are not necessarily a good place to consume vegetables in some cases.

B. Procurement

Since the amount of vegetables procured is small, the owners themselves go to wholesaler

[101] Interview with a retailer in Marikina Market (21 March 2022) and an interview with a retailer in Araneta Farmer's Market, which is a retailer market (18 March 2022)
[102] Direct observation by the Project Team (February–July 2022)
[103] Interview with an owner of small-scale eatery near Marikina Market (21 March 2022)
[104] Interview with an owner of small-scale eatery near Marikina Market (21 March 2022)
[105] Fried noodles stir-fried with such ingredients as garlic, shiitake mushrooms, onions, carrots, celery, cabbage, chicken, and shrimp in oyster sauce or other sauce.

or retailer markets by tricycle cab to procure them.[106]

C. Price

Buying prices are subject to market prices, as are retailers.

D. Quality

Quality must be assured by the buyer through connoisseurship and mutual trust, as in the case of the retailer. If the quality of the procured product does not meet their own requirements, it may require that the buyer re-sort at the cooking stage and discard the vegetables.

3) Supermarkets

Supermarkets can be categorized as retailers targeting high/middle-and lower-income groups. Supermarkets are also part of chains[107] or large mall complexes[108] managed by modern corporations. These companies lease their vegetable sales areas (concession) to outside distributors (so-called concessionaires), who procure the produce themselves, display them on the shelves, sell them, and then give a portion of the proceeds to the supermarket.[109]

A. Variety

The contract with the supermarket and concessioner determines the target items and quantities; concessioners procure, deliver, display, and sell the vegetables accordingly. The selection of items and quantities varies depending on the customer's income level. Stores for higher-income groups offer a larger quantity and variety of vegetables. In stores targeting lower-income groups, the quantity, product variety, and variety of production areas are lower. A few stores do not sell any fresh vegetables at all.[110] The person in charge for vegetable procurement in a supermarket's procurement department feels the demand for vegetables to be stagnant; instead, he sees it as declining. This is due to the rising prices of vegetables. Even within this context, the demand for onions, garlic, and highland vegetables is stable.[111]

Cut vegetables are sold in most stores. Processed foods in the Philippines are limited in variety and quantity compared to Japan, and stores that target higher-income groups offer more of them than stores that target lower-income groups. Frozen foods are also available in limited variety, but in larger quantities than other processed foods, even in stores for low-income

106 Interview with an owner of a small eatery near Marikina Market (21 March 2022)
107 For example, Robinsons, Puregold, Waltermart, SM Markets, and Metro are popular supermarket chains.
108 For example, Land Mark, SM Mega Mall, and Greenbelt are popular mall facilities.
109 Interview with personnel in charge of vegetable procurement at Puregold, a major supermarket chain (1 July 2022)
110 Direct observation by the Project Team (February–July 2022)
111 Interview with personnel in charge of vegetable procurement at Puregold (1 July 2022)

consumers.[112] This suggests that consumers seek convenience while storing vegetables.

B. Procurement

Supermarket procurement personnel do not have a good grasp of specific information on suppliers, procurement routes, production areas, transaction prices, and terms and conditions. Additionally, since supermarkets and stores usually have contracts with multiple concessionaires, the latter do not have an overall picture of the vegetables handled by the supermarkets either.[113] A supermarket chain representative targeting the middle-income group assumes that concessionaires coordinate vegetable supply through a combination of contract cultivation, procurement at the wholesaler market in the production area, and procurement at the wholesaler market in Metro Manila. When interviewed, the concessioner stated that traditional distribution takes place in response to disasters and other emergencies, and it is presumed that procurement from traditional channels plays a complementary role in adjusting supply and demand.[114] However, the ratio of dependency on contract cultivation and market procurement is unknown. Furthermore, fruits and a few legally permitted vegetables are procured through imports.[115]

C. Price

For concessionaires, the procurement price is constant because it depends on the contract amount if the product is from farmers under a contract farming system. The procurement price is subject to market price fluctuation if the vegetables are procured at the wholesale market in the production area or the wholesale market in the consumption area. Supermarkets do not permit concessionaires to adjust selling prices daily, and they review the prices on a regular basis, typically twice a week.[116]Therefore, depending on price fluctuations, shelf renters may increase their sales profit, but they also run the risk of loss. The supermarket only collects the concession fee from the sales amount and does not bear the risk.

D. Quality

According to the results of interviews with wholesalers, supermarkets and concessionaires do not select vegetables based on the criteria of grade A, B, or C. They assess the quality based on whether the vegetables meet the specifications set by the supermarkets. In addition to the concessionaires conducting the selection process again, the supermarkets conduct sampling

[112] Direct observation by the Project Team (February–July 2022)
[113] Interview with personnel in charge of vegetable procurement at Puregold (July 1, 2022)
[114] Interview with personnel at Dizon Farm, a major concessionaire (22 July 2022)
[115] Interview with personnel in charge of vegetable procurement at Puregold (1 July 2022)
[116] Interview with personnel in charge of vegetable procurement at Puregold (1 July 2022)

inspections twice a week.[117]

On the shelves, the only distinctions made regarding quality are "branded" and "unbranded" products and "organic" and "non-organic." It should be noted that branded products are not classified according to production areas or producers, but refer to vegetables that are provided by specific concessionaires. According to supermarket personnel, consumer interest in chemical reduced- and chemical free-vegetables is growing, but they do not see a boom in the market because of high prices.[118]

Direct observation of shelves from the perspective of Japanese consumers reveals that heavily damaged produce, produce with few edible parts, and that with many insect infestations stand out even in stores that target higher-income groups. In particular, many leafy vegetables lose their freshness due to the effects of prolonged storage in plastic bags. Additionally, a few rotten products can be found. There are a few stores that sell only good-looking vegetables, but they are few in number.[119] Supermarket personnel too see the loss of quality during transportation as a concern.

4) Restaurants, Chain Restaurants, Hotels

A. Variety

In addition to traditional Filipino cuisine, there are several diverse types of restaurants in Manila, including Asian, western, and fast-food restaurants. Each restaurant offers a diverse menu as per their concept. Restaurants for high-income groups, whether Filipino or not, offer a wide variety of vegetable-based dishes. These restaurants serve both cooked vegetables and raw vegetables. With the recent boom in Korean cuisine, several new opportunities to eat raw leafy vegetables have emerged. Restaurants for lower-income groups, such as traditional restaurants, tend to serve less vegetables and more rice, rice noodles, meat, and seafood.[120]

B. Procurement

Restaurants, restaurant chains, and hotels, as mentioned above, may use either traditional or modern channels to procure vegetables. Bigger restaurants tend to use modern channels, such as contract farming, while smaller ones tend to use traditional channels because they do not have the volume for contract farming or the space to manage farmers.[121]

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[117] Interview with personnel in charge of vegetable procurement at Puregold (1 July 2022)
[118] Interview with personnel in charge of vegetable procurement at Puregold (1 July 2022)
[119] Direct observation by the Project Team (February–July 2022)
[120] Direct observation by the Project Team (February–July 2022)
[121] Interview with the owner of a restaurant in Manila (29 June 2022)

Restaurant chains (fast food)[122] use both modern and traditional channels to adjust the procurement volume. The proportion of traditional procurement to modern procurement may depend on the chain; however, traditional channel is more important. Although contracts determine a certain volume of supply for farmers based on demand forecasts, this cannot be achieved for various reasons in a few cases. In such cases, the shortfall is made up from traditional distribution through consolidators and disposers. Although direct transactions with farmers (modern channel) improve the quality of vegetables, procurement in traditional markets (traditional channel) is more convenient in terms of stable supply. In addition, the contract between the restaurant chain and the farmer is not necessarily exclusive; that is, the farmer does not have to supply all the harvest and has room to sell it through other channels. The restaurant chains also provide technical support and other services with direct transactions, indicating that they see significance of this support as a corporate social responsibility (CSR) activity.[123]

Smaller family-owned restaurants and hotels that do not have many branches procure their products in the traditional market through consolidators. Restaurants and consolidators do not enter into a formal contract; they build on the relationship of kinship and trust (so-called "suki"). Consolidators procure vegetables in wholesaler markets, such as Divisoria and Balintawak, as well as retailer markets for high-income consumers, such as the Araneta Farmers' Market. Consolidators and restaurants typically have a long-term business relationship, and the consolidator procures, transports, and delivers based on orders received from restaurants the day before.[124] Quality decisions are left to the consolidator; therefore, it is important for the restaurant's operations that the consolidator is reliable. In addition, restaurants catering to higher income groups may procure vegetables from modern corporations that grow hydroponic vegetables.

C. Price

If they rely on contract farming, as the concessionaires mentioned earlier do, procurement prices for restaurants, restaurant chains, and hotels are fixed based on the contract. However, they are also subjected to market price fluctuation if they buy vegetables from the wholesaler market in the production area or the wholesale market in the consumption area. Restaurants targeting higher-income customers tend to be less concerned about the cost of food and

[122] For example, Jollibee, Chowking, and Mang Inasal, as well as foreign-affiliated chain restaurants are popular among consumers.
[123] Interview with personnel at the Jollibee Group foundation whose restaurant chain, Jollibee, is a popular restaurant chain (19 July 2022)
[124] Interview with the owner of a restaurant in Manila (29 June 2022) and an interview with a retailer in Araneta Farmer's Market (18 March 2022)

beverages, and an interviewed restaurant rarely places restrictions on the cost of procurement to procure quality vegetables.[125]

D. Quality

Restaurants, restaurant chains, and hotels have relatively strict standards for quality because trust in the corporation and the reputation as a brand are important. In addition to inspection at the delivery, they check the quality of vegetables at the cooking area. If any vegetable does not meet quality standards, it is either returned to the consolidator or discarded. It is relatively easy to guarantee quality in the case of direct transactions with farmers because intervention is possible from the cultivation stage. The interviewed restaurants, restaurant chains, and hotels promote GAP to improve quality. This is a major difference from traditional distribution, where the name GAP itself is hardly known.

5) Issues and Obstacles

Based on the above status quo, the challenges for retailers and restaurants to address are as follows.

[125] Interview with the owner of a restaurant in Manila (29 June 2022)

Table 32: Issues and Obstacles to Retailers and Restaurants

	Relevant party	Issue
1)	Retailers in wholesaler markets, retailers in retailer markets, small-scale vegetable stores (*Talipapa*), street sellers and ambulant sellers	(1) If they do not have the network and human resources to conduct procurement on their own, they need to rely on procurement from surrounding retailers, which increases the layer of transactions. (2) Fluctuation of buying prices is severe. (3) Price competition among retailers is not sufficient. (4) The buyer needs to be a connoisseur to select vegetables because the grading standards are inexact. (5) It is necessary to rely on relationships of trust with suppliers because wholesalers sometimes intentionally mix different grades. In such case, re-sorting is necessary. (6) The quality of vegetables deteriorates because of the long storage period in the retailers. (The vegetables with deteriorated quality are sold as cut vegetables.)
2)	Small-scale eateries (*Karenderia*)	(7) The variety of dishes with vegetables tends to be limited. Issues (2) (4) (5) are also common.
3)	Supermarkets	<Supermarkets> (8) Procurement and sales are left entirely to concessionaires, and supermarkets do not have a complete picture of procurement. (9) Even stores targeting higher income groups and brand-name products do not necessarily keep vegetables fresh. (10) Quantity and variety of vegetables are limited. (11) Quantity and variety of processed products made of vegetables are limited. (12) Sales volume does not increase because of the rising prices of vegetables.
		<Concessionaires> (13) Contract cultivation alone is not sufficient to meet demand, and procurement from traditional distribution sources is necessary. Issues (2) (4) (5) are also common.
4)	Restaurants, restaurant chains, and hotels	(14) It is difficult to adapt to contract farming depending on the scale of the business. Issues (2) (4) (5) are also common.

Source: Project Team

3.2 Modern Channels

(1) Contract farmers

1) Contract farming

Among the private farmers in the surveyed area, the number of farmers with contract farming is limited. According to the qualitative survey, there are only two such farmers in Benguet, and one farmer each in Quezon and Pangasinan. Of these, the ones with a

documented contract wish to continue contract farming. Moreover, those with only verbal contract do not wish to continue. The intention to continue contract farming is confirmed when the contract is not a verbal one, and the shipping quantity, price, measures to take in case of violation of the contract are clearly written. It does not depend on whether sales to others are permitted or not. The farmers in Benguet who have a contract with Company A are dissatisfied because the purchase price is kept low despite the soaring input material prices. Another example of contract farming was a verbal contract with a tomato paste processor in Pangasinan. The contract was cancelled in three to four months because the farmers could not meet the contractor's demand. In Camarines Norte, one of the major wholesalers, Company B wanted contract with the farmers, but no farmers were interested at that time. Company B reportedly wanted to have contracts for any kind of vegetables.

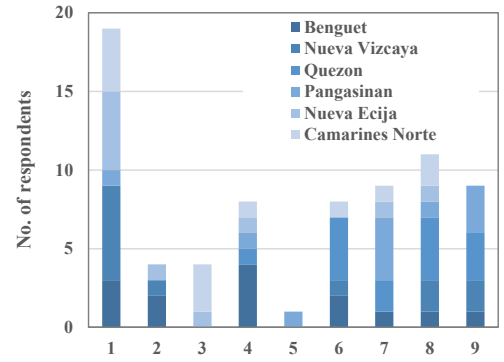

Figure 35: Intention regarding contract farming
Source: Elaborated by the Project Team based on the qualitative survey

2) A success case of contract farming

Peakless Mountain Farmers Association, an example of successful

Table 33: Summary of contract farming

Province	No. of farmers	No. of contract farmers	Contract period (year)	Commodity	Documented contract	Sales to others	Willingness to continue
Highland							
Benguet	16	2	4	cabbage, carrot, potato	yes	allowed	yes
			3	cabbage, carrot, potato	no	not allowed	no
Nueva Vizcaya	12	0					
Lowland							
Quezon	16	1	10	Cabbage	yes	not allowed	yes
Pangasinan	12	1	2	chili pepper	no	allowed	no
Nueva Ecija	12	0					
Camarines Norte	12	0					

Source: elaborated by the Project Team based on the qualitative survey.

contract farming, is a group that mainly produces cabbage and carrots in Bugias, Benguet. It has a contract with Company C located near Manila and wholesales cut vegetables to popular fast food restaurants. The collection facility was built with DA support, and the farmer group was obliged to invest 20% of the cost. The number of farmers participating in the contract farming is 85, about 30% of the neighboring farmers. The key to success is the representative's negotiation with the contractor regarding the shipping quantity to not burden the members. For example, Company C wanted to buy 60 metric tons of cabbage a month, but the farmers' group has contracted for half the amount (30 metric tons). The shipment quantity of each farmer is decided via consultation within the group, and the daily shipment quantity is indicated in the collection facility's calendar. If the farmer meets this quantity, he/she is free to ship the products to others; however, if he/she does not meet the agreed shipping quantity to the contractor, he/she is excluded from the membership. The price is decided every year through negotiation between the two parties and remains constant throughout the year. This guarantees a stable income for farmers. Agrochemical residue contents are strictly inspected by Company C, and one cabbage must weigh 700 g or more. Currently, the group has a contract to ship nine tons of carrots and two tons of potatoes as well.

Peakless Mountain Farmers Association had the experience of starting contract farming by only a verbal contract with an intermediate buyer in 2017, without signing a contract with

Table 34: Examples of buyer-sellers in modern distribution system

Company	Characteristics
Dizon Farms	It supplies fresh fruits and vegetables to more than 100 supermarkets nationwide.
North Point	Located in Bulacan, the company purchases vegetables from farmers in multiple regions through contract farming and supplies cut vegetables to the KFC and Tokyo restaurant chains. It implements pesticide residue inspections on the procured vegetables.
Lianas Vegetable Trader	A small trader-cum-farmer in La Trinidad, Benguet. It purchases lettuce from Benguet farmers and supplies it to processors in Rizal. Vegetables are sliced and packaged there and supplied to McDonald's.
LiveGreen	The company purchases organic vegetables from partner farmers and supplies them under the brand name "Organicus" to major supermarkets such as Robinsons, Rustan's, Shopwise, Waltermart, SM Hypermarkets, and Landmark. It has obtained an organic certification from the Organic Certification Center for Philippines (OCCP).
Melendres Farm	Located in Antipolo, Rizal, the company produces organic vegetables on its own farm and procures vegetables from partnering farmers and supplies them to supermarkets.

Source: Project Team

Company C, and faced problems in payment, when the association was not paid according to the shipment quantity. The association learned the lesson, and it directly signed a contract in 2018 that both parties could agree on without any contract through an intermediate buyer.

(2) Buyer-sellers, Packers, Warehousing and Food processors

1) Buyer-sellers

Buyer-sellers, or intermediate distributors, of the modern distribution system mainly comprise those who supply vegetables to supermarkets and restaurants for middle- and high-income consumers. It is inferred that many such companies purchase vegetables directly from farmers and enter into contracts with the farmers. The interview results show that the buyer-sellers of modern and traditional distribution are not necessarily incompatible with each other. On the contrary, there are cases where the modern distribution system's supply chain is supported by distributers of the traditional distribution system.

Table 34 summarizes examples of buyer-sellers in the modern distribution system (the information is collected from websites and interviews). To illustrate their characteristics, the results of interviews with Dizon Farms and Lianas Vegetable Trader are shown below in detail.

A. Company B

Founded in the 1960s, Company B is a wholesaler of fresh fruits and vegetables and supplies produce to more than 100 supermarkets nationwide, including supermarkets for middle- and high-income households in Manila. The following are interview results at the company's collection and sorting center in La Trinidad, Benguet.[126]

The center receives supplies of vegetables from two sources: one is partner farmers who understand the required quality and the other is distributors from BAPTC. The former is a so-called "suki," but with no contractual agreement. It mainly collects highland vegetables, such as cabbage, potato, carrot, chayote, and Chinese cabbage. All vegetables are collected and transported using plastic crates. Each is graded and sorted into Grade 1 and 2 categories according to its shape, weight, the extent of damage (scratches and damages caused by pests and diseases) and pesticide residues. However, the grading is done visually, and no documents or templates specify the grading standards. Regarding pesticide residue inspection, inspection equipment, such as gas chromatography, is not used.

The center supplies procured vegetables to Manila supermarkets (mostly SM group

[126] Interview at Dizon Farms' collection and sorting center in La Trinidad, Benguet, on 14 March 2022

companies and Puregold), shopping malls, such as Gaisano and Robinsons Galleria, and online shopping avenues. It ships about 10 to 15 tons of vegetables per day.

According to the company, if the supply chain is in short supply of produce due to a disaster, such as a typhoon, the company will source the shortfall from the Divisoria market. This example illustrates that the traditional distribution system plays an important role in supplementing modern distribution.

B. Company D

Company D is a small-scale trader-cum-farming company in La Trinidad, Benguet. It purchases lettuce from farmers in Benguet and supplies it to a processor in Antipolo, Rizal. The processor then slices and packs the vegetables and supplies the same to McDonald's.

The company has 30 partner farmers. It purchases various vegetables from them, but only lettuce is supplied to McDonald's. Lettuce is produced and harvested throughout the year. It is cultivated mainly on the open field; thus, the yield is lower in the rainy season. Nevertheless, the company collects and ships an average of 15,000 kgs of lettuce every month. All collected lettuce is placed in plastic crates and delivered to the processor via a reefer truck (the backload carries only empty crates). Since lettuce is sliced by the processor, no grading is performed throughout the chain (only sorting by Company D at the time of collection).

The company does not have a contractual agreement with partner farmers. There are, however, contractual relationships between McDonald's and the processor, and between the processor and Company D. The purchase price from farmers is determined by the market price, but Lianas offers a minimum price guarantee of PHP 20/kg. Between the company and the processors, the price also depends on the market price but is changed on a weekly basis.

The company provides seedlings to partner farmers. By shifting the seedling supply time by one to two weeks for each group of five farmers, the company adjusts and prolongs the harvest time to avoid price decline due to oversupply.

McDonald's requests purchases of vegetables from Good Agricultural Practices (GAP) certified farmers. Inspectors from the company conduct inspection on Company D's farm once a year. However, not all supplying farmers are GAP-certified. GAP and non-GAP lettuce are sorted and transported in separate crates, but the purchase price by the processors is said to be the same. It is possible that they are eventually mixed up during the processing stage.

2) Packers

According to a report by research firm Global Data,[127] the market size of the Philippines' packaging industry reached 6.1 billion units in 2020 in terms of packaging shipment volume. The market is projected to grow at over 3% annually between 2021 and 2025. The food industry is the largest user of packaging materials with a market share of 34.9% in 2019, followed by non-alcoholic beverages, alcoholic beverages, and cosmetics. Flexible package is the most consumed packaging material, followed by hard plastics, hard metals, paper and paperboard, and glass.[128]

In addition to manufacturers of packaging materials, packaging companies in the modern distribution system of vegetable crops include those who wrap and pack fresh and/or processed vegetables and supply them to supermarkets and restaurants. Examples for this type of packers include the following: Diajam who repacks ginger powder tea produced by a cooperative in Dolores, Quezon, and supplies to 7-Eleven and other retail chains; and Cornelle's Seafoods who slices and packs lettuce purchased from Benget farmers through a trader and delivers it to McDonald's.

3) Warehousing companies

According to DA statistics, there are 124 Accredited Cold Storage Warehouses nationwide in 2022. In the 2013 edition, which had a breakdown, 49 out of 126 facilities (38%) included fruits and vegetables as items to be stored. Others are mainly fish and meat.[129]

Of the vegetables, establishment of cold storage facilities for onion is relatively advanced. According to a 2022 report by the Asian Development Bank (ADB), there are 14 cold storages for onions in Nueva Ecija (amounting to a total capacity of 2,418,000 bags), and two facilities in Tarlac (total capacity of 310,000 bags). In addition, there are two cold storages for onions in Pangasinan. All of these areas are major onion production areas. The details of the two storage companies interviewed (KASAMNE and JADECO Cold Storage) are mentioned in Chapter 4.

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[127] Philippines Packaging Industry – Market Assessment, Key Trends and Opportunities to 2025
[128] https://www.globaldata.com/store/report/philippines-packaging-market-analysis/
https://www.globaldata.com/philippines-packaging-market-reach-69-billion-units-3-3-cagr-2024-says-globaldata/
[129] DA, Bureau of Fisheries and Aquatic Resources, List of Accredited Cold Storage Warehouse (2013 and 2020 edition)

4) Food processors

The gross value added output of the food processing industry in the Philippines in 2022 is USD 38 billion, accounting for about 10% of the Gross Domestic Product (GDP).[130] In 2018, the industry created 300,000 direct employments and 110,000 sub-contract workers.[131] Pushed by the increasing demand for processed food due to urbanization and a growing middle class, the food processing industry grew by 44.6% between 2012 and 2018.[132]

According to 2018 statistics from the Philippines Statistics Authority (PSA), there are 15,955 food processors in the Philippines, accounting for 55.1% of the total manufacturing industry (28,968). Table 35 shows the breakdown of food processors. In the food processing industry, "manufacture of other food products" accounts for the highest percentage at 55.1% with 9,084 establishments, which also takes the largest percentage share in the entire manufacturing industry (31.4%). This category mainly includes the manufacture of bread, biscuits, and others. The processing of horticultural crops is included in "processing and preserving of fruits and vegetables" and "manufacture of vegetable and animal oils and fats." The combined number of establishments under these two categories is 309, accounting for only 2% of the food processing industry (since the average numbers of employees per

Table 35: Number of food processing establishments in the Philippines (2018)

Industry description	Number of establishments	% in food processing industry	% in manufacturing industry
Processing and preserving of meat	299	1.9%	1.0%
Processing and preserving of fish, crustaceans and mollusks	278	1.7%	1.0%
Processing and preserving of fruits and vegetables	169	1.1%	0.6%
Manufacture of vegetable and animal oils and fats	140	0.9%	0.5%
Manufacture of dairy products	99	0.6%	0.3%
Manufacture of grain mill products, starches and starch products	1,701	10.7%	5.9%
Manufacture of other food products	9,084	56.9%	31.4%
Manufacture of prepared animal feeds	199	1.2%	0.7%
Manufacture of beverages	3,986	25.0%	13.8%
Food processing industry total	15,955	100.0%	55.1%
Manufacturing industry total	28,968		

Source: Philippine Statistics Authority

[130] USDA, Philippines Country Profile https://www.foodexport.org/export-insights/market-and-country-profiles/philippines-country-profile
[131] Philippines Statistics Authority, 2018 Census of Philippine Business and Industry: Manufacturing https://psa.gov.ph/manufacturing/cpbi-id/163605
[132] Ibid.

establishment in these categories are relatively high at 60 to 80. Therefore, it is possible that small and micro enterprises were excluded from statistics).

According to the United States Department of Agriculture's (USDA) report in April 2022, processed vegetables in the Philippines grew 32% in 2021. Frozen potatoes accounted for most of the category's growth, following growing demand from Quick Service Restaurants.[133]

In procuring raw materials, some large-scale food processors enter into a contract with farmers, while small-scale businesses tend to procure raw materials from traditional distribution channels, such as wholesale markets. However, some small-scale businesses procure raw materials from farmers and farmer's associations. Here, too, a relationship in which traditional distribution complements modern distribution can be seen. As for sales destinations of processed products, large-scale companies generally sell raw materials to institutional/formal buyers, such as restaurants, supermarkets, and (secondary) processing companies. On the contrary, small and micro enterprises sell it to traditional distribution, such as local markets and retail stores. Some enterprises sell it to formal enterprises, such as supermarkets, like the large enterprises do. Below are some examples of food processors.

A. Company E

Company E is a large-scale food processing firm and one of the major players in tomato processing.[134] Tomatoes are sourced mainly from farmers in Ilocos North and South through contract farming. Contract farmers are obliged to use the seeds of the tomato varieties for processing developed by the company, such as Illocos Red, which are provided to contract farmers at a low cost. Under an agreement with Company E, contracted farmers produce according to a seeding schedule that synchronizes with the company's processing capacity and production schedule to reduce the need for storage facilities. Additionally, the company provides producers with on-site technical assistance and regular follow-up, and strictly controls the production process and quality. Harvesting takes place from mid-January to April under the supervision of on-site technicians. The produce is transported to collection and processing plants in Company E's hired trucks. Sorting takes place at the processing plant. Tomatoes are then processed into such forms as paste, juice, sauce, ketchup, and peeled/diced tomato.

In procuring produced tomatoes, Company E requires contract farmers to deliver 90% of

[133] The varieties of potatoes produced domestically in the Philippines (mainly in Benguet) are not suitable for processing for such products as French fries and potato chips. Thus, they are mainly imported from countries such as the United States. Imports are on the rise, with 26,000 tons imported in 2020.

[134] This account on NFC is mainly based on Asian Development Bank, 2022, Analysis of Fruit and Vegetable Value Chains in the Philippines, Final Report.

the contract volume. The remaining 10% is allowed to be used for self-consumption, market sales, and others. This flexibility is devised to prevent beach of agreement. To strengthen and ensure farmers' compliance with trade contracts, the company organizes contract farmers into small groups of three to five farmers to create collective responsibility for each other's quota and commitment. By sharing cultivation techniques and information among members through this system, farmers support each other so that each member can achieve their quotas.

According to ADB, Company E was the only tomato paste processing plant in northern and central Luzon at the time of the report, consuming about 29,000–30,000 metric tons of Illocos Red tomatoes annually. Tomato paste production totaled 2,850 metric tons in 2019, and the products were mainly sold to fast food chains (58%), sauce and ketchup manufacturers (35%), fish canners (7%), and traders (<1%).

B. Topdac Multi-purpose Cooperative

Topdac Multi-purpose Cooperative (TMPC), located in La Trinidad, Benguet Province, is involved in the processing and sale of kimchi in collaboration with Gift of Grace Food Manufacturing (GGFM), which was founded by one of the TMPC members. TMPC members receive technical training on kimchi processing from the member who founded GGFM. They process Chinese cabbage from their farmlands into kimchi. Members purchase packaging materials from GGFM (PHP 9 per pack) and sell packed kimchi (500 g per pack) to GGFM through TMPC at PHP 109 per pack. GGFM sells kimchi under the brand name "Kimuchi Gift" to supermarkets like Puregold, Robinsons, Savemore and SM in Baguio, Ilocos, La Union, Pangasinan, Pampanga, Tarlac, Nueva Ecija, Nueva Vizcaya, Isabela, and Bulacan. Furthermore, they supply kimchi via distributors. TMPC wants to double its amount of processing to increase production and is considering developing new products, such as radish and carrot kimchi. Furthermore, they are exploring sales channels other than GGFM.

According to local news, the global kimchi market has grown significantly in recent years. Therefore, to meet the growing demand, South Korean investors plan to set up a 3,000-hectare kimchi factory in La Trinidad.[135]

C. Pinagdanlayan Rural Improvement Club Multi-Purpose Cooperation

Pinagdanlayan Rural Improvement Club Multi-Purpose Cooperation (PRIC-MRC), located in Dolores, Quezon Province, is in the ginger powder tea manufacturing business. In addition to Dolores, ginger is procured from Nueva Vizcaya. Ginger in Dolores is harvested from March to July; during the rest of the season, ginger is procured from Nueva Vizcaya.

[135] https://www.wowcordillera.com/2019/02/coming-soon-first-kimchi-factory-in.html

Local varieties of ginger are cultivated and procured. The cooperative procures 2.5 tons per week throughout the year (estimated at 120 tons per year). A 1.5-ton truck funded by DA is used to purchase the raw materials in Nueva Vizcaya. In Dolores, ginger comes from 3 hectares of leased land and individual members' farms. The cooperative buys ginger from members at PHP 60–70/kg on average, and PHP 93/kg when prices are high. It adds PHP 10 extra per kg to the price of Sentron Pamilihan Market in Sariaya to encourage member farmers to supply ginger to the cooperative.

The ginger powder tea has two sales destinations: (1) cooperative members purchase the products and sell them through websites and so on and (2) supply to Prominex Venture, the company which repacks the product under the brand name "Sanlo Salabat" and sells it to retailers such as 7-Eleven, Mercury Drug and South Star Drug nationwide. The cooperative signs a five-year contract with Prominex Venture, and the shipping volume is decided through monthly discussions.

The cooperative is facing unstable supply of electricity because household electricity is used as the power source. Therefore, it is necessary to change to power supply for factories. Furthermore, although the cooperative wishes to expand the scale and develop sales destinations other than Prominex in the future, it is not possible to expand the scale immediately owing to the additional equipment and facilities required.

Furthermore, production and supply of ginger from cooperative farmers in Dolores is on the decline; farmers are discouraged by severe losses caused by blight diseases as well as high opportunity costs due to ginger's long cropping season of more than one year. This has led to an increase in the volume supplied from Nueva Vizcaya. In addition, although the harvest time is coordinated among farmers, some farmers must uproot and sell their ginger before their turn due to the disease outbreak. The manager of the cooperative has requested technical guidance on pest control for member farmers.

4 Current Situation of Infrastructure

4.1 Production and Distribution Infrastructure

4.1.1 Facilities in Production Areas

(1) Irrigation Facilities

Unlike paddies, where large-scale irrigation systems are well developed, small-scale pump irrigation is commonly used by individuals or small farmer groups for horticultural crops. Water sources differ between the highlands and lowlands. It is common to irrigate the lowlands with groundwater while pumping river water and springs are used in the highlands. The power sources of the pumps are both engine and electricity, and the sources of electricity are a normal distribution network or solar power. In the highlands, various cases were observed, such as the water being guided from the source by a hose for several kilometers; from the Barangay Waterworks and Sanitation Association (BAWASA), a local water supply system; and sprinklers were used for irrigation. In recent years, the DA has been focusing on the solar-powered irrigation system (SPIS) and supports its installation from the HVCDP budget or other sources.

The results of the qualitative survey are shown in Table 36. Cells showing distinct responses are shown. As for irrigation methods as a whole, furrow irrigation, which is popular in the lowlands, is common, although sprinklers are dominant in the highlands of Benguet and Nueva Vizcaya. In Quezon, the most common answer was manpower. The main water sources in the highlands are rivers and springs, and groundwater is common in the lowlands. Pumps are popular as power sources. However, gravity is common in Nueva Vizcaya, and it seems to bring water over long distances. Regarding the sufficiency of irrigation water, many farmers in the two highlands complained of shortages, whereas the majority of farmers in the lowlands answered sufficiently.

Table 37 shows the results of the irrigation projects for horticultural production in the five surveyed provinces. The DA has built the Agricultural and Biosystems Engineering Management Information System (ABEMIS) to properly monitor and record various projects, and Table 37 is based on this system. Pangasinan was excluded because sources of funding are not clear and unable to determine whether it is for horticultural production or rice farming.

On average, 1.4 projects and about PHP 800,000 are invested annually per province, with the majority being SPIS, while project cost is about PHP 600,000. More investments are made in Benguet, Quezon, and Nueva Vizcaya.

Table 36: Status of irrigation facilities in the six provinces (units other than the average are the number of respondents)

		Benguet	Nueva Vizcaya	Nueva Ecija	Pangasinan	Quezon	Camarines Norte	Average	
Method	Farrow	0	0	10	12	0	11	41	%
	Basin	0	0	0	0	2	0	3	%
	Sprinkler	13	11	0	0	0	0	30	%
	Drip	0	0	2	0	0	0	3	%
	Drip/Sprinkler	2	1	0	0	0	0	4	%
	Manpower	0	0	0	0	13	1	18	%
	None	1	0	0	0	1	0	3	%
	Total	16	12	12	12	16	12		
Water Source	Undergroud	0	0	8	10	9	11	48	%
	River	10	5	4	1	2	1	29	%
	Spring	4	6	0	1	3	0	18	%
	Reservoir	1	1	0	0	0	0	3	%
	Rainfed	1	0	0	0	1	0	3	%
	Total	16	12	12	12	15	12		
Power	Pump	8	1	9	10	7	11	60	%
	Gravity	7	11	3	2	6	0	38	%
	Manpower	0	0	0	0	1	1	3	%
	Total	15	12	12	12	14	12		
Sufficiency	Sufficient	6	2	5	12	11	10	58	%
	Insufficient	10	10	7	0	5	2	43	%
	Total	16	12	12	12	16	12		

Source: Project Team

Table 37: Results of irrigation projects for horticultural production by DA in the five provinces (2017-2021)

Province	Number of Projects							Total Cost	Average Cost
	SPIS*1	Canal*2	Sprinkler	Spring*3	PISOS*4	Total	Average	'000 PHP	'000 PHP
Benguet	7	1	1	3	-	12	2.4	6,613	551
Nueva Vizcaya	7	-	-	-	-	7	1.4	4,390	627
Nueva Ecija	2	-	-	-	-	2	0.4	1,166	583
Quezon	9	-	-	-	-	9	1.8	5,550	617
Camarines Norte	1	1	-	-	2	4	0.8	2,430	607
Total	26	2	1	3	2	34	-	20,148	593
						Average*5	1.36	806	

SPIS*1; Solar-Powered Irrigation System

Canal*2; Irrigation Canal

Spring*3; Spring Development

PISOS*4; Pump Irrigation System for Open Source

Average*5; /year/province

Source: ABEMIS

However, many farmers complained of water shortages during the dry season, and some had to limit their farming area because of a lack of irrigation water. The initial investment in installing irrigation facilities is a heavy burden for farmers who cannot be adequately maintained and managed for economic reasons. Even when tap water is used only in the dry season, the unit price is PHP 10–15/m^3, and the total cost may exceed PHP 1,000; thus, the cost becomes an issue. Furthermore, flood damage because of heavy rain has been reported in the lowlands.

(2) Horticultural Facilities

As for horticultural facilities, greenhouses and shades are not used in most areas. However, if they are used, their use is limited to seedling production. Subsequently, stakes for growing tomatoes and trellises for string beans or other crops are widely installed using locally available materials. Tractors are generally used for plowing. The results of the qualitative survey are shown in Table 38, and cells with distinct responses are colored. Regarding horticultural facilities, Benguet has approximately a 70% usage rate of facilities, such as greenhouses and shades, but overall, it is about 40%. The most common way to obtain these facilities was for farmers to make them on their own, suggesting that they were devised according to the available materials. For plowing, tractors are commonly used, but it is not uncommon to use livestock in the lowlands. In Quezon, one-third of the respondents answered that they used only manpower, and the introduction of agricultural machinery was delayed for the cultivation of horticultural crops.

Table 38: Status of horticultural facilities in the six provinces (units other than the average are the number of respondents)

Item			Benguet	Nueva Vizcaya	Nueva Ecija	Pangasinan	Quezon	Camarines Norte	Average
Horticultural Facility	Facility	Greenhouse	5	0	0	1	1	0	
		Shade	5	0	0	0	7	3	
		Net house	1	3	3	0	1	3	
		Total	11	3	3	1	9	6	
		Facility rate, %	69	25	25	8	56	50	39 %
	Means to obtain	Purchase	3	0	0	0	1	0	
		Donated	2	0	0	0	0	0	
		Invented	6	3	3	1	7	5	81 %
		Total	11	3	3	1	8	5	
Plowing	Method	Tractor	12	7	6	8	7	2	
		Manposer	1	2	0	0	5	0	
		Tractor/Manpower	3	3	0	0	2	1	
		Livestock	0	0	0	0	0	4	
		Livestock/Tractor	0	0	6	3	1	5	
		Toral	16	12	12	11	15	12	
		Tractor use rate, %	94	83	100	100	67	67	85 %
		Livestock rate, %	0	0	50	27	7	75	26 %
		Manpower rate, %	6	17	0	0	33	0	9 %

Source: Project Team

Table 39: Results of DA's greenhouse projects in four provinces (2017-2021)

Province	No. of Projects		Total Cost	Average Cost
	Total	Annual	'000 PHP	'000 PHP
Benguet	165	33	50,067	303
Nueva Ecija	9	1.8	2,946	327
Quezon	27	5.4	6,430	238
Camarines Norte*1	4	4	4,483	1,121
Total	205	-	63,926	312
Average*2		8.2	2,557	

Camarines Norte*1; 2019 data only

Average*2; /year/province

Source: Project Team based on ABEMIS

Table 39 shows the results of greenhouse projects in the four surveyed provinces using the ABEMIS data. Pangasinan and Nueva Vizcaya were excluded because they had no data. Furthermore, Camarines Norte only has data for 2019.

According to Table 39, 33 greenhouses are built in Benguet every year with the budget of the HVCDP and National Organic Agriculture Program (NOAP), but installation is not progressing in other provinces. The average project cost was approximately PHP 300,000. To improve quality and diversify cropping seasons, it is necessary to control the growing environment of crops and develop greenhouses.

(3) Storage Facilities

Most of the farmers do not have storage facilities, and ships produce immediately after harvesting. The exception is onions, which can be stored for a long time. There are cold storage facilities for onions in Nueva Ecija and Pangasinan, where onions are widely cultivated. According to Nueva Ecija's Agri-Infrastructure Officer, there are currently 11 onion refrigeration facilities in the province, and three more applications have been submitted. Table 40 summarizes information about the facilities visited during the qualitative survey. The leading actor is the Nueva Ecija Onion Producers Association (Katipunan at Samahan ng mga Magsisibuyas sa Nueva Ecija: KASAMNE), which consists of 17 cooperatives with 800 ha of

Table 40: Information on the onion cold storage facilities visited

Item	KASAMNE 1	KASAMNE 2	Palayan City	NEPG
Year of Construction	1993	2007	2020	Not known
Cost (PHP million)	40	128	191	Not known
Capacity (1,000 bags*1)	100	120	120	320
User	KASAMNE member	Same as left	Open but local farmers prioritized	Open, priority for individual/ local farmers
Fee	PHP 210/bag/8 months	Same as left	PHP 180/bag/7 months	PHP 140/bag/4 months; PHP 110/bag/3 months Extension: PHP 35/bag/ month
Backup Generator	350, 380 kVA	450 kVA x2	1,500 kVA	750 kVA x2
Note			Constructed by PRDP*2	

*1: 1 bag = about 30kg
*2: Philippines Rural Development Project, implemented by DA and World Bank

Source: Project Team

farmland and 1,200 onion farmers. It operates three facilities: KASAMNE1, KASAMNE2, and Parayan City, as shown in Table 40. These three facilities were built adjacent to each other in a block of the city of Parayan. Generally, the use of facilities begins in March and ends in December, while maintenance is done in January. The operation and maintenance costs are PHP 2.5 million/month/facility. Electricity is obtained from the grid, but it is unstable, and the use of a backup generator is costly.

Another provincial facility (Nueva Ecija Provincial Government: NEPG) was purchased by the province from its former owner in 2014, and its operation and maintenance costs are PHP 2 million/month. Unlike the facilities operated by KASAMNE, the power supply from the grid is stable. In such facilities, some users rent extra space and lease it to other users to earn profits; however, NEPG provides individual farmers with first-come-first-served and short-term services. It protects individual farmers who have difficulty making advance reservations.

Other facilities in the province include 2,000 bags × four rooms of solar power cold storage set up in Nueva Ecija Agri-Pinoy Trading Center (NEAPTC) under the budget of ADB. The operation just started in February 2022, and two rooms are currently in use, while there are no problems with the function. Furthermore, the onion warehouse built in St. Domingo by the PRDP has a structure without walls and cannot control the temperature. Onions can be stored in the St. Domingo warehouse for up to three months, but there are many damages and losses; therefore, it is rarely used. At the time of the survey, the only user had no choice but to use this facility because there were no vacancies in any other facility.

In Bayambang, Pangasinan Province, there is cold storage for onions by a company called JADECO, which has been in operation for eight years. Onions come from neighboring farmers, Nueva Ecija, and Mindoro Island. A total of 40 rooms in two buildings can store 120,000 bags, and the monthly operation and maintenance costs are PHP 1.1 million. The fee is PHP 225/bag, and the period is up to six months. It is used from February to October, and requests often decline during the harvest season. Because power outages often occur during the dry season, generators are used, but the fuel costs are high. A tomato farmer attempted to use it, but it was not profitable.

Furthermore, cold storage was installed in the BAPTC in Benguet. However, it is not used because the facility cannot be kept cold because of a lack of capacity because of the feasibility study not being properly conducted. A visit was made to a cold storage facility built in 2022 in Mankayan in the northern part of the province. The peripheral facility was incomplete, and it took some time until the start of the operation. Furthermore, the Japan Agricultural Exchange

Council (JAEC), a Japanese NGO, is building a cold storage facility in Bugias through a grant from the Ministry of Foreign Affairs of Japan. Cold storage was also planned at the Camarines Norte Agri-Pinoy Trading Center (CNAPTC) in Camarines Norte, but it was not equipped because of budget constraints.

Meanwhile, an official of the DA- Cordillera Administrative Region (CAR) commented that although it is possible to construct cold storage in terms of budget, support is needed because of a lack of know-how in moisturizing and other aspects of the operation.

(4) Shipping

Table 41 shows the results of the qualitative survey regarding the means of transporting agricultural products, and cells with distinct responses are colored. Trucks and general vehicles are mainly used in the highlands, and motorcycles are also used in the lowlands. In Quezon, the responses from all farmers were "collected by buyers," and it seems that they rarely arrange their own means of delivery.

Under these circumstances, because of the stagnation of agricultural product distribution during the COVID-19 pandemic, the DA started to provide trucks and refrigerated vehicles to transport agricultural products nationwide through its regional offices. As of July 2022, 30 refrigerated vehicles and 42 transport trucks/vans were provided nationwide, including those under procurement. The beneficiaries include cooperatives and LGUs, and the total budget is approximately PHP 200 million.

Table 42 summarizes the vehicles provided by the DA in the six target provinces. One refrigerated vehicle is provided to Benguet, Pangasinan, and Quezon, and eight ordinary transport vehicles are provided. Four LGUs and seven cooperatives were the beneficiaries.

Table 41: **Means of transportation[136] of agricultural products (units other than average are the number of respondents)**

Item	Benguet	Nueva Vizcaya	Nueva Eciha	Pangasinan	Quezon	Camarines Norte	Average	
1. Truck	8	8	4	2	0	0	39	%
2. Vheicle	8	1	3	4	0	2	32	%
3. Motorbike	0	0	1	0	0	5	11	%
4. 1.&3.	0	0	4	0	0	2	11	%
5.Tricycle	0	0	0	1	0	1	4	%
6. On foot	0	3	0	0	0	0	5	%
Total	16	12	12	7	0	10		

Source: Project Team based on data from DA AMAS

[136] From KADIWA ni Ani Kita Financial Grant Program.

Table 42: Vehicles provided by DA nationwide

Item		Luzon	Visaya	Mindanao	Total
Beneficiery	Municipality/City	10	3	6	19
	Province	3	0	4	7
	Cooperative	23	8	12	43
	Others	1	0	1	2
	Total	37	11	23	71
No. of Vehicle	Refer van	14	7	9	30
	Truck/Van	24	4	14	42
	Total	38	11	23	72
Cost	PHP Million	93	40	64	197

Source: Project Team based on data from DA AMAS

Table 43: Vehicles provided by DA to the six provinces

Region	Province	Mun/City	Recipient Type	Beneciciary	Amount (PHP million)	Reefer van	Ordinary
CAR	Benguet	La Trinidad	LGU	Municipality	4.50	1	
I	Pangasinan	-	LGU	Province	4.43	1	
II	Nueva Vizcaya	Bambang	Coop	Agrizkaya Cooperative Federation	1.96		1
		Kasibu	Coop	Kasibu Farmers Development Cooperative	2.00		1
III	Nueva Eciha	Cuyapo	LGU	Municipality	2.50		1
		San Isidro	LGU	Municipality	1.50		1
IV-A	Quezon	General Luna	Coop	Kapuso Malaya Chapter/	2.00		1
		Lucena City	Coop	Quezon Palay Seedgrowers Association Inc.	2.00		1
		Panukulan	Coop	Bongliw Fisherman's Association	2.50	1	
		Dolores	Coop	Pinagdanlayan Multi-Purpose Cooperative (PMPC)	2.00		1
V	Camarines Norte	Talisay	Coop	Ambos Camarines Agriculture Cooperative	1.94		1
	Recipients Total	LGU	4	Figure Total	27.34	3	8
		Coop	7				

Source: Project Team based on data from DA CAR

Since they have been provided, information on utilization needs to be collected.

Tramlines (Agricultural Tramline System, ATS) are also used in mountainous areas where it is difficult to construct roads for vehicles. ATS connects farmlands to the nearest farm to the market road (FMR), transports agricultural inputs, such as fertilizers, to the field, and

transports the harvested agricultural products to the FMR. Among the provinces surveyed, in the mountainous areas of Benguet and Nueva Vizcaya, ATSs were developed by the DA and others. During the qualitative survey, one ATS in Benguet and three ATS in Nueva Vizcaya were visited. ATSs provided by the HVCDP of DA usually have a length of several hundred meters and a single transportation capacity of 200-350 kg and can transport goods in about three to four minutes, where it takes about one hour on foot. It operates daily during the harvest season and is a valuable means of transportation for farmers. During the operation, PHP 1/kg of harvested material and PHP 25/bag of agricultural materials were collected for operation and maintenance costs and the operator's salary. However, because they require strong power, obtaining spare parts is a major issue. Among the ATSs visited, only one was operated and managed in good condition. The other was in operation. However, the efficiency was low, and the engine was under consideration for renovation. The other two were not operating because of the need to replace parts and the effects of the landslides. Although maintenance is performed at a standard level, it is difficult for users to solve problems that cost more than the financial capacity of their group; therefore, the users, local governments, and DA need to coordinate for a solution.

However, there are cases where tramlines are installed and used at the individual level. According to an example from Benguet, the length is 150-450 m, and the carrying capacity is 25 kg, which is smaller than that of ATS. However, the facility is built at a low cost using the engine of a motorcycle or car. This is expected to reduce the manpower requirement at the individual level.

Regarding the status of ATS maintenance, organized information, such as facility inventory, was not collected in this survey; however, Table 44 shows a list of ATS projects for 2016-2017, which is the only available data from the HVCDP budget of DA-CAR. The total cost is approximately PHP 30 million for all 14 projects, and it is approximately PHP 21 million per project. Approximately two-thirds

Table 44: ATS project with HVCDP budget in CAR (2016-2017)

Province	Municipality	Barangay	Cost ('000 PHP)
Benguet	Buguias	Amgaleygey	2,145
		Baculongan Sur	2,109
		Sebang	2,005
	Atok	Paoay	2,065
		Cattubo	1,700
	Bakun	Gambang	1,990
	Bokod	Bila	1,906
	Kamangan	Lubo	2,121
	Mankayan	Belill	2,021
Mountain	Bauko	Monamun Norte	2,397
		Monamun Sur	2,278
	Barlig	Lias	2,548
Apayao	Conner	Ili	2,042
Ifgao	Tinoc	Tuocan	2,509
		Total	29,836
		Average	2,131

Source: Project Team

Table 45: Farmer's packaging material (units other than average are number of respondents)

Item	Benguet	Nueva Vizcaya	Nueva Ecija	Pangasinan	Quezon	Camarines Norte	Average
None	7	0	0	0	2	0	11 %
Plastic	2	0	4	12	8	9	44 %
Plastic/Sack	0	1	6	0	1	3	14 %
Box	4	0	0	0	2	0	8 %
Plastic/Box	2	6	1	0	3	0	15 %
Net/Plastic/Crate	0	0	1	0	0	0	1 %
Net/Sack	1	3	0	0	0	0	5 %
Net/Crate	0	2	0	0	0	0	3 %
Total	16	12	12	12	16	12	
Rate of Plastic, %	25	58	100	100	75	100	76 %
Rate of Box, %	38	50	8	0	31	0	21 %
Rate of Crate, %	0	17	8	0	0	0	4 %

Source: Project Team

of the projects were concentrated in Benguet. If such a budget is spent on ATS maintenance every year, development can be expected to proceed at a considerable speed, but the budget for other years and regions has not been confirmed.

Table 45 shows the farmers' responses regarding packaging. Responses for multiple materials were also categorized separately. Usage rates are shown below the total line for plastic (transparent plastic bag), boxes (the material is not specified here), and crates, which are also used in combination with other materials. Overall, plastic is the most popular, with the majority in five provinces except Benguet, but other materials, such as sacks, boxes, nets, and crates, are also used. Most respondents said that they would not package it in Benguet. Boxes are somewhat used in Benguet, Nueva Vizcaya, and Quezon, and crates are rarely used in Nueva Vizcaya and Nueva Ecija.

Regarding specific shipping destinations, LTVTP accounts for the majority of shipping destinations in Benguet. Some are shipped to BAPTC or both, and some farmers listed contract farming destinations. In Nueva Vizcaya, all ships travel to the NVAT. In Nueva Ecija, the Cabanatuan Municipal Sangitan market is the most popular, and NEAPTC does not function as a wholesale market because of opposition from Cabanatuan City. In Pangasinan, PAPTC is the most common. In Quezon, SPPAQ is the most popular, and in Camarines Norte, CNAPTC is the most popular; both provinces have other options, and some farmers have multiple options.

4.1.2 Market Access of Farm Products

(1) From Farm to FMR (Farm to Market Road)

In order to ship agricultural products to the market, they must first be transported from the farm to a nearby motorable road (FMR). In the lowlands, the road network in rural areas is relatively well developed. Since it is flat, there are no major obstacles to access from the farm to the FMR. Subsequently, there are places where farmland and FMR are separated in the mountainous areas of the highlands, manpower and horses are used to transport goods, and as mentioned above, ATS is being installed. However, it is difficult for them to pass through rural paths and unpaved roads during the rainy season. To improve the efficiency of farming in the medium-to long-term, it is necessary to develop FMRs up to farmlands.

(2) Road Network from Production Areas to Consumer Market

Although there is no clear definition of FMR, it is reasonable to assume that it corresponds to barangay roads in the road classification of the Philippines. Roads are divided into national, provincial, municipal, and barangay roads according to the management entity, and the Department of Interior and Local Government (DILG) organizes the road length data of each division in the Road and Bridge Information System (RBIS), as shown in Table 46. The RBIS is a relatively new initiative that started in 2018, and it seems that not all cities and municipalities in all provinces are properly registered. Therefore, it is not possible to compare provinces because of the large variation in quantity, but it provides an overview at the national level. Looking at the pavement rate, almost all national roads are paved, while approximately 40% of barangay roads are paved. The difference in proportions by category is not very large; however, the number of barangay roads may be too small. The road density is 0.56 km/km^2, which is far from the desirable 1.0 (3.24 in Japan according to 2020 statistics), and road extension is still required, especially in rural areas.

Meanwhile, the development of the highway network has been vigorously promoted, and the length has increased by 1.5 times from 420 km in 2015 to 626 km in 2020. This has shortened the transport time from Benguet and Nueva Vizcaya, which are located on highways, to Manila.

4.1.3 Distribution Facilities

(1) Wholesale Markets in Production Area

Table 47 shows the wholesale markets of production areas nationwide based on the information obtained from the DA and qualitative survey. There are 22 markets in the table, of which eight are under construction and one is not in operation; thus, 13 are currently in operation. The columns on project names are color-coded; nine APTC facilities in light blue, four trading posts in light brown, three food terminals in light green, and six other facilities without color. Food terminals are new facilities, and full-scale operation is yet to be realized. There are various management entities, such as cities/municipalities, provinces, and market management organizations, but as shown in light blue, management by the city/municipality is most common. Although there is no significant difference in the function of the market, even if the names are different, there are various operating entities and methods.

Many new facilities are available. The structure is simple and consists of a covered workspace, parking space for collection and shipping vehicles, and a management office. Few problems are foreseen for the facility until the end of its service life.

As mentioned above, NVAT in Nueva Vizcaya is regarded as the most standard market among the various operating entities, methods, and surrounding environments. Although it is managed by the provincial government as a whole, related parties, including farmers, invest in and use the facility, and it is operated based on a consensus built among the stakeholders. Therefore, stakeholders rack their brains to increase the market value and cultivate a sense of solidarity and entrepreneurship. As seen in Section "4.1.1, (4) Shipping," the high loyalty of

Table 46: Road length for each category in the Philippines

Category	Length (km)			Rate (%)	
	Paved	Unpaved	Total	Paved	Category
National	32,527	593	33,120	98	20
Province	29,826	16,540	46,366	64	28
City/Mun.	28,994	12,928	41,922	69	25
Barangay	17,727	27,580	45,307	39	27
Total	109,074	57,641	166,715		
Road Density (km/km2)			0.56		

Source: Prepared based on RBIS (accessed April 2022) and DPWH (national road) by the Project Team.

Table 47: List of Wholesale Markets in Production Areas

Region	Province	City/ Mun.	Barangay	No	Project Name	Note	Management Entity	Finance	Start	Comp.
CAR	Benguet	La Trinidad	Pico	1	La Trinidad Vegetable Trading Post	Operational	LGU La Trinidad		1983	1984
			Betag	2	Benguet Agri-Pinoy Trading Center	Operational	BAPTC Consortium	2011	2012	2017
1	Pangasinan	Urdaneta City	Poblacion	3	Pangasinan Agri-Pinoy Trading Center	Operational	CLGU - Urdaneta City	2012	2013	2015
	Ilocus Sur	Santa Maria	Danuman West	4	Ilocos Sur Provincial Trading Post	On-going construction	DA RFO-I	2020	2021	-
2	Isabela	Roxas	Munoz West	5	Isabela Agri-Pinoy Trading Center	Operational	MLGU - Roxas	2013	2013	2014
	Nueva Vizcaya	Bambang	Almaguer North	7	Nueva Vizcaya Agricultural Terminal	Operational	PLGU - Nueva Viscaya and NVAT	2013	2013	2014
			Villaros	6	Regional Organic Trading Center	Not Operational	DA RFO / NVES	2012	2013	2014
3	Nueva Ecija	Cabanatuan City	Caalibangbangan	8	Nueva Ecija Agri-Pinoy Trading Center	Operational	PLGU NUeva Ecija	2012	2013	2014
			Sangitan	9	Sangitan Public Market	Operational	CLGU Cabanatuan			
4A	Quezon	Sariaya	Tumbaga 2	10	Sentrong Pamilihan Ng Produktong Agrikultura Ng Quezon	Operational	SPPAQ Foundation			2006
			Sampaloc 2	11	Sariaya Agricultural Trading Center and Facilities	On-going construction	MLGU - Sariaya	2020	2021	-
	Batangas	Ibaan	Malainin	12	Batangas Provincial Agricultural Trading Center	On-going construction	MLGU Ibaan	2020	2021	-
		Tanauan City	Sambat	13	Tanauan City Trading Post	On-going construction	LGU Tanauan CIty	2020	2021	-
4B	Palawan	Puerto Princesa City	Irawan	14	Puerto Princesa City Agri-Pinoy Trading Center	Under Constructio n	CLGU Puerto Princesa City	2015	2015	-
5	Camarines Norte	Vinzons	Mat-i	15	Camarines Norte Agri Pinoy Trading Center	Operational	PLGU Camarines Norte, Labo Multi-Purpose COop.	2013	2013	2016
	Camarines Sur	Pili	San Jose	16	Camarines Sur Provincial Trading Post	On-going construction	PLGU Camarines Norte	2020	2021	-
7	Cebu	Dalaguete	Mantalongo n	17	Dalaguete Agri-Pinoy Trading Center	Operational	MLGU Dalaguete	2013	2013	2016
		Cebu	South Road Properiets	18	Central Visayas Regional Food Terminal	Agreed	-	-	-	-
8	Leyte	Javier	Picas	19	North Eastern Leyte Agri Pinoy Trading Center	Under Constructio n	MLGU Javier	2014	2014	-
10	Bukidnon	Talakag	Miarayon	29	Regional Food Terminal	Completed		2020	2020	2021
11	Davao del Sur	Davao City	Daliao, Toril	21	Davao Food Terminal Complex	Operational	CLGU Davao City	2015	2015	2022
CARAGA	Surigao del Norte	Siargao	Dapa	22	Siargao Agri Pinoy Trading Center	Operational	PLGU Surigao del Norte	2013	2013	

farmers to NVAT also indicates the degree of fulfillment of market management. In Quezon, the SPPAQ is operated by SPPAQFI, and member farmers benefit from the operation. In Camarines Norte, CNAPTC has been operated by the provincial government since its establishment in 2014; however, since 2020, the LPMPC has become the main operator and is working to improve the market. In the case of La Trinidad in Benguet, the preceding LTVTP operated by the municipality is the most popular market in the province. The major problem with LTVTP is that it is located in an urban area, thus having limited space, while BAPTC is in the suburbs and there is plenty of space. The municipality participates as a board member in the BAPTC management consortium led by BSU, so the two are having complementary relationship. On the other hand, in the case of Cabanatuan City in Nueva Ecija, NEAPTC was a latecomer and is operated by the NEFVMC until the pandemic, but NEAPTC could not be reopened as a wholesale market because of pressure from the city which is operating the preceding Sangitan market. Therefore, two private agribusiness companies (KLT Fruits Inc. and Dizon Farms) currently use this facility under the control of the provincial government.

(2) Wholesale Markets for Consumers

Divisoria is the largest vegetable collection point in Metro Manila, followed by Balintawak (two-thirds of BAPTC vegetables are shipped to Divisoria and 14% to Balintawak[137]). Multiple wholesale markets are concentrated in both districts, and vegetables and fruits are brought from all over the country and shipped again to various places. Divisoria straddles the Tondo and San Nicolas areas of Manila, and the main wholesalers for vegetables are spreading mainly along Padre Raba St and Recto Avenue. Balintawak is located in Quezon City, and the main wholesale markets for vegetables are Juliana, Cloverleaf, and Riverview. There are several other large markets in Metro Manila, but a considerable amount is purchased from these areas.[137,138]

The Project Team visited Juliana Market in Balintawak during a qualitative survey. The market is run by a private company operating in several other markets. Juliana Market is located on leased land of approximately 1.8 ha and has covered market facilities of less than 6,000 m^2, aisles, parking lots, offices, etc. Overall, it seemed a bit congested but was being operated efficiently. For example, space was allocated according to the production area under the roof, and space for moving cars was secured. The maintenance cost is approximately PHP 10,000–15,000/month, and repairs for leaks are undertaken. The place was kept clean by

[137] Survey on Issue Analysis of Food Value Chain in the Philippines, August 2019, JICA
[138] https://www.juanmagsasaka.com/2021/04/marketing-your-produce-major-wholesale.html

disposing of garbage at a dump site using two vehicles every day. Although it is too small, expansion is difficult because the land is leased. A barcode operation system was introduced before, but it did not catch up because tenants use cash transactions and the system is costly.

DA aims to improve the food security and profits of farmers and form a new distribution system of vegetables and fruits with high efficiency and transparency, which is different from the above-mentioned traditional distribution system. DA has been working to increase access to agricultural products for low-income earners since 2019, which is called "Kadiwa ni Ani at Kita Program (hereinafter referred to as "Kadiwa Program")." In the Kadiwa Program, the DA has promoted sales of agricultural products with mobile sales by truck, events in collaboration with local governments and shopping malls, and online sales by cooperatives. The DA also plans to further promote this and form a distribution flow from the aspects of infrastructure and capacity development through growing producer groups as a collector, transporting products to food delivery hubs in urban areas, and delivering products from delivery hubs to institutional buyers and consumers. Among them, strengthening Food Terminal Inc. (FTI, established in 1968 to collect agricultural products, currently a state-owned enterprise under DA but does not fulfill its originally intended function) in Taguig City, Metro Manila, as a hub facility, is also included. However, it is expected that a considerable amount of time and budget will be required to achieve this.

(3) Processing Facilities

Although various efforts have been made in each province, the number of economically viable processing facilities is limited. **Table 48** shows the processing facilities visited during the qualitative survey, introduced by the Agribusiness and Marketing Assistance Division (AMAD), a branch office of the DA Agribusiness and Marketing Assistance Service (AMAS) at the regional level, and provincial and municipal agricultural offices. Some of them are steadily expanding their businesses, such as the kimchi of Benguet, ginger tea in Quezon and Nueva Ecija, and dried taro leaves of Camarines Norte, while others are not on track as a business, although they are fully equipped with government support.

Table 48: Processing facilities visited in the qualitative survey

Province	City/ Mun.	Facility	Outline
Benguet	Atok	Topdac Multi-purpose Cooperative (TMPC)	TMPC (932 members) produces kimchi from cultivated Chinese cabbage and makes great profits. Gift of Grace Food Manufacturing (GGFM), a food company, provides technical guidance to TMPC, and TMPC's products are distributed in north-central Luzon. TMPC is currently in discussions with the Department of Agrarian Reform (DAR) and the Department of Trade and Industry (DTI) to establish a processing factory.
Nueva Vizcaya	Aritao	Federation of Aritao Rural Improvement Club (FARIC)	FARIC, which started operating in 2016 with the support of PHP 3.4 million from DA, has processing equipment and purchases surplus tomatoes to produce such items as candy, wine, and jam. However, as FARIC must purchase the tomatoes at PHP 15/kg or less, it cannot sell products at a price of PHP 50/kg at the time of the survey. Thus, FARIC is not fully utilizing its equipment.
	Bambang	Agrizkaya Cooperative Federation (ACF)	ACF is a coalition of agricultural unions in Nueva Vizcaya, with a sales office and processing plant near NVAT. The sales office sells products such as vegetable and fruit chips, powder, tea, and coffee brought in by affiliated farmer groups. However, the amount handled is small and the processing facilities are not fully utilized.
Nueva Ecija	Quezon	Kaba-baihang Masigla ng Nueva Ecija (KMNE)	Aiming for zero waste, KMNE produces such items as tomato candy, jam, and dried vegetable powder using local organic ingredients as much as possible. It also uses sun dryers with external support, but the demand for its products is small.
	Talavera	Jerwin's Herbal Product	An individual produces and sells turmeric and ginger powdered tea. Although the scale is small, she has regular customers, various sales channels, and stable income. Raw materials are purchased from NVAT.
Pangasinan	Binalonan	Jomah's products	Since 2009, it has been producing and selling chips of such fruits and vegetables such as banana, taro, and sweet potato at an individual level. Although the facility was strengthened by investing PHP 3 million, the demand has dropped sharply owing to the COVID-19 pandemic, and farmers have switched their produce from sweet potatoes to onions. Currently, the products are produced based on orders only.
Quezon	Dolores	Pinagdanlayan Rural Improvement Club Multi-Purpose Cooperative (PRIC-MRC)	As a measure against the price drop of locally produced ginger, PRIC-MRC started producing powdered ginger tea. With marketing support from a Canadian NPO and support from the One Town, One Product Program of DTI, PRIC-MRC is currently shipping products to a major customer called Prominex Venture, which sells products in its own brand in stores and online. PRIC-MRC's business is steady and seeking expansion.
Camarines Norte	Labo	Jun's Dried Laing Supplier	Taro leaves, which are popular as a local ingredient, are dried and shipped. Jun's ships 3-4.5 metric tons/month to an agribusiness company called Dizon Farm, which ships products to Robinson, a supermarket, as well as domestically and internationally as a raw material for insect repellents and cosmetics. Raw materials are procured from farmers of 15 barangays in the vicinity. Leaves are dried mainly in the sun, and in the rainy season with a dryer that uses rice husks as fuel. Moisture content before shipment is strictly controlled.
		Daguit Agrarian Reform Beneficiary Organization (DARBO)	With the support of Department of Agrarian Reform (DAR), DARBO has dried taro leaves and shipped them to local supermarkets for six years. Ten members supply raw materials and produce 70 kg/day in a greenhouse-type sun drying facility. A major problem is that the product is damaged quickly because quality control is lax with no measurement of the water content.

Source: Project Team

Table 49: Projects of processing facilities for horticultural crops by DA in the six provinces (2017-2021)

Province	No. of Project		Total Cost	Average Cost
	Total	Average/year	'000 PHP	'000 PHP
Benguet	3	0.6	5,000	1,667
Nueva Vizcaya	0	-	-	-
Nueva Ecija	1	0.2	1,000	1,000
Pangasinan	0	-	-	-
Quezon	10	2	28,760	2,876
Camarines Norte	0	-	-	-
Total	14	-	34,760	2,483
	Average*1	0.6	1,390	

Average*1; /year/province

Source: Project Team

From the ABEMIS data, the projects of the processing facility for horticultural crops by DA are shown in Table 49. The number of projects in Quezon is outstanding, with an average of two projects annually, and the number of projects is less in other provinces. The average project cost is approximately PHP 1.4 million.

4.2 Digital Technologies in Agriculture Sector

Digital technologies in the agricultural sector can be broadly categorized into three areas: precision agriculture, e-commerce, and financial inclusion. The use of digital technology requires three elements: smartphones, Internet connectivity, and cloud servers. A variety of sensors are required for the measurement of temperature, humidity, sunlight, soil moisture, etc. Moreover, the precision agriculture sector requires three types of data: environmental measurements, biometric measurements, and farming records.

In this section, the digital agricultural initiatives in the Philippines is examined.

(1) Overview of digital agriculture

Initiatives for agricultural digital technology in the Philippines are led by universities and research institutes in the production sector and by government organizations and private companies in the distribution sector. This is generally similar to other ASEAN countries, such as Thailand and Indonesia. Furthermore, the Philippines has a relatively well-developed financial system, even in rural areas where many overseas Filipino workers send money to their families. Farmer loans are also available at low interest rates for those who are members of production cooperatives (see (4) for an overview).

Therefore, in addition to using digital technology for farmers' credit, digital technology has been introduced to provide farmers with loans for farming materials and living expenses through smartphones.

Figure 36: Digitalization Strategy of OneDA

Source: DA-ICTS, Digital Agriculture Roadmap

(2) Initiatives by governmental organizations

Government agencies in the Philippines are actively promoting digital agriculture, and the DA is implementing the "OneDA" policy. Among the four major components of OneDA, "modernization" includes "technology & innovation including digital agriculture." The DA-ICTS[139] has already developed a roadmap for the ICT sector in 2020, including the BayAni Kita app and other applications.

The Department of Science and Technology (DoST) is implementing the project together with research institutions, including the University of the Philippines Los Baños (UPLB). The flagship project is "Project SARAi." Based on environmental measurements, SARAi provides online information on the weather, precipitation, and drought forecasts for each region. Currently, SARAi mainly targets rice, corn, bananas, and other crops, whereas horticultural crops are limited to tomatoes.

DTI has jurisdiction over all large and small e-commerce businesses. In terms of collaboration with other ministries in the e-commerce field, DeliverE was developed by the United States Agency for International Development (USAID), DTI, and DA. DeliverE is a one-stop system that links with the e-commerce services of existing supermarkets, such as Robinsons, and dedicated e-commerce sites, such as GrabMart and PandaMart, to implement everything from ordering to transportation and sales of agricultural products. This is expected to become a new distribution route for fruits and vegetables in the future.

[139] ICTS: Information and Communications Technology Service

Figure 37: The scheme of DeliverE

Source: InsightSCS

(3) Initiatives by the private sector

In the Philippines, private companies, especially start-ups, involved in agricultural digitalization are virtually limited to the upstream distribution sector (e-commerce). Only a few start-ups are involved in financial inclusion. In particular, there are very few start-ups compared to Indonesia, which is a leading ASEAN member country, like the Philippines. This is because the investment market for start-up companies is far less than in Indonesia.

Field survey results indicated that all start-up companies engaged in precision agriculture in the Philippines were unable to continue their businesses. This is considered to be because of the difficulty of monetizing the service by collecting service fees from farmers. As a reference case, a Japanese digital start-up company provides precision agriculture services (e.g., recording farming data) in Myanmar by collecting fees from local food companies instead of farmers with weak economic power (contract farmers of food companies). This could serve as a reference for future monetization in the Philippines. Regarding financial inclusion, there are a few examples of projects implemented in cooperation with major banks, but the spread of financial inclusion is still in its infancy. Consequently, businesses operated by start-ups in the Philippines are naturally concentrated in e-commerce.

(4) Financial inclusion using digital technologies

Digital technology has a high affinity for the financial sector, and its use for financial inclusion in the agricultural sector is rapidly increasing in developing countries. The field survey revealed that the introduction of digital technology for financial inclusion has only just

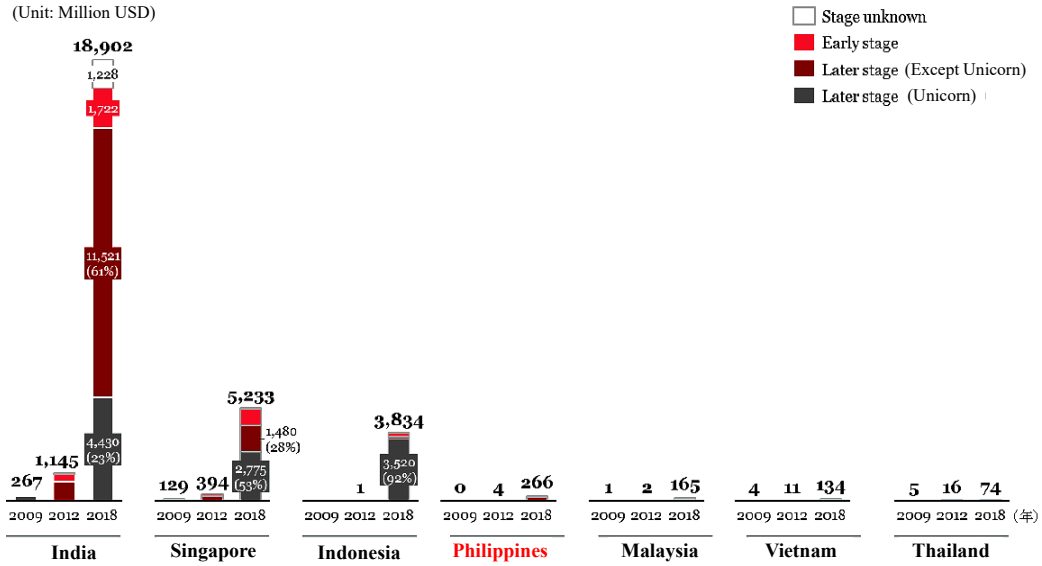


Figure 38: Total procurement of start-ups in six ASEAN countries and India

Source: PwC Advisory report for Ministry of Economy, Trade and Industry (*In Japanese*)
https://www.meti.go.jp/policy/external_economy/toshi/kaigaima/kanren/southeastasia_india.html

begun in the Philippines. The survey also revealed that costs are an issue in the implementation of digital technology. One start-up company that introduced digital technology for financial inclusion was found to be a fintech company in the process of starting a pilot project to provide fertilizers and loans to farmers using smartphones for greater convenience in rural areas. The company was in the process of initiating the project. The emergence of such companies indicates the potential for the introduction of digital technology in rural financing in the Philippines. Table 50 provides a summary of the findings of the field survey.

Table 51 shows the financing environment provided by the agricultural cooperatives in the target area. It is indicated that the farmers who are members of agricultural cooperatives are able to obtain loans at relatively low interest rates. Additionally, all associations responded positively to cooperation in the implementation of the pilot project.

Table 50: Financial Inclusion and Digital Technology Adoption in Agricultural Cooperatives

Province	No. of interviewed organization	No. of organization with digital technology	Reason for not introducing digital technology
Quezon	3	1	N/A
Benguet (Including Baguio)	4	0	Weak Signal
Pangasinan	3	2	Not ready and expensive (to introduce digital technology)
Nueva Vizcaya	3	2	Weak signal, not ready and expensive (to introduce digital technology)
Nueva Ecija	3	1	Expensive
Camarines Norte	3	3 (All are member of NATCCO[140])	N/A

Source: Project Team

[140] A federation of approximately 800 cooperatives in the Philippines. In addition to agricultural cooperatives, it includes consumer cooperatives. https://www.natcco.coop/

Table 51: Financing Environment Provided by Agricultural Cooperatives

Province	% of members growing vegetables	Borrowed amount	Interest rate	Loan term	Amortization schedule	Repayment rate
Quezon	70%	5,000 to 300,000	2.5%/ month	3 to 6 months	weekly	100%
	30.60%	5,000 to 50,000	2-2.5%/ month	6 months to 1 year	weekly	90%
	95%	10,000 to 50,000	2-5%/ month	4 months to 1 year	After Harvest	70%
Benguet	28%	50,000 to 150,000	15.5% per annum	6 months	One-time payment, after harvest	75%
	72%	10,000 to 50,000	2.95%/ month	6 months	Monthly or 1 time payment	100%
	100%	20,000 to 300,000	18%/annum + 3% service charge	6 months to 1 year	Monthly or 1 time payment	80%
Pangasinan	30%	20,000 to 150,000	1.6%/month	2 to 6 months	One-time payment	70%
	30%	50,000 to 70,000	15%/annum + 3% service charge	6 months to 1 year	One-time payment, after harvest	90%
	7%	15,000 to 50,000	3%/month	4 - 6 months	Monthly and lumpsum	63%
Nueva Vizcaya	50%	20,000 to 100,000	1%/month + 4% service Charge	4 - 6 months	One-time payment. Optional for monthly amortization	80%
	36%	5,000 to 30,000	14%/annum + 1.6% Service Charge, 1% Filing Fee	4 - 6 months	One-time payment	85%
	80%	15,000 to 100,000	1.5%/month, 3% Service Charge (One time)	4 to 6 to 12 months	One-time payment	75%
Nueva Ecija	100%	50,000 to 500,000	26%/annum, 2% Service Charge	6 months	One-time payment	95%
	30%	50,000	3%/ month	5 - 6 months	Lumpsum payment	77%
	100%	10,000 to 500,000	14%/annum + notarial fee	4 - 6 months	One-time payment	99%
Camarines Norte	30%	5,000 to 50,000	2%/month + 2% service charge (one time)	One-time payment or 2-3 amortization	One-time payment or 2-3x amortization	50%
	30%	30,000 to 300,000	2%/month + 2% service charge (one time) + 1.33% Insurance	4 - 18 months	One-time payment	97%
	38%	10,000 to 100,000	18%/annum	4 - 6 months	One-time payment	90%

Source: Project Team

(5) ICT infrastructure of target areas

Fixed internet is not available in the highlands, including Benguet. The reasons for this differ by region. In Benguet, the reason is that the provincial government is negotiating with PLDT, the largest telephone company in the Philippines. In Nueva Vizcaya, the reason is that the communities are located far from roads. Regarding cellular phones, SMART is generally the most popular carrier used among survey participants because areas had good signal conditions. The penetration rate of smartphones in rural areas exceeds 50% in many areas. However, there are some areas, such as Nueva Vizcaya, where the penetration rate is only approximately 5%. Therefore, it is expected that the use of the Internet in project areas will be based on mobile phone networks.

Table 52: Use of fixed Internet lines in the targeted areas

Province	Municipality	Area Type. Highland/ Low land	Are there any Internet service providers operating in your barangay?	If YES, what are the Internet Service Providers?	5.3 If No Why do you think there are none?
Quezon	Dolores	Lowland	YES	PLDT and General Telephone System, Inc. (GTSI)	N/A
	Dolores	Lowland	YES	PLDT and General Telephone System, Inc. (GTSI)	N/A
	Sariaya	Lowland	YES	PLDT	N/A
	Sariaya	Lowland	YES	PLDT and General Telephone System, Inc. (GTSI)	N/A
Benguet	Buguais	Highland	NO	N/A	PLDT Company application still in process
	Buguais	Highland	NO	N/A	PLDT Company application still in process
	Atok	Highland	NO	N/A	The community is far and is not accessible from the main road
	Atok	Highland	NO	N/A	PLDT still negotiating with LGU
Pangasinan	Asingan	Lowland	YES	Converge	N/A
	Asingan	Lowland	NO	N/A	Ongoing Line Connection from the Town Proper of Asingan
	Villasis	Lowland	YES	PLDT and Converge	N/A
	Villasis	Lowland	YES	PLDT and Converge	N/A
Nueva Vizcaya	Kayapa	Highland	NO	N/A	The community is far and is not accessible from the main road
	Kayapa	Highland	NO	N/A	The community is far and is not accessible from the main road
	Dupax Del Sur	Highland	NO	N/A	The community is far and is not accessible from the main road
	Dupax Del Sur	Highland	NO	N/A	No cellular sites
Nueva Ecija	Bongabon	Lowland	YES	PLDT	N/A
	Bongabon	Lowland	YES	PLDT	N/A
	Talavera	Lowland	YES	Converge and PLDT	N/A
	Talavera	Lowland	YES	Converge and PLDT	N/A
Camarines Norte	Talisay	Lowland	YES	Converge and PLDT	N/A
	Talisay	Lowland	YES	Converge and PLDT	N/A
	Vinzons	Lowland	YES	Converge and PLDT	N/A
	Vinzons	Lowland	YES	Converge and PLDT	N/A

Source: Project Team

Table 53: Conditions of ICT infrastructure (including mobile network) in the targeted areas

Province	Municipality	Area Type. Highland/Low land	Among the Telco providers which is preferred and patronized more by most of the people	Why	What is the % (estimate) of the population in the barangay that are using smart phones? (HH: Households)
Quezon	Dolores	Lowland	Smart and Talk 'N Text	More Promos are offered that can be use by majority of the community	70% out of 720 HHs
	Dolores	Lowland	Smart and Talk 'N Text	Better Signal Connection	60% out of 760 HHs
	Sariaya	Lowland	Smart and Talk 'N Text	Better Signal Connection - Cell / Signal tower is near the community	70% out of 790 HHs
	Sariaya	Lowland	Smart and Talk 'N Text	Better Signal Connection	80% out of 802 HHs
Benguet	Buguais	Highland	Smart and Talk 'N Text	Established Signal Connection	80% out of 978 HHs
	Buguais	Highland	Smart and Talk 'N Text	More Loading Station	65% out of 1,284 HHs
	Atok	Highland	Smart and Talk 'N Text	Better Signal Connection	60% out of 925 HHs
	Atok	Highland	Smart and Talk 'N Text	Better Signal Connection - Cell / Signal tower is near the community	60% out of 723 HHs
Pangasinan	Asingan	Lowland	Smart and Talk 'N Text	Better Signal Connection	60% out of 330 HHs
	Asingan	Lowland	Smart and Talk 'N Text	Better Signal Connection	70% out of 922 HHs
	Villasis	Lowland	Globe	Better Signal Connection - Cell / Signal tower is near the community	50% out of 1,202 HHs
	Villasis	Lowland	Globe	Better Signal Connection - Cell / Signal tower is near the community	75% out of 1,360 HHs
Nueva Vizcaya	Kayapa	Highland	Smart and Talk 'N Text	Better Signal Connection - Cell / Signal tower is near the community	75% out of 193 HHs
	Kayapa	Highland	Smart and Talk 'N Text	The only signal that can be accessed in the area	90% out of 60 HHs
	Dupax Del Sur	Highland	Smart and Talk 'N Text	The only signal that can be accessed in the area (only a limited portion of the community has access to the signal)	10 Household out of 247 HHs
	Dupax Del Sur	Highland	Smart and Talk 'N Text	The only signal that can be accessed in the area	5% out of 376 HHs
Nueva Ecija	Bongabon	Lowland	Smart, Talk 'N Text and Globe	Better Signal Connection - Cell / Signal tower is near the community	48% out of 1,400 HHs equal for SMART TNT and Globe
	Bongabon	Lowland	Smart and Talk 'N Text	Near and visible to signal tower	65% out of 585 HHs
	Talavera	Lowland	Globe and Touch Mobile	Promotions of Load	70% out of 463 HHs
	Talavera	Lowland	Globe	First network accessible by barangay Constituents	70% out of 519 HHs
Camarines Norte	Talisay	Lowland	Smart and Talk 'N Text	Strong signal compared to other network	70% out of 300 HHs
	Talisay	Lowland	Smart and Talk 'N Text	Strong signal compared to other network	60% out of 800 HHs
	Vinzons	Lowland	Smart and Talk 'N Text	Strong Signal and Load Promotions	90% out of 1,334 HHs
	Vinzons	Lowland	Smart and Talk 'N Text	More signal towers for SMART and Talk 'N Text	70% out of 1,640 HHs

Source: Project Team

Table 54: Electricity supply condition in rural areas

Province	Municipality	Area Type. Highland / Lowland	Are all households connected to the power service provider?	If No, the reason	Are there farmers using solar power?	If YES, estimate how many?
Quezon	Dolores	Lowland	YES	N/A	YES	10% but only flashlights
	Dolores	Lowland	YES	N/A	YES	8-10% but only flashlights
	Sariaya	Lowland	YES	N/A	YES	Solar lights are being used in street lights provided by politicians
	Sariaya	Lowland	YES	N/A	YES	Solar lights are being used in street lights provided by politicians
Benguet	Buguias	Highland	NO	Cannot afford the electric connection rate	NO	N/A
	Buguias	Highland	YES	N/A	YES	5% out of the total households
	Atok	Highland	YES	N/A	YES	10% out of the total households
	Atok	Highland	NO	Location of other Households is far from the mainline	YES	5% out of the total households
Pangasinan	Asingan	Lowland	YES	N/A	YES	Solar power is used for street lights only; some farmers have solar flashlights
	Asingan	Lowland	YES	N/A	YES	Solar power is used for street lights only
	Villasis	Lowland	NO	Few households has budget for installation	YES	Solar power is used for street lights only
	Villasis	Lowland	YES	N/A	YES	Solar power is used for street lights only
Nueva Vizcaya	Kayapa	Highland	NO	Other households are far from the mainline	YES	20% of the total households
	Kayapa	Highland	NO	Few households have budget for installation	NO	N/A
	Dupax Del Sur	Highland	NO	Require 5-10 households so that service drop will be provided by the electric cooperative	YES	25 households
	Dupax Del Sur	Highland	NO	Distance from the mainline and service drop	NO	N/A
Nueva Ecija	Bongabon	Lowland	NO	Few households have budget for installation	YES	30% of the total households use solar power for lights at night in combination with power supply
	Bongabon	Lowland	YES	N/A	NO	N/A
	Talavera	Lowland	YES	N/A	YES	10% out of the total households
	Talavera	Lowland	YES	N/A	YES	N/A
Camarines Norte	Talisay	Lowland	YES	N/A	YES	Irrigation
	Talisay	Lowland	NO	Not enough budget for electric installation	NO	N/A
	Vinzons	Lowland	YES	N/A	YES	Irrigation
	Vinzons	Lowland	YES	N/A	NO	N/A

Source: Project Team

Table 54 shows the electricity supply conditions in rural areas. There were two areas without an electricity supply in Benguet, four in Nueva Vizcaya, and one each in Nueva Ecija and Camarines Norte. Overall, there is no electricity supply to the highlands, with one site each in Benguet and Camarines Norte and two sites in Nueva Vizcaya, where solar power is not available. Theft of power cables, which use a large amount of copper, is common in

developing countries. Fortunately, no theft of power cables has been reported in the surveyed areas. Overall, these survey results indicate that the highland vegetable-growing areas, where the pilot project is expected to be implemented in the future, face extremely difficult conditions in terms of infrastructure, such as mobile phones, internet connections, and electricity.

5 Issues

5.1 Common Issues in Vegetable Value Chains

(1) Vegetable Farmers

The most serious issues raised by vegetable producers are to address the decline in yield caused by pests and diseases and to level fluctuations in prices due to overproduction. Along with other issues, the points confirmed by the qualitative survey are summarized below. As the details in the highland and lowland production areas are explained in Sections 5.2 and 5.3, the common issues are briefly summarized here.

A. Improvement of pests and diseases control method

In a hot and humid environment, vegetable production is widely affected by pests and diseases, causing yield reduction. This was more severe in the four lowland areas. According to a qualitative survey in the six provinces, farmers estimated that an average of 14% of their products was a production loss because their quality did not reach the standard for shipping even when they were harvested. Farmers controlled pests and diseases using agrochemicals. In an attempt to enhance pest and disease control, three or more chemicals were mixed in some cases, and the mixture, called "cocktail," was used repeatedly. They also included agrochemicals that are prohibited from use. The same chemicals were customarily continued, even if insects and bacteria developed resistance to chemicals, as explained by extension workers. Solanaceae vegetables, such as tomatoes, in lowlands are often damaged by soil-borne diseases, such as bacterial wilt. Therefore, especially during the seedling raising period in the

Figure 39: Loss due to damage from armyworm (Spodoptera frugiperda) (onion in Nueva Ecija)

Source: Project Team

open field, care must be taken to ensure seedlings are not infected with soil-borne diseases. Raising seedlings using seeding trays could be an effective method for avoiding infection. In addition, farmers in the surveyed area did not use the sticker solution[141] that Japanese farmers typically use to mix agrochemicals when spraying. This might have reduced the effectiveness of these chemicals. Therefore, an appropriate method to control pests and diseases must be developed.

Figure 40: General shipping form for lowland farmers (Camarines Norte)

Source: Project Team

B. Avoiding seasonal declines in farm-gate prices

Severe seasonal declines in farm gate prices and market prices are common issues in highland and lowland areas. Many vegetables have a difference of four to five times between the highest and lowest prices, and the harvested vegetables are left in the field because when the price is low, it is not worth the shipping cost. The price decline depends on the production environment of the area and the type of vegetable. The current situation of price fluctuation in each area and vegetable and the causes are described in Sections 5.2 (2) and 5.3 (1).

C. Promotion of proper crop management

Hardly any farmers in both highlands and lowlands decide the amount of fertilizer application based on soil analysis. There are free soil analysis services in some areas, but the farmers do not use the service and determine the amount of fertilizer based on their own experiences or examples of neighboring farmers. Most farmers apply organic materials together with chemical fertilizers. In the highlands, a large quantity of chicken manure is applied, some of which is almost raw. Proper soil management based on the results of soil analysis is urgently required.

D. Verification and improvement of shipping form

In many cases, farmers ship their products in closed plastic bags (Figure 40). The temperature and humidity inside the bag appear to be high, and quality deterioration has been

[141] In Japan, many local governments recommend the use of sticker solution to improve the effectiveness of agro-chemicals in all cases. Some local governments say that sticker solution is not required when the agrochemical to spray is an emulsion.

observed in the market. Packaging in plastic bags is preferred because it is easy for market dealers to handle; however, this form must be improved to reduce losses during marketing. Therefore, it is necessary for not only farmers but also dealers to discuss and consider improvement methods.

(2) Buyer-sellers in the production areas

A. Large fluctuation in trading prices

As reported in Chapter 3, large fluctuations in trading prices in the wholesale markets of production centers are observed throughout the year. From the data given by BAPTC and SPPAQ, large fluctuations are observed in the trading prices of highland vegetables with large handling quantities, such as cabbage, potato, Chinese cabbage, carrot, and white radish, and of lowland vegetables, such as yardlong beans, tomatoes, biter gourds, sponge guards, and eggplants.

The countermeasure is to practice shipping adjustments by referring to the price fluctuations throughout the year. Making cropping calendars in farming planning, specifying early and late maturity of vegetables, introducing semi-forced or forced cultivation using facilities to increase productivity, adjusting shipping, and introducing temporary storage and refrigerators to adjust shipping would be countermeasures on the production side.

As supportive countermeasures, market information about demand for crops, varieties of crops, prices, seasonal changes in prices, and changes in demand should be provided to producers through disposers, truck wholesalers, and APTC management bodies. Based on this information and together with technical instructions, farming planning can be made by producers.

DA has to continue compiling daily price data in traditional wholesale markets, such as the Divisoria and Balintawak markets of the National Capital Region (NCR),[142] and provide information to the supply chain stakeholders. This information can also be utilized for policy planning to support farmers for cultivation techniques, provision of production materials, and subsidy projects to realize production and shipping adjustments.

B. Invisible cost is accounted for quality deteriorations

Farmers generally bring their harvested produce without packaging or vinyl sacks[143] to

[142] DA obtains wholesale price information and handling volumes from four traders at the Divisoria market. The monitoring of price information at the market has just begun in November 2021.

[143] Tomatoes are transported and handled with plastic crates.

Figure 41: Cabbages transported without any packaging from the farm to BAPTC (left), physical damage to carrots (middle), and rotting of chayote (right)

Source: Project Team

wholesale markets, resulting in quality deterioration due to exposure to rainfall and physical impact during transportation. Vegetables in vinyl sacks are damaged or scratched owing to physical impact when they are loaded onto 10-wheel trucks at wholesale markets, and when they are unloaded at wholesale markets in consumption areas.

Vegetables in closed vinyl sacks rot when kept in it for a long time. However, the use of refrigerators has been limited. As the freshness of vegetables is lost, price loss occurs (Figure 41). In retail markets, this lost value is counted and added to the retail prices. Consequently, consumers pay for this invisible cost when purchasing vegetables.

To maintain freshness and avoid physical damage, stackable and nestable plastic crates with steel handles can be utilized by the stakeholders of vegetable supply chains.[144]

C. Limited usage of market information from APTC (BAPTC and NVAT)

Wholesale markets represented by the APTC release market price information every day through Facebook. However, farmers in remote and topographically difficult areas face difficulty accessing information owing to poor Internet connectivity. Price information is collected for archive purposes only, and the use of market information is thus limited.

Against this backdrop, the BAPTC is planning to participate in INFOCAST, a project to disseminate market price information to farmers through the text message function of a domestic communication service provider, SMART. SMART has already provided an account

[144] Results of focus group discussion among farmers, disposers, and truck wholesalers in BAPTC (29 June 2022).

for the BAPTC, and 5,000 farmers have registered as of March 2022. INFOCAST will help farmers in shipping adjustments together with technical instruction once they can access the price information.

D. Unclear grading standards despite sorting of vegetable

The Bureau of Product Standard of DTI developed a national standard for respective crops, in which grading standards are indicated as first, second, and third classes. However, this grading standard was not applied. A specification for grading standards does not exist in practice. Although the management body of the market does not intervene, disposers visually judge the size, shape, color, and existence of damages. In addition, uniformity of vegetable is considered for packaging in vinyl sacks while price difference is made based on grade "Good," "Average," and "Reject."

Currently, grading through visual observation is accepted by farmers, disposers, and truck wholesalers. Although not necessarily a major issue, the most important condition for a clear grading standard is whether defining the specification and clarifying the grade creates a clear price difference on the downstream side. If so, by setting a clear definition of "Good," "First class," or "A class" as grading standards, producers are motivated to increase the production of the specific class. This leads to a profit increase for farmers.

Accordingly, profitability of "Good" produce at farm gate can be calculated based on price change of "Good" and "Average," ratio of "Good" class at wholesale markets, and the production cost of farmers. If the farmers show their motivation to produce "Good" produce by viewing the clear specification of "Good," they can be assisted with technical improvements in cultivation, post-harvest technology, packaging, and transporting harvested produce.

E. Ununified management and services of APTC

Although APTCs in the respective provinces function as wholesale markets, the management body and market services are not unified. For example, SPPAQ is managed by a foundation and provides trading services using a barcode purchasing management system. The services also include providing technical instructions for cultivation, post-harvest handling, and transportation from the farm to the farmers' markets. The decision-making body of the BAPTC is composed of DA, BSU, provincial governor, provincial congressman, among others. The management body is not involved in the trading. Disposers transact trading. As for the PAPTC, an agricultural cooperative manages the trading location. NVATI is established by a joint venture of a private company and the local government of the province and municipality, and has a marketing section that functions as a disposer. Even CNAPT has not received enough

stock for its original purpose.

According to the DA[145], although a unified operation plan was envision at the planning stage of each APTC, it has not been realized.

DA promotes APTCs in 23 locations nationwide, and APTC development projects are planned[146]. According to the DA, APTC in major cities will be modernized as food hubs[147]. In order to standardize the APTC's operating body and the market services, it is necessary to create a development model for APTC that is easy to deploy nationwide in line with its original purpose.

F. Accumulated unpaid dues to disposers by wholesalers (BAPTC and PAPTC)

The accumulation of unpaid dues to disposers by wholesalers is a serious issue in BAPTC and PAPTC. Purchasers of wholesalers in Manila negotiate with disposers in the BAPTC to buy vegetables and arrange transportation. After the purchasers procure in accounts payable, there are cases in which the disposers are unable to contact the purchasers, which leads to not collecting the remaining payment. In this case, disposers have to pay the farmers from their own funds. Although the same problem occurs in PAPTC, the market management body does not take any action.

Electric transactions can be a solution. However, farmers, disposers, and truck wholesalers also prefer cash transactions. Therefore, market management bodies and government authorities must strengthen their functions against such market transaction frauds and incidents.

[145] Remote interview with DA-AMAS (August 14, 2022).
[146] The Pilot Survey for Disseminating SME Technologies for Introduction of IT for Agricultural Products Distribution (May 2015, JICA)
[147] Remote interview with DA-AMAS (August 14, 2022).

(3) Consumption side

A. Low vegetables consumption

According to the FAO, the standard vegetable requirement for adult is 87.6 kg a year.[148]

Figure 42 shows that the annual vegetable consumption per capita in the Philippines is 63.0 kg, which is approximately 25 kg less than the requirement. Among southeast Asian counties, the Philippines' consumption is positioned in the middle.

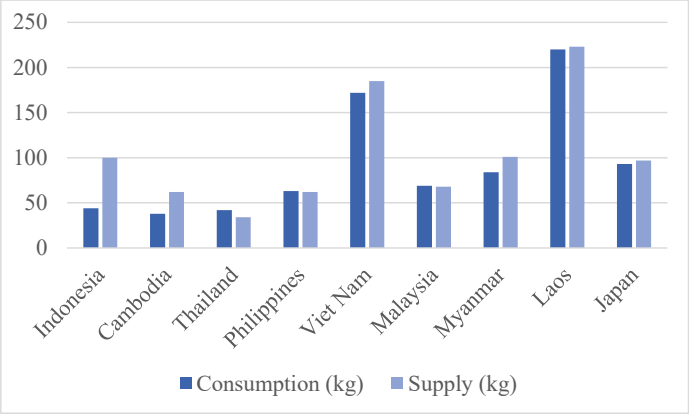


Figure 42: Annual vegetable consumption per capita (2021) and supply of vegetables (2019) in Southeast Asian countries and Japan

Note: FAO excludes potatoes from vegetables and includes mushrooms, melons, and watermelons.
Source: Consumption is from Vegetable Consumption in Asia – Landgeist and supply is from FAT Stat (https://www.fao.org/faostat/en/#data/SCL)

To increase the consumption of vegetables in the Philippines, the following should be considered: (a) raising health awareness and the role of vegetable consumption in health through educational activities for parents and young individuals; (b) developing, proposing, and disseminating recipes for healthy eating habits in easily understandable formats for consumers; and (3) promoting home gardens and developing recipes for city dwellers to eat vegetables without hassle.

B. Quality deterioration of leafy vegetables in supermarkets

The Project Team observed the low quality of leafy vegetables sold at supermarkets in the National Capital Region of Manila. According to a modern channel-trading firm, because of long-distance transportation without reefer trucks,[149] the freshness of vegetables is bound to be compromised.

It is important to study the current status of leafy vegetables before identifying solutions. Production records of leafy vegetables sold at supermarkets and transportation channels, the number of days taken from the farms to supermarkets, and packaging and transportation

[148] Vegetable Consumption in Asia - Landgeist (Accessed on 10 July 2022)
[149] Interview with a wholesale operator of collection and shipping center, Dizon Farms in Benguet Province (14 March 2022).

methods need to be studied. Based on this information regarding the degree of freshness of vegetables, there is room for improvement. For instance, the use of plastic bags for preserving freshness can be considered in supermarkets. Most vegetable vendors in supermarkets operate under shelf rental by modern channel trader companies such as Dizon Farms[150]; therefore, collaboration with these firms is required.

C. Underdeveloped market of processed vegetables

The Project Team observed that compared with processed vegetable food items in Japan, very limited varieties of processed vegetable items are sold in supermarkets in the NCR of Manila, although many varieties of vegetables are produced in the country.

Support for fostering processing enterprises or firms from scratch is time-consuming. Thus, successful cases of vegetable processing food businesses must be increased and shared as supportive actions for existing processing firms to expand their businesses or for farmers' organizations and multipurpose cooperatives to promote vegetable processing food businesses.

D. Low supply of crops despite potential market demand

Market survey results show that many consumers wish to increase their consumption of lettuce and broccoli. However, the production volume of these two vegetables is lower than that of such products as onion, eggplant, tomato, and garlic, which are also consumed more, according to the results of the market survey. The production growth rate of lettuce and broccoli for the past five to ten years was lower than that of onions (Table 55). The production and shipment of lettuce and broccoli must be increased to meet consumer demand.

Table 55: Growth rate of crops and top producing province

Crop	5-year growth (%)	10-year growth (%)	Production in the Philippines (metric ton)	Top producer	
				Province	Production (metric ton)
Onion	14.3	55.0	186,589	Nueva Ecija	135,629
Lettuce	12.2	7.0	1,707	Benguet	1,232
Broccoli	11.9	15.2	2,133	Benguet	2,064
Green beans	10.4	52.0	26,932	Pangasinan	6,528
Eggplant	7.6	18.6	185,807	Pangasinan	81,972
Watermelon	7.5	11.3	53,918	Pangasinan	23,086
Yam	6.9	18.2	4,674	Cagayan	981
Tomato	3.3	9.4	138,562	Ilocos Norte	27,935
Okra	1.3	4.3	21,992	Nueva Ecija	6,893

Source: Prepared by the Project Team from data of the Philippines Statistics Authority

[150] A modern channel wholesale firm in the Philippines.

Actions must be taken to increase the production of lettuce and broccoli through the support of the HVCDP and services of the Agricultural Training Institute (ATI) of DA.

E. Difficulty in determining organic vegetables at sales point

Market surveys show that currently, 60% of the respondents buy organic vegetables. Meanwhile, the Project Team found that sometimes there are no logos of organic certification bodies on the products, although they are sold as organic vegetables. Thus, it is doubtful whether consumers will buy organic vegetables.

In the Philippines, the logos of organic certification bodies are displayed on packages of organic vegetables. The Bureau of Agriculture and Fisheries Standards (BAFS) of the DA gives authority to certification bodies for certification services and supervises them. There are few domestic certification bodies in the country. A well-known example is the Organic Certification Center for the Philippines (OCCP), along with several other international certification bodies, including the participatory guarantee system (PGS).[151] The organic certification label on the package must include the name of the certification body, logo or sticker, and ad certification number authorized by the BAFS.[152] Thus, there are as many logos as certification bodies.

The Project Team observed some cases where the vegetables were sold as organic vegetables but did not meet the previously mentioned conditions, and the certification body's name and BAFS certification number are not displayed on packages.

As the consumption of organic vegetables will increase according to the market survey, it is necessary to inform consumers about organic vegetables correctly, with proper display in accordance with regulations.

5.2 Issues on Highland Vegetables

(1) Vegetable Farmers

The issues of highland vegetable producers are described separately for issues related to production technology and marketing.

[151] It is an organic certification system among members of farmers' organizations.
[152] Interview with DA-AMAS on 29 March 2022

Table 56: Yield of major vegetables in two highland provinces

Unit: metric tons/ha

Province	Commodity [a]	Potential yield [b]	Estimated yield (2020) [c]	Average yield from qualitative survey	Average yield from quantitative survey [d]
Benguet	Potato	15-20	19.1	6.1	14.1
	Cabbage	60-85	20.9	9.0	23.9
	Carrot	70	19.1	4.4	18.3
Nueva Vizcaya	Squash	10-15	13.5	6.0	--
	Onion	20-30	12.6	0.5	--
	Tomato	70	14.5	6.0	--
	Cabbage	60-85	5.3	7.0	--
	Cauliflower	60-70	2.7	8.8	--

a: Major commodities according to national statistics and qualitative survey
b: Potential yield of the major variety in each province.
c: Calculated from production quantity and planted area in Philippine Statistics Authority (psa.gov.ph), accessed on 17 September 2021.
d: The average values of farmer's answers excluding the upper and lower outliers of 10%

Source: Elaborated by the Project Team based on Philippine Statistics Authority Data base, Commercial Crop Variety Database, the qualitative survey and the quantitative survey.

1) Issues in production technology

Table 56 shows the yields of major vegetables based on national statistical data and answers from qualitative and quantitative surveys.

Figure 43: Potato plants damaged by late blight

Source: Project Team

With most vegetables, the yields reported in the qualitative survey were lower than that in the national statistics data and the potential yield of the varieties. In Benguet, where the quantitative survey was conducted, the yield from the survey was as high as that of the national statistical data, but lower than that of the variety information, except for potato. The main cause of the low yield in Benguet is damage by pests and diseases, such as late blight and bacterial wilt of potatoes (Figure 43). In Benguet, there are concerns regarding soil-borne diseases and a decline in soil fertility caused by continuous cropping of potato, cabbage, and carrot thrice a year in the same field. To avoid these problems, proper technology for raising disease-free seedlings, diversification of commodities and varieties, and promotion of appropriate methods for using agro-chemicals are required.

In Nueva Vizcaya, the cabbage and cauliflower yields in the survey were higher than those in the statistical data, probably because the surveyed area was only in the highlands at an altitude of 800–1,200 m.

According to a survey, potato producers procure seed tubers that local agricultural input suppliers propagated over several years from the seed tubers imported from the Netherlands,

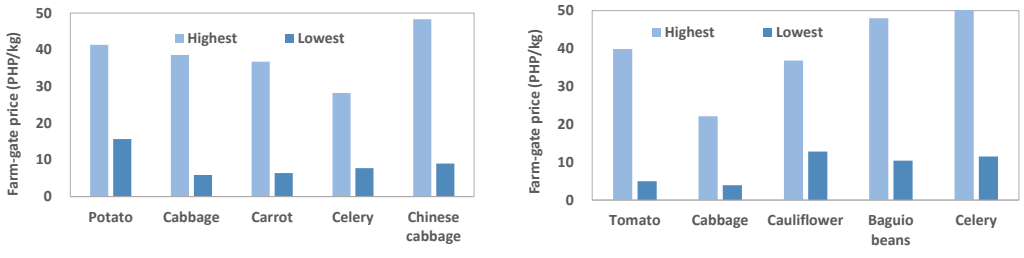
or self-propagate them continuously for three to five years from imported ones from the Netherlands, Germany, and Canada. Some farmers procured the seed tuber materials produced by the NPRCRTC of BSU, but stopped using them because of insufficient quantity of the materials. Continuous self-propagation of seed tubers could spread the damage caused by viral diseases, although the symptoms of viral diseases have not yet been confirmed. If it spreads, the damage to Benguet, the major potato producing area, would be significant. Thus, it is crucial to build a seed tuber production system using the original material from the tissue culture produced by NPRCRTC to ensure that disease-free potato tubers reach the farmers. This would sustain a high yield of potatoes and reduce the production cost for farmers.

Regarding irrigation, farmers used sprinkler irrigation for year-round cultivation of cabbage and potato, but around 60% of farmers in Benguet and 80% in Nueva Vizcaya answered that there was a shortage of irrigation water during the dry season. Optimum irrigation methods, including the in-farm and intake-water methods, need to be proposed by verifying the timing and area of water shortage and its effect on vegetable productivity. Diversification of cultivated vegetables also needs to be considered.

It should be noted that in the qualitative survey, few farmers were able to answer the yield easily; in that case, the yield was estimated from the area and shipment amount.

2) Issues in marketing

The most serious issue for vegetable farmers regarding marketing is price fluctuations. Figure 44 shows the highest and lowest farm gate prices obtained by the qualitative survey. Even with potato, which had the least price fluctuations, there was a four-fold difference, and there was a five-fold difference in Chinese cabbage, which had the largest price fluctuations.



Benguet　　Nueva Vizcaya

Figure 44: Highest and lowest farm-gate price

Source: Elaborated by the Project Team based on the qualitative survey between March and April 2022

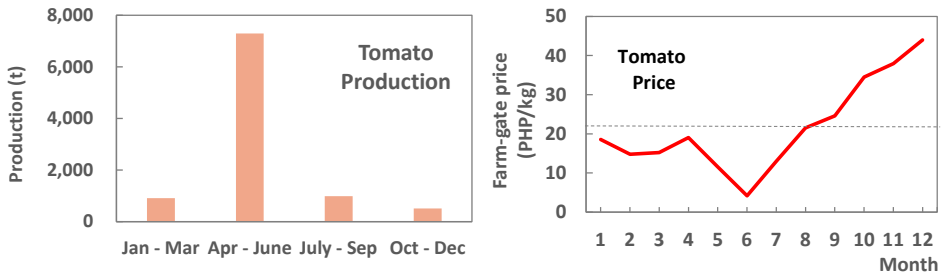


Figure 45: Change in production quantity and farm-gate price of tomato in Nueva Vizcaya (2020)

Source: Elaborated by the project team based on the Philippine Statistics Authority Database

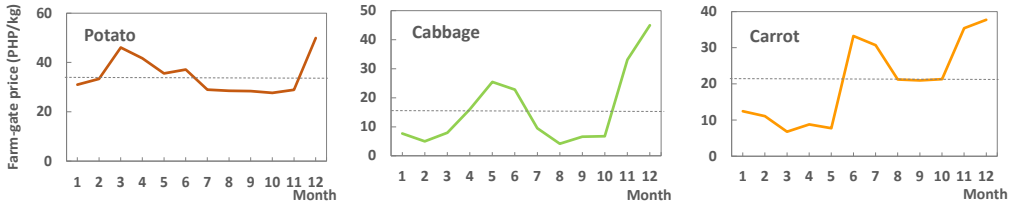


Figure 46: Changes in farm-gate price of major vegetables in Benguet (2020)

Note：The dotted line is the average price
Source：Elaborated by the project team based on the Philippine Statistics Authority Database

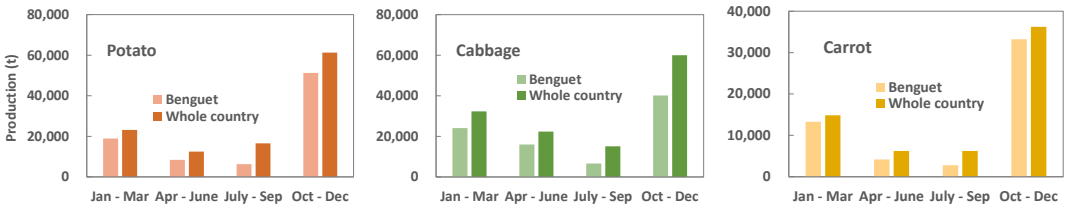


Figure 47: Changes in production of major vegetables in Benguet (2020)

Source: Elaborated by the Project Team based on Philippine Statistics Authority Database

Figure 45 shows quarterly production quantity and Figure 46 shows fluctuation of farm-gate prices of three major vegetables in Benguet, based on the data set of national statistics.

Vegetable production is a major source of cash income for the farmers in both provinces; therefore, almost all products are considered sold. Benguet province is a major production area for potato, cabbage, and carrot, accounting for 75%, 67%, and 84% of the national production,

respectively. The price fluctuations of cabbage and carrot are particularly large, but potatoes that can be stored for some period fluctuate only to a certain extent from the average price. However, the prices of all three vegetables rise during the Christmas season, indicating that demand exceeds the increase in production. The price fluctuation from January to July depends on production quantity, but the price decline from August to October may be due to the restraint of consumption before the Christmas season. It is clear that the farmers' income is improved by shipping the products between November and December, when the demand is high, or between May and June, when production is low. This can be achieved by introducing suitable varieties, cultivation systems, irrigation, and storage facilities.

The farm-gate price of tomatoes, one of the main vegetables in Nueva Vizcaya, is directly affected by production quantity. High production in April–June lowers the price in May–July (Figure 46). Cultivation in greenhouses can adjust shipping time and obtain high tomato yields; however, in the current situation, greenhouses provided by HVCDP or other programs are not always effectively used. Thus, it is necessary to analyze the current situation and promote the appropriate use of greenhouses. The major tomato variety is currently Diamante Max, which is a determinate type. It is important to examine the possibility of introducing a long-harvesting indeterminate type of tomato or cherry tomato. The national production quantity is not included in the figure, as the market share of tomatoes in Nueva Vizcaya is only about 4%.

In both provinces, a majority of farmers ship their products to wholesale markets through intermediate trader called "disposer." They also procure agricultural inputs for farmers and, in some cases, deduct 30% of sales. They also proposed the type of vegetables and planting time for farmers. It seems beneficial for farmers that disposers who are familiar with market trends can also provide technical proposals. However, some farmers mentioned that the shipping destination was limited, and they were not able to discuss the price. It is necessary to discuss such an approach with all concerned parties that leads to the profit of the entire society. The approach may include the diversification of shipping destinations, without causing confusion in the market, and training related to the diversification of both cropping seasons and types of vegetables for both farmers and disposers.

Farming in mountainous areas requires much effort to bring the harvest to the road that can be accessed by shipping trucks (Figure 48). According to a qualitative survey, it can take up to an hour to carry the harvest from the field to the road during the rainy season. Farmers must hire many workers for harvesting and carrying, and the labor cost can exceed 70% of the production cost.[153]

[153] Quantitative Survey (Farming Management Research) between April and June 2022

(2) Buyer-sellers in the production areas

A. High labor cost relating to works of disposers (BAPTC)

The results of the quantitative survey indicate that disposers are in excessive competition, and their business sustainability is questionable. It also indicates that the labor cost borne by disposers accounts for 76.5% of the total cost. This result corresponds to the findings of the qualitative survey.

Figure 48: Carrying a harvest in a slope

Source: Project Team

If vegetables are sold at a relatively high farm gate price by disposers, who are the link between farmers and truck wholesalers, the disposers can increase farmers' income. However, the disposers of the BAPTC face excessive competition, thus affecting sustainability of the value chain.

Disposers can improve their competitiveness in two ways if they have market power to control prices: first, they need to increase selling prices to truck-wholesalers and second, they need to reduce the procurement prices of vegetables. However, it is difficult to implement both options. For the first case, the hub wholesaler in Manila, which is a downstream buyer, does not accept the offer because of its competition. Otherwise, pushing lower prices to farmers has the consequence of reducing farmers' income, which contradicts the pathway of enhancing farmers' welfare. Therefore, the only option for disposers is to reduce the cost burden. From this perspective, disposers have been observed to conduct various value-added activities instead of merely intermediating transactions between farmers and truck-wholesalers, as seen in Table 57. For example, disposers take up sorting, grading, packaging, and loading-unloading of vegetables.

In contrast, some traders on a traditional value chain around public markets, such as the Sentrong Pamilihan Ng Produktong Agriculturura in Quezon Province, reduce marketing costs by using various services provided by the public market. If the rural public markets in Benguet extend and provide such services, especially for sorting, grading, and packaging vegetables to disposers, their condition may improve.

In summary, the quantitative data analysis showed that the intermediaries in lowland areas and consumption areas, besides disposers in highland areas, are sufficiently competitive actors. Thus, they do not excessively obtain profits and control market prices as actors with market

power (the NMR of such actors is usually over 20% or 30%). In other words, intermediaries do not lose the sustainability of their businesses, which may be caused by excessive competition. If intermediaries hamper proper competition, DA needs to regulate such behavior to maintain appropriate competition for intermediaries.

Meanwhile, interventions to reduce the costs that intermediaries must bear will be effective not only for disposers in Benguet, who need to improve their business situation, but also for the actors who are determined to be sufficiently competitive in the study. Therefore, many stakeholders are interested in such interventions to reduce costs. For example, enhancing marketing functions such as sorting, grading, and transporting vegetables by public markets could be an effective intervention for enhancing traditional value chains.

Table 57: Traders' tasks (percentage)

	Benguet Province (Only disposers)	Quezon Province (All samples)
Sorting and grading of vegetables	70.59%	52.63%
Processing	0.00%	31.58%
Packing	70.59%	52.63%
Transporting	0.00%	36.84%
Uploading and downloading	64.71%	36.84%
Trade negotiations	100.00%	84.21%

Source: Project Team

The following measures are recommended to deal with the issues described above: a) post-harvest practices performed at BAPTC to be shifted to on-farm, sorting and grading, weighing, packaging, and others; and b) introducing a simplified transaction service through a sales management system (ESL system), which is practiced by SPPAQFI in Quezon, as a service of BAPTC's disposer. As for a), the transaction may be simplified by introducing the use of a plastic crate. In this case, the farm gate price must be set by calculating the farmers' post-harvest operation costs. As for b), efficient transactions can be performed by digitizing.

5.3 Issues on Lowland Vegetables

(1) Vegetable Farmers

Similar to highland vegetable production areas, the challenges specific to lowland vegetable farmers are as follows: 1) challenges in agricultural production techniques and 2) challenges in marketing.

1) Challenges in agricultural production techniques

In addition to the optimization and promotion of pest and disease control and crop management mentioned in Section 5.1(1), specific challenges relating to lowland vegetable production areas that producers express include the development of agricultural production techniques for adapting to climate change. The Philippines is a country with severe typhoon damage; in these four provinces, agricultural damage is significant because of rising temperatures, shorter rainfall periods, and torrential rains caused by recent climate change, as well as by strong winds known as *Habagat* (southwest monsoon) and *Amihan* (northeast monsoon).

Table 58: Yields of major crops in four lowland provinces

Unit(ton/ha)

Province	Crop[a]	Potential yield[b]	Estimated yield(2020)[c]	Avarage yield of Qualitative Survey	Avarage yeild of Quantitative Survey[d]
Quezon	Bitter gourd	15-20	7.3	9.4	12.6
	String beans	35-40	2.7	0.4	9.2
	Eggplant	30	23.8	4.0	8.3
	Tomato	70	13.2	27.1	31.0
Pangasinan	Eggplant	30	20.7	3.7	-
	Bitter gourd	15-20	6.4	5.2	-
	Bottle gourd	15-20	23.2	2.3	-
Nueva Ecija	Oninon	20-30	14.9	6.4	-
	String beans	35-40	15.6	11.5	-
	Bitter gourd	15-20	7.0	9.1	-
	Tomato	70	11.7	3.9	-
Camarines Norte	Squash	10-15	NA	3.6	-
	Bitter gourd	15-20	NA	2.8	-
	String beans	35-40	NA	1.7	-

[a] Crops with the highest number of responses in Philippine statistique authority (psa.gov.ph) data and qualitative surveys.

[b] Potential yields of the most commonly grown varieties in each province.

[c] Calculated from data on production and planted/harvested area by commodity referenced by the Philipinne Statistique Authority (psa.gov.ph) on the 17 September 2021.

[d] Average of yield from quantitative survey results in Quezon Province, excluding upper and lower outliers of 10%.

Source: Prepared by the Project Team based on data from the Philippine Statistics Authority Database, commercial crop variety database, and results of qualitative and quantitative surveys.

Table 58 shows the yield per hectare of the main crops identified in the qualitative survey of the project area, with the potential yield of the most commonly grown local varieties, estimates from provincial data published by the Philippine Bureau of Statistics, and the results of the qualitative and quantitative surveys conducted by the project.

Compared to the potential yields of the varieties used in the project area, the yield of vegetables in the four lowland provinces is lower. The estimated yields based on national statistics, the yields of farmers interviewed in the qualitative survey, and the yields of farmers interviewed in the quantitative survey in Quezon were two to five times, two to ten times except for tomato, and two to three times, respectively, lower than the potential yields of the used varieties.

According to the farmers interviewed in the qualitative survey, the problem of pests and diseases is enormous because of the hot and humid farming environments. In addition, the recent climate change is a reason for low yield and productivity. In particular, in the provinces of Quezon and Camarines Norte, where rainfed agriculture is commonly practiced, the overall vegetable production and yields have decreased because timely crop management becomes difficult owing to yearly changes in rainfall patterns, and river water used for supplementary irrigation depletes before flowering and ripening of plants.

Even in Pangasinan and Nueva Ecija, where irrigation facilities are relatively well developed, there is a lack of rainfall, rivers, and groundwater for irrigation caused by climate change. Qualitative research indicates that the problem was the higher cost of fuel for pumping water compared to the lack of water in Pangasinan. However, in 2021, the San Roque Dam, which provides irrigation water for 32,000 ha of agricultural land in the province, was at its lowest level ever, and agricultural water shortages occurred partially.[154] In addition to the effects of low rainfall across the country, in these two provinces, surface irrigation (furrow irrigation) practice using slopes in vegetable fields may have reduced water resources because of the increase in evapotranspiration and infiltration losses (Figure 49).

Figure 49: Figure Furrow irrigation in a field of string beans in Nueva Ecija

Source: Project Team

Production planning and water use adapted to the limatic conditions are necessary to improve this situation. Effective measures include the development and dissemination of suitable production planning methods based on detailed weather information, the introduction of water and soil conservation techniques suited to the topography of the field and crop type, and the introduction of water-saving agricultural

Figure 50: Windbreak fences made of coconut branches and leaves in Camarines Norte

Source: Project Team

[154] Philippine News Agency, "San Roque Dam in Pangasinan resumes operation" and "San Roque Dam not likely to release" https://www.pna.gov.ph/ (Accessed 3 July 2022)

technologies such as water intake and irrigation facility development and drip irrigation to increase the efficiency of irrigation water use.

In addition, in Nueva Ecija from March to April and in Camarines Norte from December to February, the strong winds of the northeast monsoon *of Amihan* damage growing or pre-harvest vegetables every year. In both provinces, farmers should make shade nets and 2-3 m high windbreak fences using coconut leaves (Figure 50) to protect vegetables every year, which increases the cost of vegetable production.

Possible measures include building strong windbreaks or introducing vegetables as intercropping in orchards, such as coconut, mango, and papaya, or putting up hedgerows. The introduction of crops and varieties that can be grown from December to April, when strong winds are likely to come, is also worth considering.

In any case, it is necessary to check the extent to which weather information is being measured in each locality and the current situation of agricultural technique support using this information and to act appropriately.

2) Issues in marketing

As mentioned in Section 5.1(1), a serious marketing problem for vegetable producers is the fluctuation of vegetable farm gate prices, especially low-priced sales. To remedy this situation and improve farmers' income by selling their products at the highest possible price, it is necessary to equalize the quantity and timing of harvesting and shipping.

In lowland vegetable production areas, outdoor production is the basic method of vegetable growth under a hot and humid environment and lack of agricultural water due to low rainfall and depletion of river and well water because of climate change. This limits the crop season. Consequently, farmers in the province plant, harvest, and ship the same crops at the same time of year, which leads to a collapse in farm gate prices. Production costs such as seeds, fertilizers, and pesticides often exceed sales income, resulting in loss-making operations. When the farm gate price is below the cost of transportation, products are sometimes destroyed in the field (Figure 51).

Figure 51: Onions discarded in Nueva Ecija owing to low prices

Source: Project Team

Figure 52 shows the highest and lowest farm gate prices for the main crops from the results of the qualitative survey in the four lowland vegetable-producing provinces.

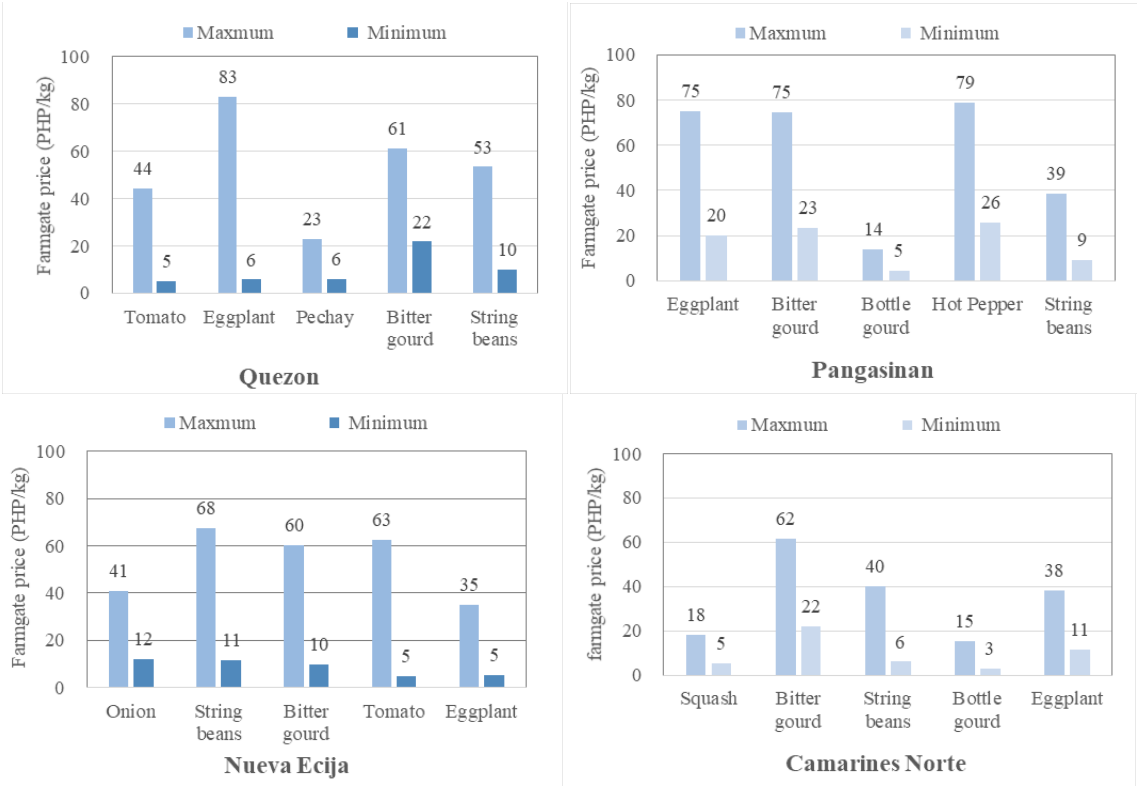


Figure 52: Highest and lowest farm gate prices in lowland vegetable production areas (2022)

Source: Prepared by the Project Team from the results of the qualitative survey (March–April 2022)

In the four provinces, farmers generally produce the same crops, but the lowest prices are about one-third to one-twelfth of the highest prices, with price differences varying by crop type and province. Specifically, price differences tend to be large for eggplant, tomato, and string bean, and relatively small for bitter gourd. For example, Figure 53 shows the variation in the production and farm gate prices of eggplant, tomato, and bitter gourd in the provinces of Quezon, Pangasinan, and Nueva Ecija.[155] According to interviews with farmers in the four lowland provinces where qualitative research was conducted, these crops were grown primarily for sale; hence, the volume of production and shipment was assumed to be roughly equivalent to the volume of sales.

The prices of eggplants in Pangasinan from April to June and those of tomato in Quezon

[155] The data source, the Philippine Statistics Authority Database (https://psa.gov.ph/), was in maintenance and no information was available for Camarines Norte, the newly targeted province of the project.

Eggplant **Tomato** **Bitter gourd**

Figure 53: Production (Upper) and farm gate prices (Lower) by crop type in lowland provinces (2020)

Source: Prepared by the Project Team based on data from the Philippine Statistics Authority Database

from January to March were the lowest because of production, with shipping volumes being the highest throughout the year. When the shipment volumes of both crops decreased from September to October, prices started to rise and peaked in November and December; their prices increased by 10-12 times higher than their lowest prices.

In contrast, the price of bitter gourd was less volatile, as they were produced and shipped in relatively stable quantities from January to October in all provinces. In Nueva Ecija, prices increased with a decrease in their volume of production from October onward, but prices in November were still about 4-5 times higher than the lowest. Incidentally, surging bitter gourd prices in Quezon in November 2020 could be an exception, as the prices of all vegetables rose sharply at this time.[156]

Although some farmers prefer speculative management to take advantage of such farm gate prices, it is difficult to produce vegetables while anticipating soaring prices of bitter gourd in Quezon Province in November 2020. Moreover, only farmers who own developed fields with drainage and irrigation systems enabling water management during heavy rain or drought can

[156] https://legacy.senate.gov.ph/press_release/2020/1126_recto1.asp (Accessed 20 July 2022)

ship their products at the highest prices from October to December.

Consequently, it is necessary for ordinary farmers to equalize the volumes of production and shipment of vegetables to sell their products at a high price and obtain stable agricultural income. Therefore, the development of irrigation facilities, promoted by the Philippine government, could be a long-term measure. However, as short- to medium-term measures, it is realistic to encourage farmers to adjust their cropping plan for harvesting and shipping when the market prices are high, to promote crops and varieties highly adapted to environmental conditions, and to introduce planned production and shipping through farmers' organizations. For example, as major seed companies develop and sell seeds suited to the current environmental conditions, long-harvesting varieties of solanaceous vegetables, such as tomato, eggplant, and pepper, which are not day-length responsive, can be promoted. It is also worth considering the introduction of new crops, such as cherry tomato and sweet pepper, which are becoming increasingly marketable. Alternatively, onion, which are day-length-responsive crops, can be harvested earlier and sold at high prices before price collapse if farmers practice planned production and shipment using varieties different from ordinary ones or shift from direct sowing to transplanting.

In addition, farmers' production and shipments can be equalized by supporting several innovators, such as agro-industrial companies and ordinary farmers, who have started producing and selling seeds and seedlings that enable early and long-term harvesting.

As a different approach, if members of farmers' organizations produce certain crops by gradually shifting the growing season and ship a certain volume of products regularly for a long period, they will be able to sell to fixed customers in a stable manner, which will stabilize the farm management of each member and help form a special production area. However, in this case, it is necessary to establish a financial system that enables farmers to raise funds when they need to invest in agricultural production and farming facilities and to create a profit-sharing system that strengthens organizations and farmers' awareness.

(2) Buyer-sellers in the production areas

A. Narrowed market channels of farmers (Pangasinan)

In some cases, the collectors are cornering farmers. While they help farmers improve their livelihoods by supporting them from funding to harvesting, shipping, and purchasing harvested produce, the farmers become more dependent on collectors; this limits the diversification of market destinations, as seen in Pangasinan.

Shifting from traditional distribution to modern distribution and diversifying sales channels

are recommended. Specifically, diversifying sales channels can be practiced by either a) promoting contract farming or b) introducing business-to-business (B-to-B) e-commerce (EC). It is easier to implement (b) than (a). In other words, farmers can ship a certain quantity of vegetables at their discretion without being bound by a contract. As it goes through the EC platform management organization, the shipping adjustment function on the production side becomes less important.

B. Underutilization of wholesale market facilities (NEAPTC and CNAPTC)

The NEAPTC began operations in 2015 as an alternative to the crowded Sanguitan wholesale market. However, the NEAPTC is currently only used by two private wholesalers in modern distribution channels. Cooperation between city authorities and the provincial government did not go well. Consequently, the shifting of traders from the Sanguitan Wholesale Market to the NEAPTC has been cancelled. Currently, only modern distributors, namely, Dizon Farms, and KLT Fruits,[157] are operating. The failure of the NEAPTC to function as a provincial wholesale market is a major challenge.[158]

CNAPTC is operated by the Labo Progressive Multi-Purpose Cooperative (LMMPC) as a wholesale market. However, vegetables in the province of Camarines Norte are shipped to Daet, Labo, and Talisay municipal or city markets, as well as vegetables from other provinces, instead of shipping to the CNAPTC. The province's ordinances require wholesale vegetable transactions to be performed only at the APTC. The CNAPTC in Talisay is strategically located close to the highway with ample parking and trading floors. However, this approach has not been fully used. It can handle 50 tons of vegetables per day; however, the current average handling amount is 300 kg per day, which is extremely small.

5.4 Issues on Infrastructure

(1) Facilities in Production Areas

A. Insufficient irrigation facility

Most farmers use irrigation facilities, but many complain of water shortages during the dry season, and some farmers have limited cropping areas because of water shortages. For farmers who cannot maintain irrigation facilities properly due to economic reasons, large-scale rehabilitation and initial investment are a heavy burden; therefore, financial support is required. The DA supports the installation of irrigation facilities through HVCDP, and such projects

[157] A fruits processing firm
[158] Interview at NEAPTC on 5 April 2022

should be continued. The cost of tap water is an issue, and efficient water use is important. In addition, flood damage due to heavy rain has been reported in the lowlands, and the improvement of drainage is important.

B. Insufficient development of horticultural facility

To improve quality and diversify crops and cropping seasons, it is necessary to control the growing environment of crops as well as to develop greenhouses. While the DA is vigorously promoting greenhouses in Benguet, the number of greenhouses is limited in other provinces, thus necessitating its promotion. Damage to greenhouses due to typhoons has also been reported; therefore, it is important to introduce appropriate specifications and take measures against storms.

C. Underdeveloped storage facility and lack of know-how in operation

Currently, only the shipping time of onions is controlled by cold storage, whereas other crops are difficult to store for a long time, and it is also difficult to secure economic efficiency. Onion cold storage facilities are in high demand and the management is stable in many facilities, but general grid power sources are unstable, and some facilities have no choice but to use high-cost generators.

On the contrary, an official of the DA CAR commented that although it is possible to construct a cold storage with its budget, they lack moisturizing and other operational expertise and thus need support. Therefore, formulating a cold chain in combination with refrigerated vans is challenging.

D. Loss freshness at the time of shipping

Based on the lessons learned from the stagnation of agricultural product distribution during the COVID-19 pandemic, the DA has provided 72 transport vehicles nationwide for taking agricultural products to LGUs and cooperatives, and their effective use is expected. Thirty refrigerated vehicles were included, and measures for their utilization were considered.

Plastic bags are the main material for packaging, and there are issues such as deterioration due to loading and unloading and transporting long hours, and the high rate of waste thereof. Therefore, there is room to improve transportation by using cardboard boxes and crates to reduce deterioration.

E. Access of farm products

a. From farm to FMR

Depending on the location, heavy labor is required to transport the harvested produce and inputs between farmlands and the nearest FMR; therefore, road construction and installation of tramlines are required. The DA is promoting tramline projects, but the number is limited, and once a problem that exceeds the economic capacity of the user group occurs, the use of tramline is typically stopped. Thus, it is important to form a consensus among stakeholders on how to deal with such cases in advance. Examples of the installation of inexpensive tramlines with individual ingenuity may become widespread in the future.

b. Road network

Road density is still low in the country, especially in rural areas, and the pavement rate of barangay roads is only approximately 40%. Therefore, improvement is required.

F. Underutilized distribution facility

a. Wholesale market in production area - defects in some facilities and trial and error of operation methods

Many new facilities are available. There are a few problems in terms of facilities, as the structure is simple, but some facilities have problems such as cold storage facilities not functioning and insufficient water supply and drainage functions. Many old markets used for a long time are in urban centers; therefore, it is difficult to expand the space, and traffic congestion occurs during the busy season.

In terms of operation, markets such as NVAT in Nueva Vizcaya serve as a model, while markets such as NEAPTC in Nueva Ecija have not been able to function as wholesale markets owing to conflict with pre-existing markets. DA intends to improve the efficiency of the conventional multi-layered, inefficient, and non-transparent market management through farmers' organizations, but it is still in a state of trial. Many new markets will be opened, and the search for better management methods is expected to continue.

b. Wholesale market in consumption area - many restrictions on traditional distribution and unclear new distribution system

Most vegetables distributed throughout the country are concentrated in Divisoria and Balintawak in Metro Manila and are traded within the traditional wholesaler hierarchy. The

DA aims to form a new distribution system against this traditional one, including providing trucks to producer groups, training as collectors, and developing food delivery hub facilities in urban areas of consumption. However, the feasibility and timing of its realization are unclear, and it is difficult to observe collaboration with the project at present.

c. Processing facility - only few are economically viable

Although efforts have been made in each province, the number of economically viable processing facilities is limited. Organizations that start from the production of marketable products are on track, but those that start from processing surplus products do not have high marketability and purchase raw materials only when there is a surplus, making most of them economically unviable. However, although the facility for ginger tea in Quezon started from processing surplus products, it is growing steadily because of the marketability of its products and the opportunity to partner with leading companies.

5.5 Issues on Digital Technologies in Agriculture

(1) Limited mobile coverage

As seen in Chapter 4, the vulnerability of the overall infrastructure in highland areas, such as Benguet, was highlighted in the rural areas of the Philippines. Specifically, there was no mobile phone connection and electricity was not available. ICT and power infrastructure issues existed prior to the use of digital technology using the Internet.

One general issue in the Philippines is the unavailability of mobile phone connections when one leaves the road for a short distance. This is a distinct phenomenon in the Philippines and is not observed in Thailand, India, or Africa. This is because the Philippine government has imposed high taxes on tower-type mobile base stations with wide coverage, and the mobile phone companies have built their networks using base stations installed on utility poles with small coverage.[159] Furthermore, the infrastructure is underdeveloped in the highland areas, as mentioned above. In Benguet, where a pilot project is expected to be implemented, the area where mobile phones can be used is very limited.

IoT devices required for environmental measurements on farms need to use wireless networks, such as cellular phone lines (3G or higher) for data communication. With the current mobile infrastructure in the Philippines, there are likely to be many cases where IoT devices cannot be used when installed far from roads. In addition, according to interviews with e-Supportlink, a company that installed equipment in the Sentrong Pamilihan market in Quezon

[159] Information acquired by the Project Team

Province through a JICA private sector partnership, transactions of agricultural products are also conducted on farms. In such cases, measures were needed to deal with the lack of cell phone reception. Therefore, the introduction of digital technology to projects in rural areas is a major challenge.

The legend is shown below. Mobile phone reception is not available in areas where these colors are not present.

2G (GSM)	3G	4G	4G+	5G
Blue	Green	Orange	Red	Purple

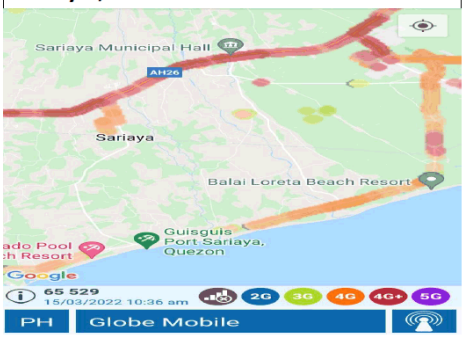
Smart/Sun/TNT
Atok and Buguias, Benguet

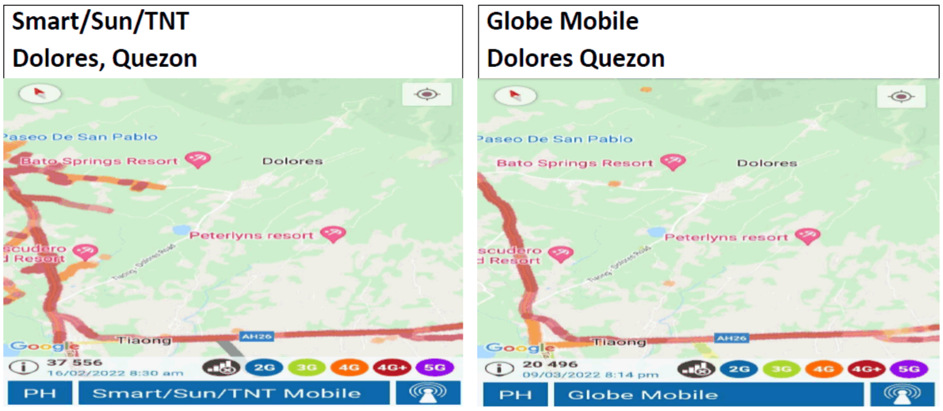
Globe Mobile
Atok and Buguias, Benguet

Benguet

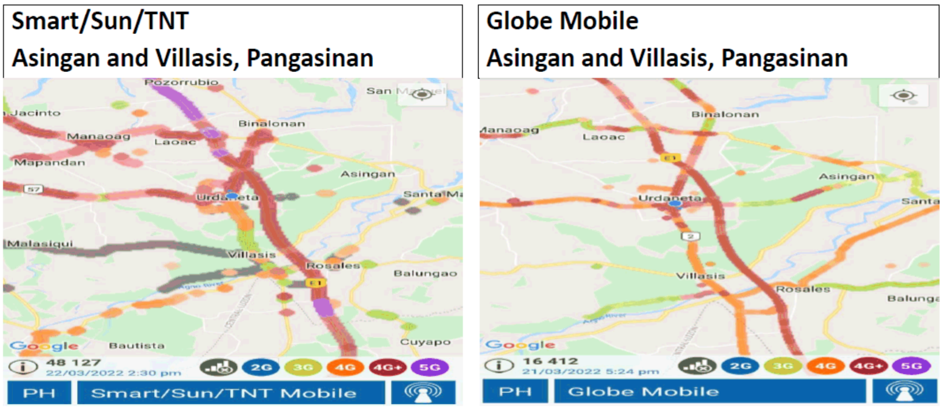
Smart/Sun/TNT
Sariaya, Quezon

Globe Mobile
Sariaya , Quezon

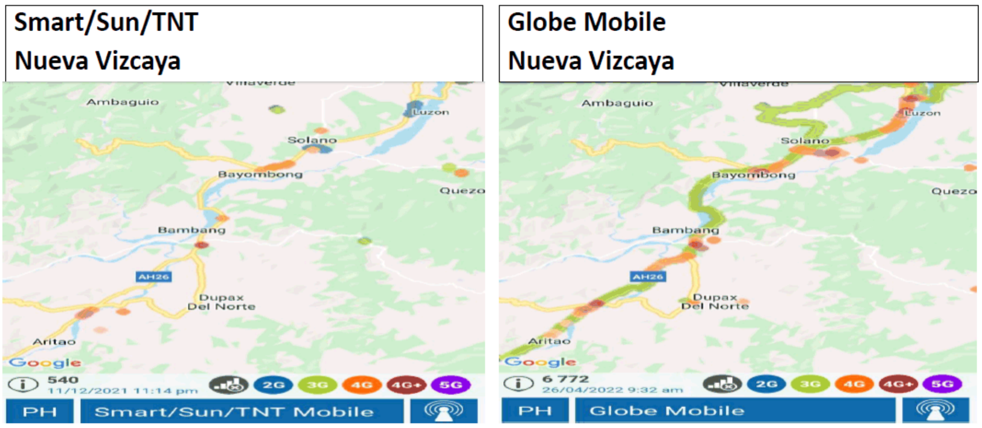




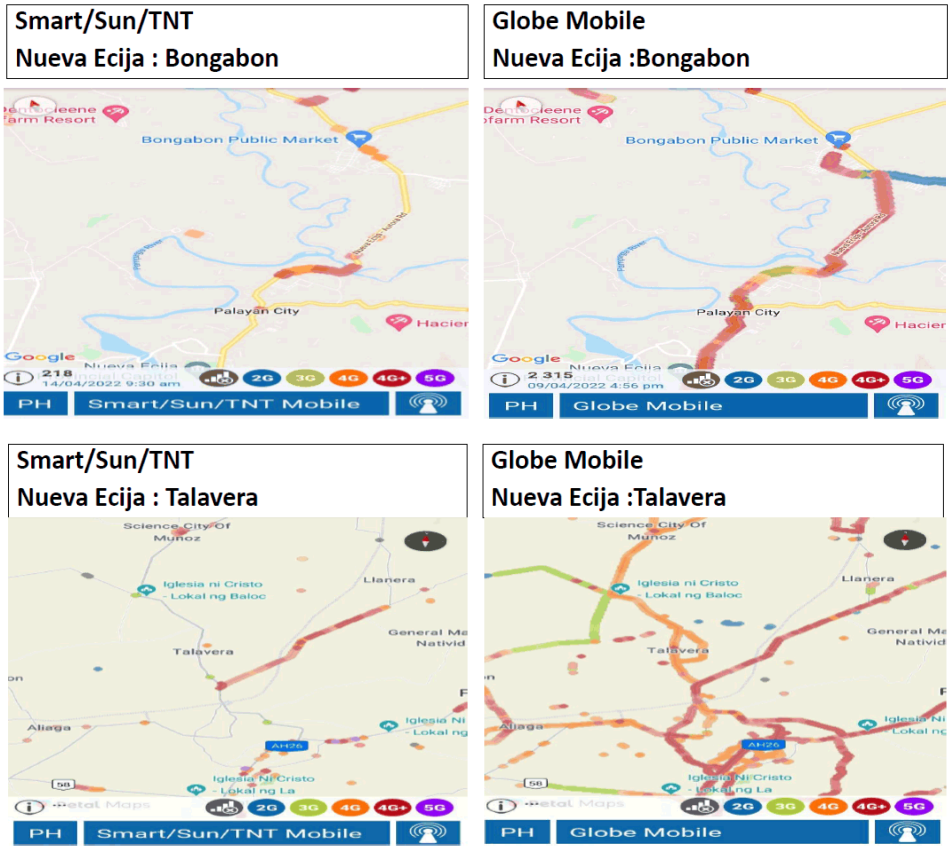
Quezon



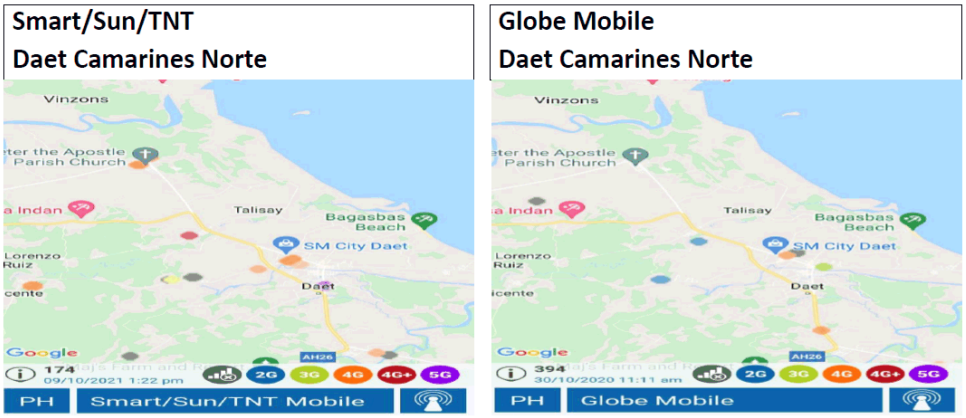
Pangasinan



Nueva Viscaya



Nueva Ecija



Camarines Norte

Figure 54: Signal conditions of mobile network in each province

Source: Project Team

Mobile phone coverage is extremely limited, even along roads, particularly in Camarines Norte. As a reference for promoting the realization of the agricultural IoT in the Philippines,

the case of Japan's mountainous regions is helpful. Although Japan has a population coverage rate of 99% for mobile phones, mobile phone signals do not connect in mountainous areas that account for 40% of farmland in Japan.[160] One possible solution to this problem is the Low Power Wide Area (LPWA) technology, a wireless communication technology with low communication speeds ranging from a few kbps to several hundred kbps, compared to cellular phone systems. LPWA has power-saving characteristics that allow operation for several years to decades with ordinary batteries and a wide area capability that allows communication over distances of several kilometers to tens of kilometers.[161] Yosano town in Kyoto Prefecture uses LPWA to create an environment that enables wireless Internet access for the entire town and to facilitate agricultural digitalization.[162]

Figure 55: Sample LPWA instruments

Source: ISA Co., Ltd

(2) Improvement of ICT literacy and applications for rural areas

There is a problem, not limited to the Philippines, regarding the underutilization of smartphones in rural areas. The survey results showed that only two out of 24 regions in six provinces were aware of Bayani Kita being promoted by the DA.[163] Furthermore, only one region in Pangasinan was aware of DeliverE. Both applications were exceptionally well known in this region, and respondents in this region indicated that, in addition to these applications, they also used Facebook and other services.

In Japan, the Japan Agriculture Cooperative (JA) started activities in cooperation with the Japan Agricultural News to promote the use of smartphones and SNS (LINE) in rural areas where there are many elderly people in April 2022.[164] [165] This approach may also be helpful in the Philippines.

The Bayani Kita app also needs improvement as digital technology spreads to the rural areas of the Philippines in the future. The Bayani Kita app is being developed as a one-stop

[160] https://www.maff.go.jp/j/nousin/tyusan/siharai_seido/s_about/cyusan/
[161] https://www.maff.go.jp/j/nousin/kouryu/jouhoutsuushin/attach/pdf/jouhou_tsuushin-1.pdf
[162] https://agricycle.jp/ict/
[163] One region each in Pangasinan and Camarines Norte.
[164] The Japan Agricultural News as of April 22, 2022 (*In Japanese*) https://www.agrinews.co.jp/news/index/70968
[165] The Japan Agricultural News as of June 16, 2022 (*In Japanese*) https://www.agrinews.co.jp/news/index/82391

application for farmers, implementing weather, market conditions, and e-commerce in coordination with DeliverE. However, there is a remarkably large amount of information required for registration[166] in the current Bayani Kita application, and it takes more than 10 minutes to register, even for a person who is familiar with the application. Furthermore, because Bayani Kita's interface is entirely in Tagalog, it would be difficult to spread the Bayani Kita app to areas such as Visayas and Mindanao, where different languages are used. In contrast, DeliverE, developed by DTI and DA with USAID, requires only a Philippine mobile number, SMS authentication, and password, and those unfamiliar with the system can also register within a few minutes. Therefore, Bayani Kita needs further improvement in rural digitalization.

(3) Potential utilization of digital technology in agricultural in the Philippines

Currently, various digital technologies related to agricultural production and distribution are being developed in Japan and other countries. In relation to the Project, it is necessary to consider the introduction and coordination of appropriate digital technologies in agricultural, needed to improve production and distribution, taking into account that horticultural crops in the Philippines are cultivated outside. This section describes digital technologies that could be used to improve the production and distribution of horticultural crops from the perspective of Japan-Philippines collaboration, not only in the implementation phase of the Project but also in other schemes.

A. Digital technology for production

The following digital technologies are considered promising for improving the productivity of horticultural crops in the Philippines. To improve agricultural productivity, digital data on environmental measurements (temperature, humidity, amount of sunlight, soil moisture, etc.) in the field, biometric measurements (determination of growth conditions through images), and farm management records are required. Furthermore, individual farming guidance for the farmers will be necessary.

[166] As far as the survey team confirmed in April 2022, Bayani Kita's registration items include name, gender, date of birth, and address, as well as ID status, ID type (national ID, passport, etc.), ID number, mobile phone number, other phone number, mother's designation, source of income, whether she is indigenous or not, ethnic name if she is indigenous and whether they have previously registered with the Registry System for Basic Sectors in Agriculture (RSBSA) of the DA, whether they know their RSBSA reference number, and their RSBSA reference number. In addition, Bayani Kita cannot be registered unless they have a valid mobile phone number in the Philippines.

a. Development of a wireless data communication network in the field

As mentioned in Chapter 4, the biggest challenge in introducing digital technology in the Philippines in the field of agriculture is the narrow coverage of mobile phone signal coverage which makes it difficult to conduct wireless data communication in fields needed for the introduction of IoT devices. The exact same situation is observed in the mountainous areas that make up 70% of Japan's agricultural land. This is because cellular phone companies charge for the cost of operating cellular phone signals for areas in areas inhabited by humans.[167]

Currently, the Ministry of Agriculture, Forestry and Fisheries, Japan, is playing a central role in addressing this issue in Japan.[168] Also, new wireless communication technologies such as IEEE802.11ah, which is slightly faster than LPWA and can handle large amounts of data, are also being put to practical use.[169]

In Japan, there are already examples of LPWA implementation by local governments. Yosano Town in Kyoto Prefecture, which introduced Softbank's "e-kakashi" within the town, has built an LPWA data communication network throughout Yosano Town in order to solve the problem of data communication network connectivity in the mountainous areas. Yosano Town's efforts could serve as a reference for agriculture in the Philippines. More details are available from the following link.

YOSANO Agricycle (In Japanese) https://agricycle.jp/ict/

b. Softbank's "e-kakashi"

SoftBank's e-kakashi is an agricultural digital service that combines a terminal with environmental measurement and data communication functions, digital farming records, and AI-based judgment of cultivation conditions. The product was highly evaluated by founder and CEO Mr. Masayoshi SON in the Softbank group's first internal start-up competition, and was adopted as an internal business in 2013.[170] E-kakashi was designed from the beginning with global expansion.[171] A model change was made in 2021, and the price of one terminal

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[167] Based on interviews with engineers who used to work for SoftBank.
[168] Guidelines for the Development of Information and Communication Environments in Agricultural and Rural Areas (March 2022, *In Japanese*)
https://www.maff.go.jp/j/nousin/kouryu/jouhoutsuushin/attach/pdf/jouhou_tsuushin-1.pdf
[169] Guidelines for the Development of Information and Communication Environments in Agricultural and Rural Areas P.27
[170] https://iotnews.jp/archives/65387
[171] According to an interview with Mr. Takashi TOGAMI, who is in charge of development at SoftBank. IoT devices that do not consider global expansion may not pass telecommunication-related certifications when deployed overseas, or may incur additional costs for specification changes.

was reduced to about 100,000 yen[172] (approximately 41,000 PHP, the rate on September 2022). Since the e-kakashi can also be charged by solar power, the only cost required for operation is wireless data communication.

The e-kakashi achieved high results in the SATREPS project in Colombia. Subsequently, the e-kakashi has also been widely deployed in Central and South America and Africa in collaboration with the Ministry of Internal Affairs and Communications and the Sasakawa Africa Foundation, in addition to the deployment in Japan, including Yosano Town, Kyoto Prefecture

A particularly useful reference is the "Efforts to improve the productivity of African agriculture based on scientific knowledge using e-kakashi," which the company is implementing in Ethiopia in East Africa in collaboration with the Sasakawa Africa Foundation. It was announced at the TICAD 8 side event on August 26, 2022 that similar efforts would be launched in Nigeria in West Africa. Together with the improvement of field communication environment by LPWA, etc. mentioned above, it is expected to improve agricultural productivity in the Philippines.

c. Farming guidance using smartphones, SNS, etc. for farmers

In the Philippines, as a result of the abolishment of the Agricultural Extension Bureau due to the enactment of the Decentralization Act in 1991, disparities in agricultural extension services have arisen among local governments.[173] For comparison in Indonesia, which is a leading member of ASEAN like the Philippines, and where organizing the farmers are not so much advanced, there are cases where the farmers are given farm management guidance using smartphones and SNS.[174] Even in Japan, there are cases where the farmers who have newly entered peanut cultivation have learned farming methods on YouTube. These methods can be introduced at relatively low cost within JICA projects. In addition, it is considered necessary to introduce digital data recording of farming history, which is necessary for effective farming.[175]

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[172] https://www.e-kakashi.com/news/20211004
[173] Atsushi MURAKAMI (2004) “Effects of decentralization on extension projects in the Philippines” (in Japanese) https://www.n-fukushi.ac.jp/gp/coe/report/pdf/200406_murakami.pdf
[174] JICA (2020) Report on Information Collection and Confirmation Study on Smart Food Chain Development in Developing Countries (in Japanese) Slide No.38
https://www.jica.go.jp/activities/issues/agricul/jipfa/ku57pq00002kzmox-att/information_gathering_01.pdf
[175] JICA (2020) Report on Information Collection and Confirmation Study on Smart Food Chain Development in Developing Countries (in Japanese) Slide No.38
https://www.jica.go.jp/activities/issues/agricul/jipfa/ku57pq00002kzmox-att/information_gathering_01.pdf

d. Linkage with the SARAi project

The various data collected by these systems can be linked to the SARAi project, which is being implemented mainly by the University of the Philippines supposing that new technological development will be required. At present, however, the SARAi project targets only tomatoes as a horticultural crop. Future trends will need to be monitored closely as other promising horticultural crops may also be addressed in the future.

e. Financial Inclusion and Digitalization

The survey result shows that Filipino farmers do not have much difficulty in raising funds for farming operations if they are members of cooperatives. However, in actual rural areas, access to cash is difficult and remittances are often time-consuming. During the field survey, the Project Team met a start-up company, FinEcoSys. The company develops financial systems, and the company's executives themselves are farmers. The company has developed a smartphone app to facilitate rural remittances that also works with banks, and is running a pilot in a cooperative in Nueva Ecija.

B. Rationalization of distribution and sales of horticultural crops by utilizing digital technology, SNS, etc.

Although the freshness of fruits and vegetables deteriorate fast among the agriculture products, they are distributed based on the priority of production side even in Japan. As a result, there is a gap between the actual demand and the supply and demand gap. Therefore, Toka Osaka Co., Ltd (Shinmei Group) and NTT Group are working on DX (digital transformation) of fruit and vegetable distribution through digital twin.[176,177] However, efforts to optimize distribution using digital twins have just begun in Japan, and it is considered premature to apply them to the distribution of fruits and vegetables in developing countries, including the Philippines.

Furthermore, in order to promote e-commerce among the farmers, it is also effective for

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[176] Digital twin is a new technology that uses technologies such as IoT, AI (Artificial Intelligence), and AR (Augmented Reality) to reproduce the environment of a physical space in a virtual space, perform all kinds of simulations, and predict the future. See the link below for details.

・NTT (*In Japanese*)

https://www.ntt.com/bizon/glossary/j-t/digital-twin.html

* Softbank (*In Japanese*)

https://www.softbank.jp/biz/blog/business/articles/202009/digital-twin/

[177] Based on interviews with Toka Osaka and NTT, which are promoting the digitization of fruit and vegetable distribution. For details, refer to the following materials (in Japanese).

https://www.shinmei-holdings.co.jp/pdf/2021110502.pdf

them to send information to consumers in Metro Manila using SNS (Instagram, Facebook), which is rapidly spreading in Japan, to urban areas.[178] Since the use of SNS cost is almost free, thus it will not be difficult to try it in the implementation phase.

C. Japan-Philippines collaboration with Kochi Prefecture, an agricultural DX advanced region in Japan

It is considered promising the collaboration with Kochi Prefecture, which has had exchanges with the Philippines for many years, from the perspective of the future introduction of agricultural digital technology in the Philippines. Kochi Prefecture, located in the southern part of Shikoku Island, has a lot of mountains. Its agricultural land area is less than 3% of the prefecture as a whole. Kochi Prefecture ranks 46th[179] among 47 prefectures in terms of agricultural land area size in Japan. On the other hand, the income per hectare unit area of horticultural crops is the highest in Japan as a result of the introduction of advanced greenhouse horticulture with environmental control.[180]

Kochi Prefecture has its own exchanges with the Netherlands for about 30 years, and has implemented advanced environmental control for cultivation facilities for horticultural crops. Since 2014, Kochi Prefecture has been promoting the introduction of environmental control devices to cultivation facilities. As of April 2022, the penetration rate of environmental control devices has reached about 60%.[181] In Kochi Prefecture, environmental measurement data (temperature, humidity, sunshine hours, etc.) of cultivation facilities is uploaded to the Internet, and the agricultural digital data core system "SAWACHI", which accumulates and analyzes it as big data on the cloud, has been fully operational from September this year.

Since 2018, Kochi Prefecture has been implementing the “Kochi IoP (Internet of Plants)”, which aims to develop and socially implement agricultural digital technology in cooperation with industry, government and academia in the region with the budget allocation from the Cabinet Office, the government of Japan. At Kochi IoP, the research sector is playing a central role in elucidating the process of photosynthesis in horticultural crops, which has been

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[178] According to interviews with Japanese living in the Philippines, there are cases where residents of metropolitan Manila, including Japanese people, purchase agricultural products by contacting farmers on Facebook. This kind of movement is global, and there are many cases in Japan where JAs and individual farmers in each region use Facebook and Instagram to promote sales of agricultural products.

[179] Tokyo has the smallest arable land among Japan's 47 prefectures, and Kochi Prefecture has the second smallest arable land after Tokyo.

[180] Materials created by Kochi Prefecture in 2022 (in Japanese)
https://www.pref.kochi.lg.jp/soshiki/162201/files/2022051800260/file_20225253135343_1.pdf

[181] Based on an interview with Mr. Koji MAEDA, former director of the Kochi Prefectural Agricultural Technology Center and currently a professor at Kochi University.

regarded as a black box until now.[182] They are developing AI analysis technology for images captured by general-purpose digital cameras, etc., and it is becoming possible to numerically predict the leaf area size and fruit numbers setting of plants. So far, these techniques have been applied to green peppers, eggplants, and so on, which are specialties of Kochi Prefecture.

Since most horticultural crops in the Philippines are grown outdoors, it is not realistic to introduce Japanese greenhouse horticulture technology itself. On the other hand, it is technically possible to acquire environmental data even in open-field cultivation like the Softbank's e-kakashi. In the Philippines, horticultural crops are harvested multiple times a year, so it is possible to improve the productivity of horticultural crops by rotating the PDCA cycle based on simple data analysis.

Furthermore, there is a longstanding relationship between Benguet Province and Kochi Prefecture,[183] and many agricultural trainees from the Philippines are engaged in agriculture in Kochi Prefecture. In addition, the Kochi University IoP Co-Creation Center is looking forward to cooperating with domestic and overseas research institutions, and is considering collaboration with a Japanese-Vietnam university that is scheduled to be established in Vietnam.[184]

However, the protection of personal information is an issue not only in the field of agriculture, but also when handling digital data. In Kochi Prefecture, as the "SAWACHI" system, personal data is stored in Kochi Prefecture's cloud server, and numerical data separated from personal attributes is stored in the cloud server AWS operated by Amazon.com. These operations are also considered to be helpful in introducing agricultural digital technology in the Philippines.

For easy-to-understand material on Kochi IoP, please refer to the following articles and videos.

(Article) Transform agriculture with DX. What is the "IoP cloud" that Kochi Prefecture is working on through industry-academia-government collaboration? (In

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[182] Hiroyuki UKEDA (2021) "Evolution to 'Next Generation Greenhouse Horticulture' Led by 'IoP (Internet of Plants)'" (in Japanese)
https://www.jstage.jst.go.jp/article/jjsip/17/2/17_2_9/_pdf/-char/ja

[183] JiPFA 1st Regional Revitalization Subcommittee (July 19, 2019)
"About the circulation of human resource development with the Philippines, which was connected through the experience of JOCV" (in Japanese)
Mr. Hirofumi YOSHIKAWA, Representative Director of Kuroshio Agricultural Promotion Cooperative (Susaki City, Kochi Prefecture)
https://www.jica.go.jp/information/seminar/2019/ku57pq00002lbbpv-att/20190719_01_02.pdf

[184] Based on an interview with Professor Masaharu KITANO, the director of the Kochi University IoP co-creation center.

Japanese) https://hiptokyo.jp/hiptalk/kochi/

(YouTube) Agribusiness Creation Fair 2021 (14 minutes)

"Greenhouse horticulture evolving with IoP (Internet of Plants)" (In Japanese)

Toshihiro OKABAYASHI, Director of IoP Promotion, Kochi Prefectural Agriculture Promotion Department

https://www.youtube.com/watch?v=0FSo3MCYqWY

5.6 Issues on Gender Mainstreaming

5.6.1 Survey and analysis methods

During the qualitative survey conducted in the provinces of Benguet, Quezon, Nueva Ecija, Nueva Vizcaya, and Camarines Norte, information on tasks and activities in which female farmers excel in agricultural production and the existence and kinds of challenges are collected through interviews.

As shown in Table 59, the needs of women in agriculture were analyzed using the five domains of women's empowerment in agriculture presented in the *Gender Tagging the Agriculture Sector Projects in the Philippines and Analysis to Identify and Analyze Project-Relevant Gender Gaps* conducted by IC Net Limited as part of a World Bank project.

Table 59: Analytical perspectives on value addition through agricultural production and processing by women

Domain	Analytical perspective
Production	Identification of crops and farm work and processing that could make the most use of women's potential to increase income and value
Resources	Providing technical training, women-friendly production, and processing facilities, and supporting access to infrastructure, finance, information, and communication technology (ICT)
Income	Providing training on financial management
Leadership	Organizing women's groups, supporting their participation in cooperatives, and providing leadership training
Time	Supporting measures and facilities to reduce the burden of women's housework

Source: *Gender Tagging the Agriculture Sector Projects in the Philippines, Analysis to Identify and Analyze Project-Relevant Gender Gaps*, 2019, IC Net Limited

Table 60: Gender survey results and issues

Analysis	Results and issues
Production	Women are involved in many tasks in agricultural production, primarily in planting, weeding, and harvesting. In addition, women are involved in dealing with buyers, business transactions, marketing, budgeting, and expenditure management. That result shows they are involved in decision-making in agricultural production. However, some farmers said that women are not involved in tasks that require force or heavy labor.
Resources	Most women farmers, 29 out of 30 farmers, do not feel that they have limited access to resources related to agricultural production (production services, seed provision, financial assistance, training and extension services, finance) Only one-woman farmer indicated that she is not interested in taking out a loan or obtaining financing. Almost all farmers, 79 out of 80 farmers, reported no barriers to connecting with buyers, suppliers, and other FVC actors. In contrast, farmers who reported having barriers indicated that women are good at negotiating but are not involved in negotiations after childbirth.
Income	Because the qualitative survey included several questions on other areas, there was a limit to the number of questions on gender. Thus, in this survey, it was not possible to ask about income differences and other relevant issues.
Leadership	In planning and maintenance of agricultural infrastructure (irrigation, production, storage facilities, and others), more than half of the 80 farmers said that women are involved in decision-making, planning, and management because they are good at decision-making. In contrast, there were farmers in which only men are involved or only women make suggestions, and some farmers' involvement was skewed toward either gender.
Time	Almost all farmers, 79 of 80 farmers, do not feel that domestic work prevents women from implementing other economic activities to increase their income from their current job. Farmers who feel that they are unable to do so because of domestic work spend much of their time cleaning and cooking. Farmers who answered that there are barriers to connecting with buyers, suppliers, and other FVC stakeholders indicated that women are not involved in negotiations after giving birth. Although details were not available, it is implied that the time for economic activities is limited owing to increased domestic work after childbirth.

Source: Project Team

5.6.2 Survey results

The results obtained from the VC qualitative survey are summarized below under the five domains of women's empowerment in agriculture. Because there were no differences among the provinces, the overall results were summarized (Table 60).

5.6.3 The direction of value addition and capacity building by women in the Project

Although a few issues were identified through the qualitative survey, the survey results prove the following directions to consider for value-added creation and capacity building for women.

(1) Improvement of marketing skills

Some women deal with buyers, business transactions, and marketing. In addition, more than half of the respondents indicated that women were good at decision-making. Workshops and training programs could be conducted targeting women to instill marketing knowledge such as how to collect appropriate market information and strengthen negotiation skills with buyers. This would be in line with the objective of the pilot projects to produce vegetables with consideration of market trends.

(2) Securing time for decision-making and economic activities

There were no major issues regarding access to resources related to agricultural production, as women did not show any concern in the survey. In contrast, there was an issue of increased childcare and domestic work after childbirth that prevented women from being involved in negotiations and other activities with FVC stakeholders, such as buyers and suppliers. Although detailed information was not obtained, because women's time for economic activities was limited owing to increased domestic work after childbirth, possible measures could provide opportunities (e.g., workshops) to review the gender role division of labor and to support men's participation in housework and childcare to ensure that women could be involved in decision-making, such as negotiations.

(3) Improvement of leadership

More than half of the women were good at decision-making and involved in management. However, in some farm households, women only made suggestions, while men were responsible for decision-making. Efficient production activities could be implemented by encouraging women to participate in leadership training when providing technical assistance so that they could take on more leadership roles.

(4) Improvement in financial management capabilities

In the survey, because of the limited number of questions, income differences between men and women could not be ascertained; however, in some farm households, women were also involved in budgeting and income and expense management. Therefore, providing appropriate financial management training opportunities would further contribute to stable vegetable production by farmers.

6 Potential for Value Chain Development

6.1 Successful Cases

To formulate a hypothesis for a specific inclusive FVC model and verify it for designing pilot projects, existing successful cases that contribute to enhancing traditional and modern FVC are leveraged. Existing successful cases and those with future potential are believed to be tips for pilot projects and their candidates. Here, both existing successful cases and those with the potential for future success are referred to as successful cases.

To identify successful cases, a workshop was conducted at the beginning of the project to share the team's perspectives on identifying the cases. Categorizations of successful cases were suggested based on their contribution to enhancing FVC. Thereafter, the search for successful cases was conducted through a qualitative survey of the value chain. When team

Table 61: Categorization of successful cases

Category	Types of intervention
A	Higher production by private support
B	Production on market trends
C	Financing
D	Improved post-harvest technology
E	Forming a major production area
F	Organizing farmers
G	Improved collection system
H	Building infrastructure
I	Better market information system
J	Weight/quality-based trading
K	Improved packing and labeling
L	Strengthening wholesale market
M	Introducing cold-chain system
N	Introducing traceability system
O	Developing new sales channels
P	Value-added by processing
Q	Sales promotion of vegetables
R	Developing Smart Food Chain

Source: Project Team

members encountered potential cases during the field survey, the following information was collected:

- Who is the innovator
- Activities
- Outcome of activities
- People who have benefitted from value addition
- External support, if any
- Challenges

Each case study was compiled into a specific format. The successful cases collected in the project were categorized based on the type of intervention, as shown in Table 61. A list of all the successful cases identified during the qualitative survey is shown in Annexure 1.

From the 56 successful cases collected, those with the possibility of turning into the pilot project were selected using the following scoring: (a) feasibility as a pilot project, (b) possible impact on FVC improvement, and (c) applicability to other areas/situations.

By totaling the scores from (a) to (c), cases with higher scores were considered candidates for pilot projects. To consider these cases for pilot projects, the implementation of the project should lead to solving the issues identified in the project, and the cases should contribute to the three pillars of FVC improvement. Therefore, the following cases were selected as pilot project candidates:

Table 62: Scoring for successful cases

Category	Criteria	Scoring method
a) **Feasibility as pilot project**	• Does the case have actual needs for technical assistance interventions by the Project? • Does the case have innovators who take risks and gain returns? • Can the case set achievable targets within three years?	Mark 1 (low) to 5 (high) and triple the score
b) **Possible impact on FVC improvement**	• Does the case help reduce price fluctuations in a year? • Does the case help reduce distribution costs? • Does the case help add more values in FVC? • Does the case improve farmers' situations eventually?	Mark 1 (low) to 5 (high) and double the score
c) **Applicability to other areas/situations.**	• Can it be applied to other areas or situations easily through the support by DA?	Mark 1 (low) to 5 (high)

Source: Project Team

Table 63: Pilot projects candidates

Sl no.	Segment in value chain	Pilot project	Target	Issues being addressed	Contribution to three pillars		
					1. Making price changes smaller	2. Reducing costs	3. Making sales higher
1	Production	Strengthen market-oriented and stable cropping	Farmer	Many farmers are not managing their cropping in a market-oriented manner.	✓	✓	
2	Production	Introduce high-value crop	Farmer	Current crops that farmers produce make limited profit but farmers do not have information for developing new high value crops.			✓
3	Distribution [Traditional]/ Farmers' marketing	Optimize timing of cropping with traders' advise	Trader Farmer	There are leftover products owing to problems between farmers and traders. Farmers do not have sufficient information on market demands, especially on timing.	✓		✓
4	Distribution [Traditional]	Enhance profit by delaying timing of sales using cold storages	Farmer Trader	There is no cold storage. As a result, farmers are forced to sell their products immediately even if prices are too low.	✓		
5	Distribution [Traditional]	Minimize loss in transportation	Trader	Traditional traders feel that there is too much vegetable waste during handling and transportation.		✓	
6	Distribution/ Farmers' marketing [Traditional]	Establish a grading system for profitable trading	Trader Farmer	Some supporters have tried to introduce grading standards but neglected the profit structure, which is the only driving force for traders and farmers to adopt the standards.			✓
7	Processing	Promote value-added by processing	Farmer Processor	Farmers cannot gain more profit from raw vegetables. Processors cannot gain stable supply of raw vegetables.			✓
8	Marketing	Promote vegetable consumption	Consumer	Vegetable consumptions in the Philippines are less than other ASEAN countries.			✓
9	Infrastructure	Provide prioritized infrastructure	Farmer Trader	Farmers face difficulty in transportation i) in terrace farming and ii) unpaved farm-to-market roads. Irrigation is not sufficient for stable production.	✓	✓	✓

Source: Project Team

6.2 Potential Crops from the Market Survey

The findings from the market survey are summarized below, and potential crops and their market sizes are estimated based on these findings.

6.2.1 Key points identified by market research

(1) Consumers value the freshness and nutritional aspects of vegetables

In the consumer survey, the responses to the questions "important things to be considered when purchasing vegetables" are shown in Table 64. "Freshness" was the most important in more than 90% of the respondents, followed by "price" and "appearance." Overall, "freshness" remained the most important factor in terms of monthly household income; however, the higher the income, the higher the responses for "safety" and "place of production" (locally produced or imported), which indicates that many affluent respondents are conscious of health and food safety.

Figure 56 shows the results of the survey on vegetable purchases. "Supermarkets" and "wet markets"[185] accounted for more than 70% of the total, followed by "retail stores."[186] In recent years, there has been an increase in the number of supermarkets catering to different income groups, and in Manila alone, many stores are operated by multiple companies. Therefore, the high number of responses for supermarkets can be attributed to the fact that they are becoming more readily accessible to consumers in a wide range of income brackets. As for wet markets and retail stores, not only are they readily available, but depending on the market, consumers can easily purchase fresher vegetables. Moreover, when the Project Team conducted direct

Table 64: Important things that consumers consider when purchasing vegetables

			Base	Freshness	Price	Safety	Locally produced or imported	Taste	Appearance	Amount and size	Seasonality	Ease of use	Brand	Other
Total		%	1062	**94.7**	**77.2**	**50.9**	**40.4**	**44.0**	**67.1**	**61.4**	**26.8**	**16.7**	**11.8**	**0.2**
Monthly household income class	Low Income	%	270	90.4	75.2	48.5	34.4	42.2	57.8	56.3	23.3	14.1	12.2	0.4
	Lower middle income	%	329	94.2	82.1	50.5	35.0	39.2	68.1	62.6	23.4	16.4	11.2	0.3
	Middle middle-income	%	298	98.3	78.2	51.7	46.0	46.0	74.5	63.8	31.9	19.1	11.4	0.0
	Upper middle income	%	115	95.7	67.8	49.6	47.0	50.4	69.6	65.2	33.9	15.7	10.4	0.0
	High Income	%	50	98.0	72.0	66.0	60.0	58.0	62.0	58.0	22.0	20.0	18.0	0.0

Source: Project Team

[185] A mixed market of wholesalers and retailers with a collection of individual small stores found in traditional trade.
[186] They are represented by small-scale vegetable dealers, which are so-called Talipapa.

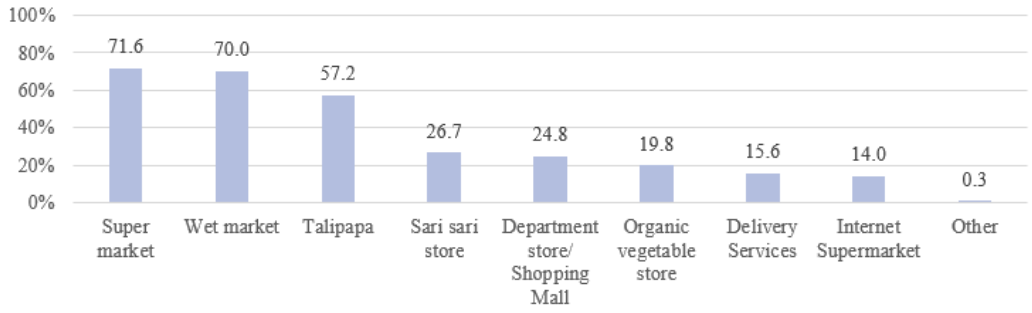

Figure 56: Where consumers purchase vegetables

Source: Project Team

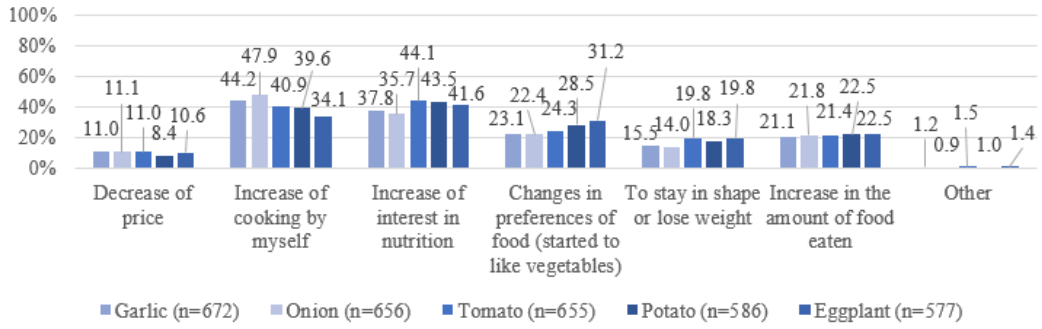

Figure 57: Reasons for the increase in the consumption of the top five products

Source: Project Team

observations in the field, many of the leafy vegetables in the vegetable section of supermarkets were in poor condition. By contrast, in wet markets and retail stores, there was less damage compared to supermarkets. This suggests that consumers value freshness. As for other services, such as delivery services and online supermarkets, the overall response rate is small; however, when considering the responses based on monthly household income, the higher the income, the higher the percentage of users. The number of online supermarkets has been increasing over the past few years, mainly among companies operating supermarkets, coupled with the impact of COVID-19. Currently, home delivery and online supermarkets are mainly used by affluent households, but there is a possibility that the market grows even larger in the future as the number of services offered increases and the range of services available expands.

When asked another question, "Has vegetable consumption increased compared to five years ago?" more than 90% of the respondents answered that vegetable consumption had increased. The top five vegetables in order of increasing consumption were garlic, onion, tomato, potato, and eggplant.[187] Figure 57 shows the responses about the "reasons for the

[187] The number of respondents who cited an increase in consumption of each vegetable was used as the parameter.

increase in consumption" of the top five vegetables. For all vegetables, "increase in cooking by myself" and "increase in interest in nutrition" were selected by more respondents (30%-40%) than the other options. This indicates an increase in cooking opportunities owing to increased staying at home because of the COVID-19 pandemic, and an increased interest in vegetable nutrition because of physical and nutritional management with awareness of infection prevention.

The above results suggest that "freshness" and "nutritional aspects" are the key points that stimulate consumers' vegetable consumption because they are of interest to consumers.

(2) Possibility of insufficient understanding of market needs through traditional trade

In the survey of food business operators, when asked about the "important things to consider when purchasing vegetables," many answered "freshness" and "price," which was similar to that of the consumers. In addition, when comparing modern and traditional trades, modern trade includes more important things to consider when purchasing vegetables (Figure 58).

When asked about their attitudes when purchasing vegetables, more than 60% of the food business operators answered that they purchase seasonal vegetables, specific brands, or

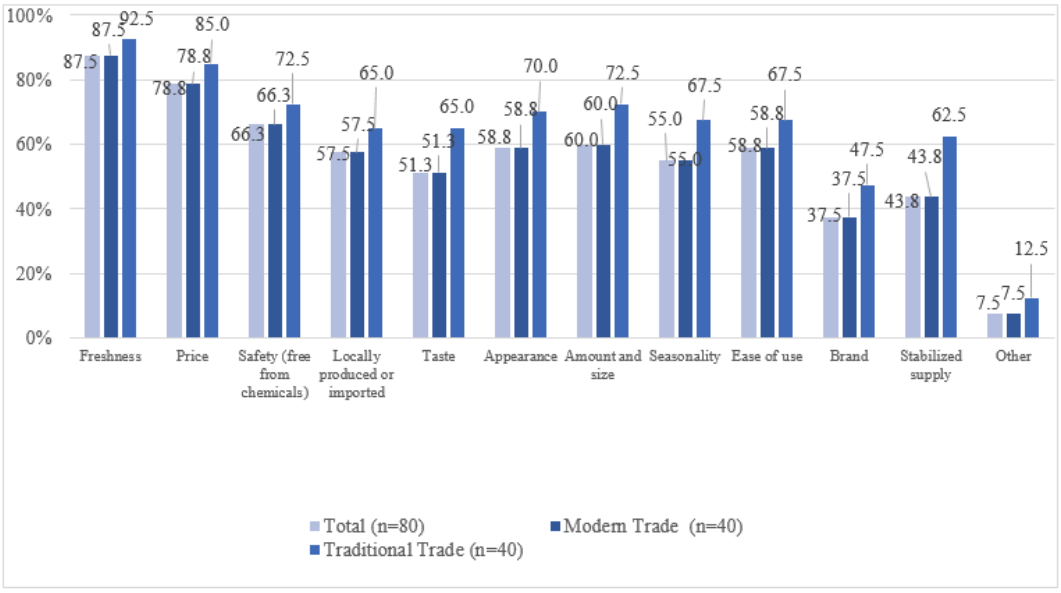

Figure 58: Important points when make decisions on purchasing vegetables

Note: Modern trade refer to supermarkets, organic vegetable store, restaurants, specialty restaurants, and hotels. Traditional trade refers to vegetable wholesale and retail businesses in Sari Sari stores (small general merchandise stores), talipapa, and wet markets.

Source: Project Team

vegetables based on multiple sources. Comparing modern trade and traditional trade, traditional trade has a lower percentage of each response than modern trade, except for "purchasing seasonal vegetables" (Figure 59).

In a separate question, the respondents were asked about "vegetables for which there was a change in the amount purchased." Overall, onions were the most common vegetables that increased in quantity purchased, followed by cabbage, while strawberries and cauliflower were the most common vegetables that decreased in quantity purchased. Comparing modern trade and traditional trade, there is a slight difference in the top five vegetables in those that

Figure 59: Awareness when purchasing vegetables

Note: The percentage is the sum of "strongly agree" and "agree".

Source: Project Team

Table 65: Vegetables with changes in purchasing quantities

	Total (n=80)				Modern Trade (n=40)				Traditional Trade (n=40)			
	Increased vegetables		Decreased vegetables		Increased vegetables		Decreased vegetables		Increased vegetables		Decreased vegetables	
Rank	Vegetable	%	Vegetable	%	Vegetable	%	Vegetable	%	Vegetable	%	Vegetable	%
1	Onion	45.00%	Strawberry	47.50%	Onion	50.00%	Patola	50.00%	Tomato, Onion, Sayote	40.00%	Broccoli, Cauliflower	50.00%
2	Cabbage, Tomato	38.80%	Cauliflower	42.50%	Cabbage, Lettuce	42.50%	Strawberry	47.50%	Eggplant	37.50%	Strawberry	47.50%
3	Garlic	35.00%	Watermelon	41.30%	Carrot	40.00%	Green papaya, Saluyot, Upo	45.00%	Cabbage, Garlic	35.00%	Watermelon, Lettuce	40.00%
4	Carrot	33.80%	Saluyot	38.80%	Tomato, Broccoli	37.50%	Watermelon	42.50%	Ginger	32.50%	Yam	35.00%
5	Eggplant	30.00%	Broccoli	37.50%	Garlic	350%	Malunggay	40.00%	Sitaw	30.00%	Saluyot	32.50%

Source: Project team

increased and decreased (Table 65).

For each vegetable, the reasons for the increase and decrease were also identified. Among the vegetables that increased, onions, which received the most responses, had the largest number of modern trade respondents (70%) who answered that the reason for the increase was the "increase in demand." By contrast, 40% of the traditional trade respondents answered "decrease in price," which was the highest number of responses compared to other options. In addition, among the vegetables that decreased, strawberries and cauliflower received the most responses; modern traders responded "decrease in demand" (approximately 30%) compared to other options, whereas traditional operators responded "increase in price" (more than 30%) compared to other options.

These findings indicate that modern trade respondents have important perspectives when purchasing vegetables and that they incorporate information on vegetable purchases from various sources. In addition, in terms of reasons for vegetables for which purchasing volume increased and decreased, it appears that modern traders can properly manage the purchasing volume of vegetables in line with the increase or decrease in demand. Furthermore, although details will be described in the subsequent section, in terms of vegetables for which purchasing volume of modern traders increased, there is no significant deviation from the commodities that have risen to the top of the list of vegetables for which the consumption volume of consumers increased. By contrast, because price fluctuations, rather than increases or decreases in demand, were cited as the main reason for the increase and decrease in vegetables purchased by traditional traders, there is a possibility that market needs are not properly captured by them.

(3) Demand for domestic/imported, cut, organic vegetables, and others

Regarding domestically produced/imported vegetables, in the consumer and food business operator surveys, "image of domestically produced vegetables" and "which vegetables would you purchase if there was a price difference between domestically produced and imported vegetables of the same kind and their quality" were asked. Regarding "image of domestically produced vegetables," consumers rated over 80% for "good taste" and "fresh," and food business operators rated over 80% for "high level of safety," "stable quality," "good taste," and "stable supply." By contrast, both consumers and food business operators have the lowest percentage for "uniform in shape and size" compared to other images. Note that there is no

Table 66: Image of domestically produced vegetables

Consumer (n=1,062)		Food business operators (n=80)	
Image	Percentage (Strongly Agree+ Agree)	Image	Percentage (Strongly Agree+ Agree)
Price is high	45.9%	Price is high	26.3%
High level of safety	74.5%	High level of safety	93.8%
Uniform in shape and size	56.3%	Uniform in shape and size	61.3%
Stable quality	75.7%	Stable quality	85.0%
Good taste	89.5%	Good taste	97.6%
Fresh	89.8%	Stable supply	85.0%

Source: Project Team

significant difference in the image of domestically produced vegetables based on attributes or type of business (Table 66).

Figure 60 presents the results regarding the question, “Which vegetables would you buy if there was a price difference between domestic and imported vegetables of the same type and quality?” Although a certain number of consumers would purchase domestically produced vegetables regardless of price, the price remains an issue of concern, with the largest number of consumers answering, “If the price is the same, I will buy a domestic product.” Food business operators have approximately the same number of respondents who answered, “If the price is the same, I will buy a domestic product,” as well as those who answered, “It does not matter if it is a domestic or imported product,” suggesting that they are less concerned about whether they buy domestic or imported products than consumers are, although they recognize the good points of domestic products. There was no significant difference in the responses between modern and traditional trade. This result may be due to the difference between what consumers look for and what food business operators consider when purchasing, which may also be linked to the lack of understanding of market needs, as mentioned in “(2) Possibility of insufficient understanding of market needs through traditional trade.”

The next section describes cut, frozen, and dried vegetables. Figure 61 shows the results of purchase frequency for cut, frozen, and dried vegetables. In terms of the percentage of customers who purchase frozen and dried vegetables at least once a week, only approximately 40% of the customers purchase frozen and dried vegetables, whereas approximately 60% of the customers purchase cut vegetables, indicating a higher number of purchasers for cut vegetables.

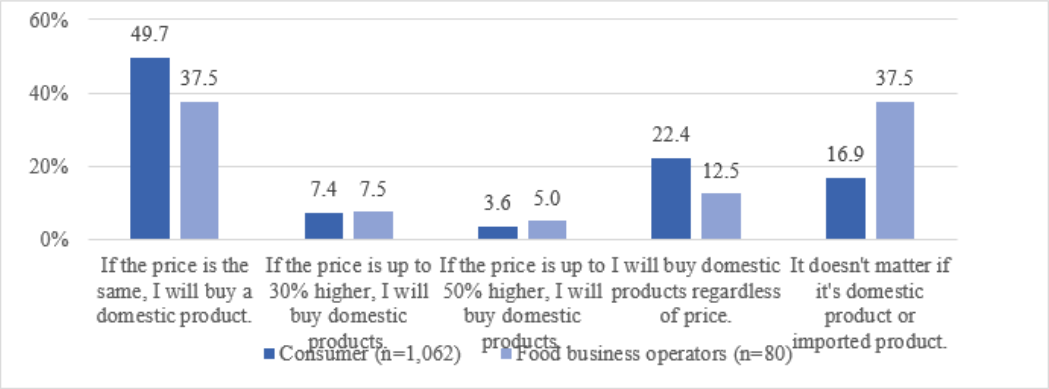

Figure 60: Choice of price difference between domestic and imported vegetables of the same type and quality

Source: Project Team

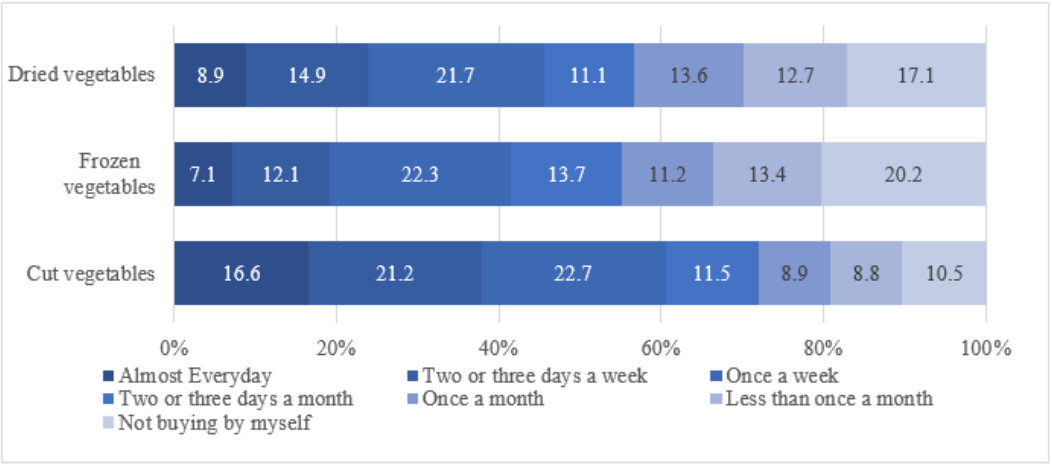

Figure 61: Frequency of purchase of cut, frozen, and dried vegetables

Source: Project Team

The Project Team has directly observed a few types of processed vegetables in supermarkets; however, cut vegetables are often placed in a separate corner. In wet markets, many stores sell vegetables that had begun to sore slightly as cut vegetables. Regarding frozen vegetables, although they were available in supermarkets, there was an impression that the variety of frozen vegetables was not very extensive. In addition, dried vegetables are only available in supermarkets for affluent people.

Future purchase intentions for cut, frozen, and dried vegetables were also investigated. When the percentages of "definitely would buy" and "probably would buy" with high purchase intention were combined, the percentage for frozen and dried vegetables was approximately 50%, while the percentage for cut vegetables was 70%, with high purchase intention not only

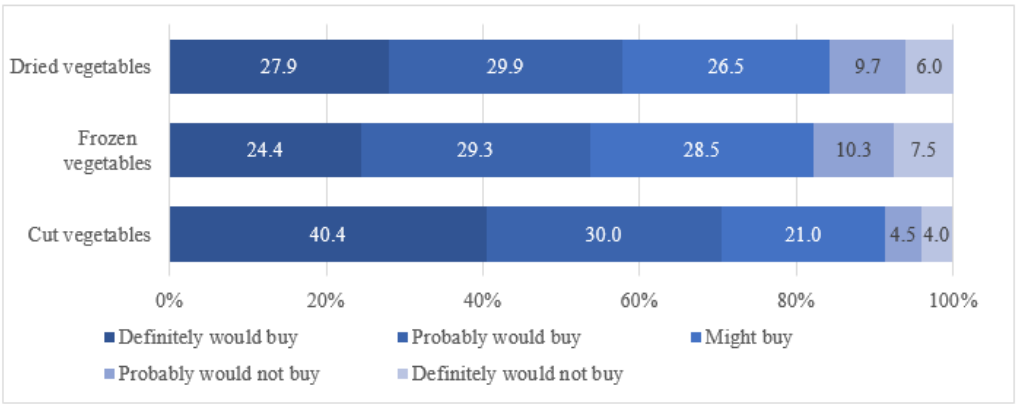

Figure 62: Intention to purchase cut, frozen, and dried vegetables in the future

Source: Project Team

Table 67: Status of purchasing organic and GAP-certified vegetables and future intentions

	Organic vegetables	GAP certificated vegetables
Purchase at your workplace	61.3%	13.8%
You would like to (also) purchase in the future	65.0%	16.3%

Source: Project Team

among current purchasers but also among future purchasers. As for frozen and dried vegetables, although the percentages are lower than those of cut vegetables, half of the respondents have purchase intentions, indicating that there is a certain number of needs for processed vegetables (Figure 62).

Finally, the following section describes organic and good agricultural practices (GAP)-certified vegetables. In the survey of food business operators, 60% of the respondents answered that they currently purchase organic vegetables, and approximately 10% answered that they purchase GAP-certified vegetables. This result indicates that many food business operators purchase organic vegetables but do not handle many GAP-certified vegetables. Regarding future purchasing intentions, organic vegetables accounted for 70% of the respondents, while GAP-certified vegetables accounted for approximately 20%. Organic vegetables were handled in many supermarkets in Manila when the Project Team visited supermarkets in the city. Additionally, it is highly likely that GAP-certified vegetables are not well known.

Table 68: Top 10 vegetables whose consumption has increased and vegetables that the respondents would like to increase the opportunity to purchase and the amount of consumption in the future

Vegetables with increased consumption					Vegetables that would like to increase purchasing opportunities and quantity in the future				
		Percentage					Percentage		
Rank	Vegetable	Total (n=970)	Men (n=466)	Women (n=504)	Rank	Vegetable	Total (n=1,062)	Men (n=515)	Women (n=547)
1	Garlic	69.3%	67.0%	71.4%	1	Tomato	46.0%	47.2%	45.0%
2	Onion	67.6%	64.2%	70.8%	2	Potato	45.3%	46.0%	44.6%
3	Tomato	67.5%	64.6%	70.2%	3	Onion	44.2%	47.6%	41.0%
4	Potato	60.4%	57.3%	63.3%	4	Garlic	44.0%	48.0%	40.2%
5	Eggplant	59.5%	60.5%	58.5%	5	Broccoli	43.1%	37.5%	48.4%
6	Carrot	56.9%	52.8%	60.7%	6	Lettuce	42.3%	38.6%	45.7%
7	Ginger	53.6%	51.3%	55.8%	7	Carrot	40.8%	39.4%	42.0%
8	Cabbage	53.1%	49.4%	56.5%	8	Eggplant	38.6%	41.9%	35.5%
9	Pechay	51.4%	48.1%	54.6%	9	Cabbage	37.5%	36.5%	38.4%
10	Malunggay	46.4%	43.1%	49.4%	10	Malunggay	35.1%	33.4%	36.7%

Source: Project Team

Note: For vegetables whose consumption increased, based on respondents who increased their vegetable consumption; for vegetables that respondents would like to increase their purchase opportunities and quantities in the future, based on all respondents.

Table 69: Top five vegetables that food business operators would like to increase opportunities and quantities to purchase in the future

	Total (n=80)		Modern trade (n=40)		Traditional trade (n=40)	
Rank	Vegetable	Percentage	Vegetable	Percentage	Vegetable	Percentage
1	Onion	40.0%	Cabbage	42.5%	Cabbage, Onion	37.5%
2	Cabbage	27.5%	Lettuce	35.0%	Tomato	27.5%
3	Carrot	22.5%	Carrot	25.0%	Eggplant	25.0%
4	Eggplant, Tomato	21.3%	Broccoli, Garlic	20.0%	Carrot, Garlic	20.0%
5	Garlic	20.0%	Potato, Cabbage, Eggplant	17.5%	Ampalaya, Sitaw	17.5%

Source: Project Team

6.2.2 Potential Crops and Market Size

Table 68 shows the results of the consumer survey when the respondents were asked about "vegetables that they would like to increase the opportunity to purchase or the quantity in the future." Tomatoes, potatoes, and onions, which are among the top three of the top ten, were ranked high in "vegetables whose consumption has increased," which was asked in another question mentioned in Section 6.2.1, indicating that these vegetables have been in high demand for some time and that consumer demand for them can be expected to continue.

As for other vegetables, broccoli, lettuce, and *malunggay* (moringa) are vegetables whose production is not large compared to other items in the statistical data of vegetable production of the Philippine Statistics Office; however, a certain level of demand is expected, as almost 40% of the respondents answered that they would like to increase their purchase opportunities

and quantity in the future. Regarding the trend values based on the characteristics of the respondents, there were no significant differences according to sex or income bracket; however, for broccoli, the percentage of female respondents was about 10 points higher than that of the male respondent, suggesting the possibility that women may be the main target group. In addition, when respondents were asked about their intention to increase their purchaseopportunities and quantity in the future, more than half of them answered "because of its high nutritional value" for all vegetables, indicating that they were interested in the nutritional value of vegetables (Figure 63).

In the survey of food business operators, the respondents were asked about "vegetables that they would like to increase the opportunity to purchase and the quantity in the future." Table 70 summarizes the top five items. Onions had the highest percentage, at over 30%, and were the commodities with the highest percentage of responses per trade. In modern trade, lettuce is second only to onions. Regarding the reason for the intention to increase the opportunity to purchase lettuce and the amount of lettuce in the future, the most common response at 50% was "increase in demand," indicating that consumer demand is being captured and that the product has high potential.

Based on the above results, the market sizes of tomatoes, potatoes, onions, broccoli, lettuce, and malunggay were estimated. The market size of malunggay is smaller than that of the others; however, a certain market size can be expected for broccoli and lettuce.

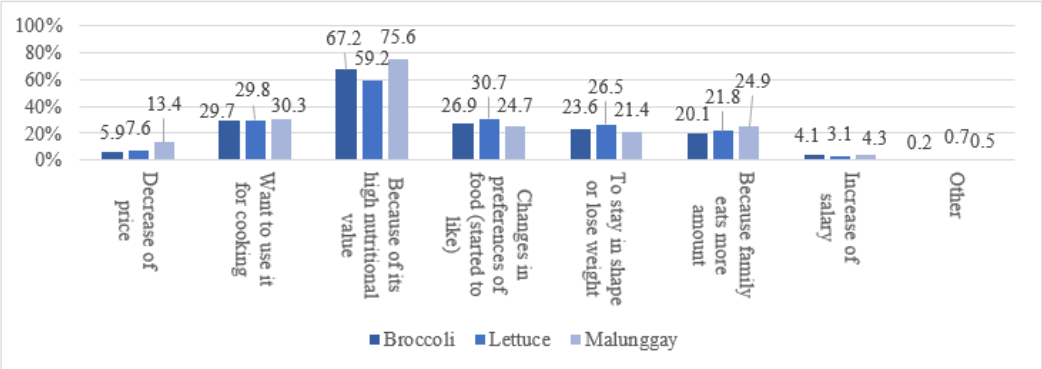

Figure 63: Reasons to increase future purchases and amount of broccoli, lettuce, and malunggay
Source: Project Team

Table 70: Estimates of market size

	Target Population (Number of households)	Percentage of those who would like to increase purchases	Average number of purchases (years)	Purchase amount per purchase (PHP)	Market size (PHP million)	Market size (USD million)
Tomato	22,975,630	46.0%	135.2	50	71,445	1,299
Potato	22,975,630	45.3%	98.8	70	71,981	1,309
Onion	22,975,630	44.2%	150.8	100	153,141	2,784
Broccoli	22,975,630	43.1%	67.6	206	137,898	2,507
Lettuce	22,975,630	42.3%	83.2	84	67,922	1,235
Malunggay	22,975,630	35.1%	93.6	45	33,967	618

Note: The number of households is from the 2015 census, the percentage of those who would like to increase their purchases, and the average number of purchases (per year) were calculated based on the results of the market survey. The purchase amount per purchase was calculated based on the Ministry of Agriculture's price monitor and the amounts found during the field survey, 1 kg for tomatoes, potatoes, and onions, while for all other items, the amount was calculated per 500 g.
Source: Project Team

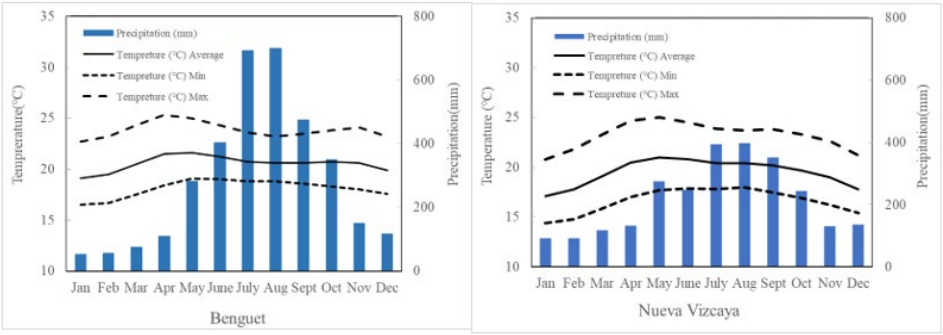

Figure 64: Monthly changes in temperature and precipitation in highland areas

Source: Climate Data Org. (https://en.climate-data.org/asia/philippines/nueva-vizcaya-1853/)

6.3 Potential Crops from Horticultural Production Technology

6.3.1 Highland vegetable production

(1) Characteristics of the production environment

In highland vegetable-producing areas, cool-season vegetables such as potatoes, carrots, cabbage, and celery are grown because the average temperature is low at 25°C or less throughout the year, and the annual rainfall is relatively high at 2000 mm or more. Figure 64 shows the monthly changes in temperature and rainfall in the highlands of Benguet and Nueva

Vizcaya, two highland vegetable-producing regions.

In Benguet, temperatures fluctuate slightly, reaching a maximum in April and May; however, the average daily temperature is approximately 23°C. The rainy season is from April to October, with the highest rainfall occurring in July and August, making cultivation more difficult at this time. In the highlands of Nueva Vizcaya, the average monthly temperatures are often below 20°C, although, during some months, the temperatures exceed 25°C. Precipitation is the heaviest from July to September; however, it rains relatively often in other months. Both provinces are characterized by easy access to irrigation water from springs and wells, and some areas are under year-round cultivation with supplementary irrigation.

Soil conditions differed between the two provinces. In Benguet, soil fertility is generally low, particularly in vegetable-growing areas, which are steep, mountainous areas with many slopes and soil degradation owing to erosion. Soil acidity is low at pH 5.5–pH 6.5, and some farmers use a large amount of powdered lime material to correct acidity, which leads to soil hardening. By contrast, in Nueva Vizcaya, the soil conditions are ideal for vegetable production. The largest area of land is covered with fertile loams derived from volcanic ashes. Moreover, river terraces have a high distribution of silty loams, which have relatively high fertility and drainage.

(2) Proposed crop and cultivation methods

In highland vegetable-producing areas, the natural environmental conditions make it possible to cultivate a wide variety of cool-season vegetables; however, farmers grow the same crops in the same area year-round, which causes replant failure, the spread of pests and diseases, oversupply, and farm-gate price collapse. Therefore, the challenge is to address these issues. To overcome these challenges, it is important to diversify the crops and varieties grown and introduce technologies that accelerate or delay harvesting and shipping times. Table 71 shows the proposed crops, varieties, and their characteristics, as well as the expected impacts and points to be considered when introducing them.

Potatoes, carrots, and cabbages are already grown in many highland vegetable-growing areas. Table 71 proposes varieties of crops that are able to mature earlier than the currently grown ones, are more resistant to pests and physiological disorders, and are in high demand to reduce post-harvest losses and for processing purposes. They allow farmers to harvest and ship a certain amount of products when farm gate prices are high before many farmers ship their products. However, as for the potatoes, Table 71 shows an improved variety of a currently commonly grown variety (Igorota), which is resistant to late blight disease developed in Northern Philippines Root Crops Research and Training Center/Benguet State University

Table 71: Proposed crops and varieties in highland vegetable areas

Crop	Variety name (Company)	Earliness (Maturity)	Characteristics	Expected impacts and Considerations
Potato	Igorota[a] (BSU)	Late maturing (90-120 days after sowing)	-DMC[b] rate (21％), suitable for processing -Moderately resistant to late blight and leaf miner	Demand is expected to increase for processing, but few seed potato breeders have been raised, and dissemination methods need to be established.
Carrot	Chun Hong (East-West)	Early maturing (90-100days after sowing)	-Highly resistant against forking and cracking -Fast-growing and high-yielding	Soil preparation and removal of stones can prevent forking and cracking roots, and post harvest losses can be reduced.
Radish	Valiant (Ramgo)	Early maturing (40-50days after sowing)	-Uniform and vigorous plant growth - Tolerant to lodging and leafminer	Medium-size varieites sold in local markets and high-end supermarkets, profitable and promising as an alternative crop.
Cabbage	Lucky Ball (Kaneko)	Early maturing (85 days after sowing)	-Good field holding ability and adapted to long distance shipping -Performs well under hot and humid condition	An early maturing variety that can be shipped earlier and sold at a higher price than usual.
Lettuce	Mini Moonred (Ramgo)	Early maturing (35-40 days after tranplanting)	-Highly tolerant to Leafminer, A flexible variety with average weig	Year-round production in greenhouses enables regular shipments in fixed quantities.
Broccoli	Lucky Miracle F1 (Ramgo)	Early maturing (65-70 days after tranplanting)	-Tolerant to damping-off, black rot, and soft-rot -Uniform plant growth & good shipping quality	Promising alternative crop to cabbage because their environmental suitability and growing methods are similar.
Tomato	Prima F1 (Ramgo)	Early maturing (65-70 days after tranplanting)	-Semi-determinate growth habit -Tolerant to bacterial wilt	Longer harvests possible by using grafted seedlings and rain shelters which can control pests and diseases.

Source: Prepared by the Project Team with reference to Commercial Crop Variety Database (https://nsic.buplant.da.gov.ph/ccvd/index.php) and Ramgo Homepage (http://ramgoseeds.com/)

(NPRCRTC/BSU). However, at present, only two farmers are audited by the Bureau of Plant Industry (BPI), which is the quarantine authority, and the challenge is to expand the use of seed potatoes and production techniques.

Lettuce, celery and broccoli are crops that are grown to some extent; however, they are not currently mass-produced. Their market demand increases in the Philippines because people consume them in the traditional dishes, such as *sinigang* (tamarind and vegetable soup) and *chopsuey* (stir-fried vegetables), and have started eating salad and increased their awareness of nutrition improvement. Additionally, radish, in particular, can be recommended, as it is found to be highly profitable according to the results of a quantitative survey in Benguet province (Chapter 3). Moreover, lettuce and broccoli are suitable for production in cool climates of the highland areas, and their production techniques are similar to those of existing

crops, such as cabbage and pechay, which make them easy to disseminate.

With agricultural greenhouses and irrigation systems, it is possible to reduce pest and disease incidence and quality deterioration using rain shelters and introduce year-round production of the above-mentioned crops, forcing or retarding culture, and off-season shipment. In addition, it is possible to introduce medium- and warm-season crops that are rarely grown in highlands. For example, tomatoes are relatively less affected by pests and diseases under cooler climatic conditions and are rarely produced by nearby farmers. The introduction of grafted seedlings of semi-determinate growth habit varieties can lead to long-term harvesting and shipping, which enables a more stable and higher-priced trade.

6.3.2 Lowland vegetable production

(1) Characteristics of the production environment

The environment in lowland vegetable-producing areas is characterized by average temperatures of 25°C or higher throughout the year, maximum temperatures exceeding 35°C, and relatively high humidity, with rainfall ranging from 150 mm to 2,000 mm. Therefore, medium and warm-season crops are suitable for growth in these areas. Figure 64 shows monthly changes in temperature and rainfall in lowland areas, such as Quezon Province and three other provinces.

The four lowland vegetable-producing provinces show monthly temperature fluctuations, with the highest temperatures in April and May before the rainy season, and vegetable production becomes difficult at that time. Heavy precipitation occurs from May to October during the rainy season. However, Camarines Norte is characterized by rainfall that continues until December, although the start of the rainy season is similar to that of other provinces.

Although irrigation facilities are relatively well-developed in Pangasinan and Nueva Ecija, agricultural water is sometimes scarce during the dry season. In the Quezon and Camarines Norte provinces, irrigation facilities are underdeveloped; thus, crops that can withstand a certain degree of dryness are rainfed in the lowlands only once a year.

In lowland areas, soil fertility is generally low owing to flooding and soil erosion, except in some areas along rivers. In Pangasinan and Nueva Ecija, soil conditions are relatively suitable for cultivation in areas where soil acidity is weak to neutral. By contrast, the Quezon and Camarines Norte provinces commonly have clay soils in the plains and fine-grained soils well-drained on gentle slopes, which are mostly acidic. Coconuts and watermelons, which can grow under soil conditions, are mainly cultivated.

(2) Proposed crops and cultivation methods

In lowland vegetable-producing areas, fruit and vegetable crops such as eggplants, bitter gourds, tomatoes, and medium- or warm season crops are mostly produced, whereas red onions, which are resistant to high temperatures, are widely grown in Nueva Ecija. However, the challenging issues are the reduction of yield and quality losses and pests and diseases caused by high temperatures, humidity, and lack of water. To address these issues, as in highland vegetable-producing areas, effective crop types and varieties, such as those with tolerance to pests and diseases, drought, and high profitability, should be selected for diversification of vegetable production. Table 72 lists the proposed cropping system and its varieties.

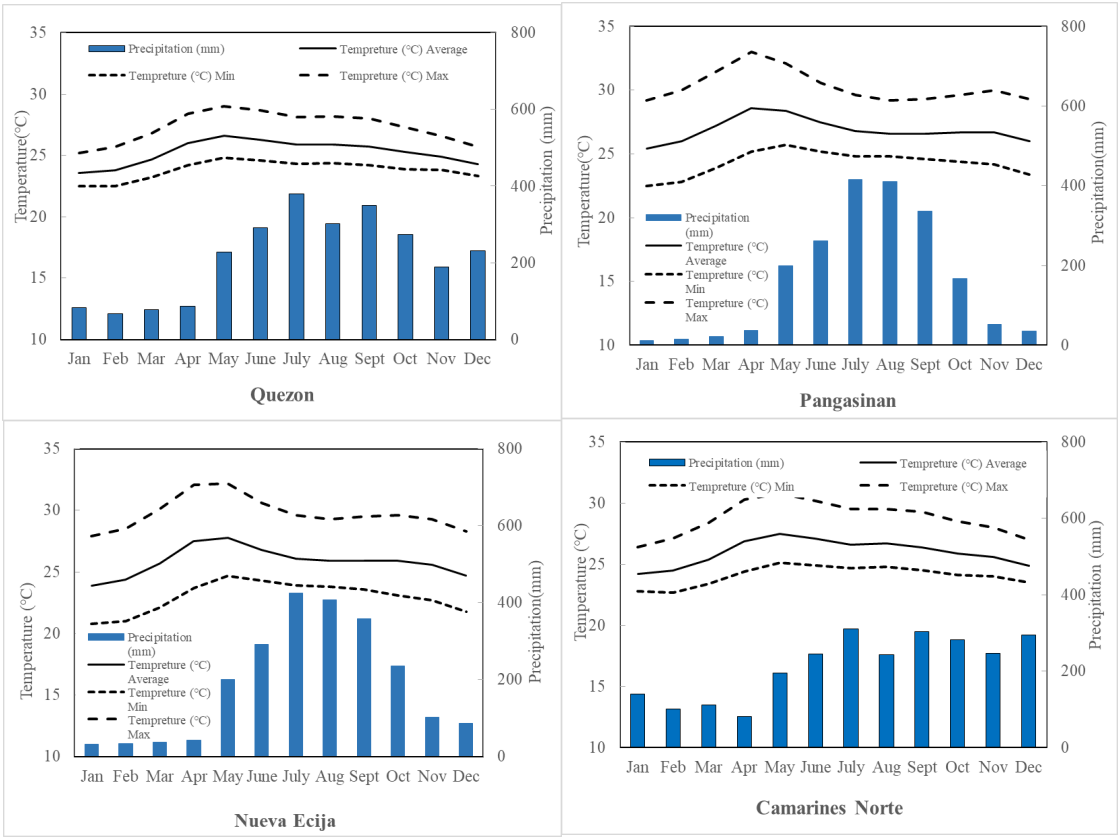

Figure 65: Monthly changes in temperature and precipitation in lowland areas

Source: Climate Data Org. (https://en.climate-data.org/asia/philippines/nueva-vizcaya-1853/)

Table 72: Proposed crops and varieties for lowland vegetable areas

Crop	Variety name (Company)	Earliness (Maturity)	Characteristics	Expected impacts and Considerations
Bitter gourd	Mestisa F1 Grafted （Farm Ready)	Early maturing (45 days after tranplanting)	-High resistance to bacterial and fusarium wilt -First harvest 45 days after transplanting	Grafted seedlings are disease resistant and can be expected to produce high yields, but farmer awareness-raising to promote their use is essential.
Tomato	Garnet F1 (East-West)	Early maturing (45 days after tranplanting)	-High yielding, adapted for lowland planting in rainy season -Intermediate resistance to Bacterial wilt	High yields with long harvests are possible in the open field and/or in greenhouses with proper plant management and irrigation.
	Cherry Tomato Dorotea (Ramgo)	NA	-Tolerant to Cucurbit aphid-borne yellows virus -Very good fruit setting with uniform	Possible to be harvested after colouring with good taste and high transportability.
Sweet peppar	Trinity F1 (East-West)	Early maturing (55-60 days after tranplanting)	-High heat tolerance and adaptable for lowland -Good quality lowland hybrid for year round planting	Suitable as an alternative to eggplants, which are prone to pests and diseases and sold cheap.
Hot pepper	Super Heat (East-West)	Early maturing (80-85 days after tranplanting)	-Intermediate resistance to Bacterial wilt -Very strong plant vigor, adapted for growing in rainfed areas	High yielding and quality, ideal for both fresh market and for processing.
Cabbage	Lucky Ball (Kaneko)	Early maturing (60 days after sowing)	-Good field holding ability and adapted to long distance shipping -Performs well under hot and humid condition	Round-bellied type which can be grown in lowland areas, and thus has the potential for high prices.
Onion	Red Hawk (Kaneko)	Medium maturing (120 days after sowing)	-Short day variety,adapted to dry sesaon planting, -Very uniform and good storage quality	Early shipping is possible if seedling growth and transplanting is introduced, but not suitable for acidic soils.

Source: prepared by the Project Team with reference to Commercial Crop Variety Database (https://nsic.buplant.da.gov.ph/ccvd/index.php) and Ramgo Homepage (http://ramgoseeds.com/)

The crops proposed in Table 72 are grown in lowland areas, where farmers either directly sow or use their own seedlings. However, problems such as poor seedling setup result in low yields and inconsistent quality. Therefore, it is effective to use seedlings from farmers and companies specializing in seedling production. In particular, for bitter gourd, the seedling made a locally popular variety called “Mestisa F1” grafted with pest- and disease-resistant rootstocks that can increase yield and profitability. Grafted seedlings are 1.4 times more expensive than normal seedlings. However, grafted seedlings can be harvested for up to five months, whereas normal seedlings can be harvested for two months. In addition, they can be harvested and shipped after the normal market period, which can lead to higher farm gate

prices and revenue.

Similarly, the use of grafted seedlings of hot peppers and tomatoes can extend the harvest period and improve the yield, quality, and profitability. Quantitative studies have shown that these three crops, including bitter gourds, are profitable. If grafted seedlings can be used to extend the harvest, farmers' incomes can be increased further. Incidentally, the Garnet F1 variety, which has a higher yield potential than Diamante Max F1, is widely grown and is suited to lowland environments. In addition, cherry tomatoes (mini tomatoes) with excellent storage and transport properties are worth considering.

Although sweet peppers, cabbages, and onions are not typical lowland vegetables, they can be grown by selecting varieties that are resistant to high temperature and humidity, thereby contributing to crop diversification. Sweet peppers, which have high nutritional value and are widely used in soups, stir-fries, and salads, have recently increased in market demand. This crop is less susceptible to pests and diseases than eggplants, which are often grown in lowland areas, and thus can raise farmers' incomes if they select and grow heat-tolerant and year-round planting varieties.

Cabbage is also recognized as a highland vegetable; however, recent advances in breeding have resulted in the development and sale of varieties that can withstand high temperatures. For example, "Lucky ball" in the table above is a round ball-type cabbage grown mainly in highland areas; however, this variety is tolerant to high temperatures and humidity to some extent and can be traded at a high price when grown in lowland areas.

Onion is one of the most consumed vegetables in Filipino households and is one of the crops to be introduced if the production environment is suitable. Farmers sow seeds directly in the main field in Nueva Ecija, one of the country's leading production areas, resulting in overselling in the markets and inconsistent bulb quality, which can lead to poor profitability. The solution to this problem is to use heat-tolerant and early maturing varieties, raise seedlings from the end of the rainy season, and transplant them. This method can shorten the growing period such that onion bulbs can be harvested and shipped before the peak season. However, onions do not like acidic soils and grow at a pH of 6.3–7.8; therefore, they cannot be grown in some areas, or the soil acidity must be corrected with lime.

6.4 Support by the other development partners

6.4.1 The World Bank

The Philippine Rural Development Project (PRDP), financed by the World Bank and administered by the DA, begin in December 2014 and scheduled to complete by May 2023.

The PRDP aims to raise incomes and agricultural and fishery productivity for smallholder farmers and fishermen. The main support activities for smallholder farmers are related to increasing the number of agricultural products available to the market and improving access to the market. The PRDP consists of four main groups of activities: a) development planning by the central and local governments, b) infrastructure development, c) business development, and d) project implementation support.

PRDP comprehensively contributes to the agricultural value chain. Specifically, activities such as expanding farmers' sales channels by diversifying crops, modernizing distribution, and developing FMRs and collection sites are being implemented. At the same time, it is also an opportunity to improve the capacity of local governments to plan and implement these activities.

During the COVID-19 pandemic in 2020, [188] with regard to the development plan a) above, 81 provinces nationwide have formulated provincial agricultural and fishery product investment plans, and 78 provinces are conducting investment projects. Of these, 74 provinces conducted value chain analyses of 64 specified agricultural and marine products. With regard to the infrastructure development in b), 455 new construction and maintenance projects are in progress, and approximately 610,000 farmers and fishermen have become beneficiaries. An 813 km FMR has been built and 1,231 km is awaiting completion. In c) business development, 623 projects were approved for budget and realized. This has benefitted 938 producer groups, of which 46% of the group's members are women.

6.4.2 Asian Development Bank

To date, ADB has almost no assistance focused on strengthening FVC of agricultural products, and has focused exclusively on infrastructure development, indirectly contributing to strengthening of FVC from the aspect of infrastructure. ADB has formulated the Country Partnership Strategy 2018-2023 as a policy for assistance to the Philippines, which includes three pillars: a) infrastructure development, b) regional economic development, and c) investment in people. In the past, ADB has put the most effort into a) infrastructure development. While implementing various projects, ADB has also supported long-term infrastructure investment mechanisms such as Public Private Partnership (PPP) schemes. ADB aims to revitalize industries including agriculture as a result.

On the other hand, since 2018, ADB has been providing technical assistance for agricultural value chain development in Asian countries. In the Philippines as well, a nationwide value

[188] 世界銀行の Public Disclosure Copy の Philippine Rural Development Project (P132317)が出所。

chain analysis of mangoes, onions, and tomatoes was conducted, and the results were compiled in a report. The report has proposed a number of projects as medium- to long-term proposals, but they are not intended to be concretely materialized.

6.4.3 Korea International Cooperation Agency (KOICA)

KOICA started "Developing Smart Farming Master Plan and Establishing Model Farms" project in West Visayas from 2022 to 2026. The project has 3 components including (1) Develop master plan for smart farming, (2) Establish smart farming model farms and managing systems and (3) Capacity building for smart farming. The counterpart agency is Regional Field Office in Western Visayas (Region VI). Total investment would be USD 800 million. The project aims to enhance the value chain of high-value crops in Region VI through the utilization of appropriate smart agricultural technologies thereby increasing farmer's productivity and income. KOICA conducted the Implementation Survey on August 5-12, 2022. According to the press release by the Regional Field Office in Western Visayas, only 7% of vegetables and other high value crops needed in hotels, restaurants and resorts in Boracay, Iloilo, and Bacolod City is self-supplied and most of them are imported from Cordillera Administrative Region.

Part III-Roadmap

7 Draft Roadmap

7.1 Issues and target images

The issues for each sub-sector explained in Part II were organized and proposed at the "Value Chain Stakeholders Workshop on Draft Roadmaps" held in the Benguet and Quezon provinces in July 2022. Farmers and wholesalers in the production area participated in the workshop, and additional opinions were added to the original proposals for the issues, target images, and solutions through discussions. After examining the opinions and information obtained from the workshop, the Project Team's plan is described below.

First, the Project Team presented a summary of the issues (Figure 66), which were organized into four categories according to the stages of the vegetable value chain: "(A) farming," "(B) farmers' marketing," "(C) trading and processing," and "(D) consumption." Some issues are placed across multiple categories because they are recognized as issues by stakeholders in multiple categories of value chains.

The representation of these issues was reversed to objective or target images (Figure 67). Figure 68 indicates to which of the vegetable value chain improvement approaches described in Chapter 2 they are specifically relevant.

A. Farming	B. Farmers' marketing	C. Trading/ processing	D. Consumption
A-1 Pest and diseases affect yield and quality of the produce.	B-1 Selling price fluctuates too much.	C-1 Selling price fluctuates too much.	D-1 Selling price fluctuates too much.
A-2 Irrigation water during dry season is limited.	B-2 Shipments are concentrated in certain seasons, and the selling price crashes.	C-2 Some cold storages are not used well.	D-2 Selling prices seem to be unified at main wholesale markets.
A-3 Flood or water shortage decreases yield in the lowland.	B-3 Limited scope of disseminating price information via FB of APTCs.	C-3 There is huge loss of vegetable at the wholesale market.	D-3 Quality deterioration is observed among leafy vegetables.
A-4 Labor is scarce but machinery is not popular except hand tractor.	B-4 Farmers' marketing channels are not diversified.	C-4 Freshness and quality deteriorate during supply chains.	D-4 Traders are congested in main wholesale markets.
A-5 Green houses are under-utilized.	B-5 Cell phone connection is not available in many rural areas.	C-5 Traders are congested in many wholesale/retail markets.	D-5 Vegetable consumption is lower than neighboring countries.
A-6 Farmers' access to finance is limited.	B-6 Carrying the products to the main road is a hard labor.	C-6 Grading is rare or grading standards are ambiguous.	D-6 There are vegetables in shorter supply than market demands.
	B-7 Paving rate of FMR (Barangay road) is less than 40%.	C-7 Even successful processing cases have difficulty in scaling-up.	D-7 Consumers cannot get safe vegetables.*
		C-8 Markets of processed foods seems to be under-developed.	

Figure 66: Issues by category

Source: Project Team

A. Farming	B. Farmers' Marketing	C. Trading/Processing	D. Consumption
A-1 Pest and diseases are controlled and yield and quality enhance.	B-1 Selling price fluctuation becomes smaller.	C-1 Selling price fluctuation becomes smaller.	D-1 Selling price fluctuation becomes smaller.
A-2 There is sufficient irrigation water during dry season	B-2 Technologies that realize early or late shipments are introduced.	C-2 All cold storages are used in full-scale.	D-2 Prices are determined based on demand and supply at main wholesale markets.
A-3 Technologies that can endure flood or water shortage are introduced in lowland.	B-3 Price information via FB by APTCs is used by farmers in full-scale.	C-3 The amount of loss of vegetable at the wholesale market decreases.	D-3 Quality of leafy vegetables is kept.
A-4 Shortage of labor is adressed by progress of mechanization.	B-4 Farmers' marketing channels become diversified.	C-4 Freshness and quality are kept throughout supply chains.	D-4 Wholesale markets are expanded and traders are accommodated with enough space..
A-5 Green houses are well utilized to increase production and income.	B-5 Cell phone connection becomes available in many rural areas.	C-5 Wholesale/retail markets are expanded and traders are accommodated with enough space.	D-5 Vegetable consumption increases.
A-6 Farmers' access to finance improves.	B-6 Measures to carry products to the main road are introduced.	C-6 Vegetables are graded to meet buyers' needs by clear standards	D-6 Supply of vegetables that are in under-supply increases.
	B-7 Paving rate of FMR (Barangay road) goes up.	C-7 Successful processing businesses scale up to get more value-added.	D-7 Consumers can get safe vegetables.*
		C-8 Markets of processed foods are developed.	

Figure 67: Objectives by category

Source: Project Team

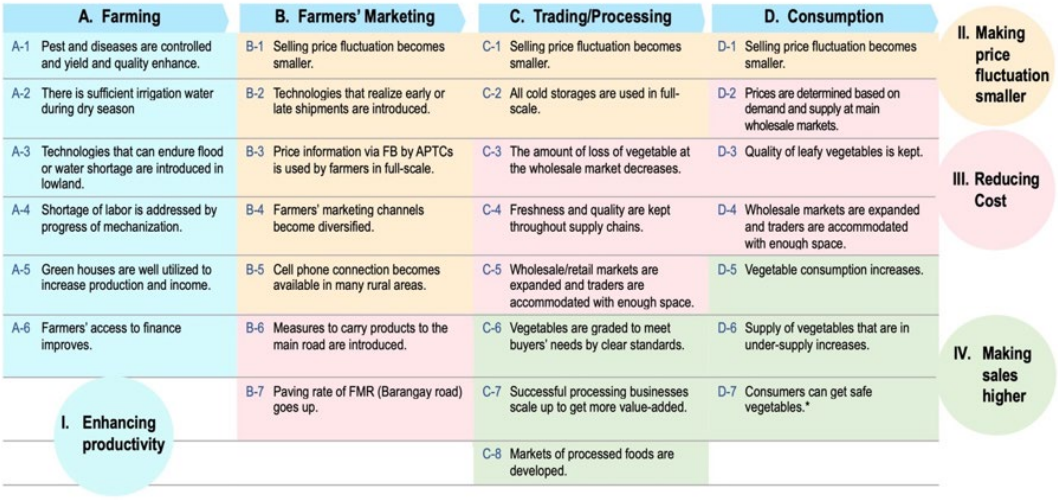

Figure 68: Grouped Objectives

Source: Project Team

Value chain improvement involves improving the vegetable distribution process from upstream to downstream. Based on this, Chapter 2, which presents the framework of the value chain improvement approach, did not mention "productivity improvement" deliberately, as shown in Figure 68.

On the other hand, in many cases, efforts on the production side are indispensable for improving distribution issues. For example, if trying to reduce price fluctuations, farmers' efforts to change the planting season, such as changing varieties and using greenhouses, will

play a central role. Alternatively, in an attempt to diversify a farmer's marketing channels—for example, if the demand for potatoes for French fries is high—it is necessary to start stably growing such varieties.

Rather, the Project Team believes that such efforts in agricultural production, which are effective in improving the value chain, should receive a great deal of attention. If they are excluded, some inclusive business models will not be viable, and the goal of improving the value chain will be out of reach. Therefore, as described later, when proposing a pilot project with the aim of building an inclusive business model, the Project Team decided to include proposals related to agricultural production as necessary.

7.2 Short-term and mid to long-term solutions

To realize the target image, the experts of the Project Team summarized the measures that were considered to be effective and proposed them at the abovementioned "Vegetable Value Chain Stakeholder Workshop on Draft Roadmap." The workshop participants, who were mainly involved in the vegetable value chain, were familiar with the situation on the ground. They were divided into four subgroups: (A) farming, (B) farmers' marketing, (C) trading and processing, and (D) consumption. Discussions were held based on the proposals of the Project Team, and ideas were added. These results are summarized in Tables 73–76.

At the right end of the table, we indicate whether the main focus is on private businesses (P) or government-affiliated organizations (G). Private businesses include farmers, distributors in production areas, processors, distributors in consumption areas, suppliers of materials and equipment, and food. Government agencies include the DA and other Philippine government agencies and development partners, such as JICA. The solution measures listed here are wide-ranging and are considered effective in realizing the objective.

It is expected that the roadmap—especially the solution measures—will be shared with those involved in the vegetable value chain and related government agencies and that each of them will play a role in their respective positions to improve vegetable value chains in the Philippines. The implementation phase of the project covered some aspects of the solutions.

Table 73: Possible Solutions on (A) Farming

	Objective	Solution	P	G
A-1	Pest and diseases are controlled and yield and quality are enhanced	Create networks of farmers and suppliers on disease resistant varieties and grafted seedlings.	√	
		Disseminate fertilizing methods and pest management methods such as crop rotation and IPM, and improve ways of dissemination.	✓	✓
		Improve agricultural dissemination methods [Mid- to long-term].	✓	✓
A-2	There is sufficient irrigation water during dry season	List farmers' groups and help them acquire irrigation facilities.		✓
		Introduce water-saving methods such as drip irrigation and mulching.	✓	✓
		Connect farmers and financial institutions.	✓	✓
A-3	Technologies that can endure flood or water shortage are introduced in lowlands.	Create networks of farmers and suppliers on flood- and drought-resistant varieties.	✓	
		Disseminate farm management knowhow that alleviates impacts of flood and drought.		✓
A-4	Shortage of labor is addressed by progress of mechanization.	Conduct feasibility studies on mechanization including harvester and washer.		✓
		Prepare financial access for mechanization.	✓	✓
A-5	Greenhouses are well utilized to increase production and income.	Create networks of farmers and suppliers on long-time harvesting varieties.	✓	
		Disseminate crop management knowhow on long-term harvesting varieties.	✓	✓
		Disseminate high-quality seedlings.	✓	
A-6	Farmers' access to finance improves.	Connect farmers with micro-finance institutions.	✓	
		Promote public financing schemes.		✓
		Promote saving, agricultural insurance, and livestock rearing.	✓	
		Train farmers on farm management after receiving finance [Mid-to long-term].	✓	✓

Source: Project Team

Table 74: Possible Solutions on (B) Farmers' Marketing

Objective	Solution	P	G
B-1 Selling price fluctuation becomes smaller.	Create networks of farmers and suppliers on early and late varieties.	✓	✓
	Create networks of farmers and suppliers on greenhouses.	✓	✓
	Disseminate a cropping calendar.	✓	✓
	Help introduce cold storage for post-harvest storage.	✓	✓
B-2 Technologies that realize early or late shipments are introduced.	Same as Solutions of B-1		
B-3 Price information via FB by APTCs is fully used by farmers.	Train farmers on how to understand price information.		✓
	Use SMS instead of FB via Internet where the connectivity is poor.	✓	✓
B-4 Farmers' marketing channels become diversified.	Create networks of farmers and institutional buyers.	✓	✓
	Train farmers on quantity and quality that institutional buyers require.	✓	
	Help buyers meet more farmers.	✓	
	Help farmers participate in Agro-Enterprise Clustering by Jollibee.		
	Help farmers participate in Kadiwa program by DA.	✓	✓
B-5 Cell phone connection becomes available in many rural areas.	Change high tax policy on tower-type antenna for mobile phones.		✓
B-6 Measures to carry products to the main road are introduced.	Support construction and maintenance of tramline in highlands.		✓
	Construct farm-to-market roads in lowlands [Mid- to long-term].		✓
B-7 Paving rate of FMR (Barangay road) increases.	Construct farm-to-market roads [Mid- to long-term].		✓

Source: Project Team

Table 75: Possible Solutions on (C) Trading and Processing

Objective	Solution	P	G
C-1 Selling price fluctuation becomes smaller.	Same as solutions of B-1		
C-2 All cold storages are fully used.	Find out why under-utilization is happening.		✓
	Prepare a guideline and make development plans based on the guideline.		✓
C-3 The amount of vegetable loss at the wholesale market decreases.	Optimize crop-wise mode of packing in farms.	✓	
	Let farmers take out outer leaves in farms, not at the wholesale market.	✓	
	Let farmers understand disadvantages of mixing unacceptable produce with quality one.	✓	
C-4 Freshness and quality are kept throughout the supply chain.	Improve modes of packing at wholesale markets in production areas.	✓	
	Introduce plastic crates.	✓	✓
	Increase the paving rate by constructing roads [Mid- to long term].		✓
C-5 Wholesale/retail markets are expanded and traders are accommodated.	Construct wholesale market facilities [Mid- to long-term].		✓
C-6 Vegetables are graded to meet buyers' needs by clear standards.	Find out grading that is required by buyers.	✓	
	Prepare grading standards if necessary.	✓	
C-7 Successful processing businesses scale up to get more value-added.	Create networks of farmers who grow raw materials and food processors.	✓	
	Improve production and marketing methods including food hygiene management.	✓	
C-8 Markets of processed foods are developed.	Identify promising processed food items through a market survey.		✓
	Develop new products.	✓	
	Create networks of farmers who grow raw materials and food processors, and food processors start producing.	✓	✓

Source: Project Team

Table 76: Possible Solutions on (D) Consumption

Objective	Solution	P	G
D-1 Selling price fluctuation becomes smaller.	Same as solutions in B-1		
D-2 Prices are determined based on demand and supply at main wholesale markets.	Create networks of farmers and institutional buyers.	✓	✓
	Implement crackdown by antitrust laws and regulations.		✓
	Construct a new wholesale market with strict antitrust management.		✓
D-3 Quality of leafy vegetables is maintained.	Improve modes of packing at wholesale markets in production areas.	✓	
	Introduce cold chain from production areas to NCR.	✓	
	Introduce cold storage near production areas and start precooling for longer shelf life [Mid- to long-term].	✓	
D-4 Wholesale markets are expanded and traders are accommodated.	Construct wholesale market facilities [Mid- to long-term].		✓
D-5 Vegetable consumption increases.	Determine content and media for vegetable promotion campaigns.		✓
	Implement vegetable promotion campaigns.		✓
	Develop easy recipes for vegetable dishes.	✓	✓
	Teach children the values of vegetables at school and public IEC.		✓
D-6 Supply of vegetables that were under-supplied increases.	Determine promising crops and prepare a plan for supporting the whole VC.		✓
	Create networks of farmers and buyers on promising crops.	✓	✓
	Construct distribution facilities including collection point and cold storage [Mid- to long-term].	✓	✓
D-7 Consumers can purchase safe vegetables.	Promote the establishment of App/IoT.		✓

Source: Project Team

In July 2022, the DA released the "Philippine Vegetable Industry Roadmap 2021-2025". Although, the surveys in the Project were conducted prior to that, a comparison with the conclusions of the DA's Roadmap and the Roadmap of the Project is shown in Table 77. Overall, the roadmaps of DA and the Project are aligned. The difference is that DA's Roadmap seeks to cover the entire vegetable value chain while the proposed activities in the Project's Roadmap puts emphasis on the improvement of the distribution part. MV2C's Roadmap can be said that it covers a portion of the Philippine Roadmap. In addition, the Project's Roadmap has more detailed descriptions of the distribution part. For example, (1) it clearly states that the price volatility can be mitigated by staggering the timing of vegetable production and marketing, and (2) it includes not only the farmers but also the intermediaries as the target beneficiaries.

Table 77: Comparison between the conclusion part of the Philippine Roadmap and MV2C's Roadmap

Philippine Roadmap		MV2C's Roadmap
OBJECTIVE 1. Ensure year-round sufficiency levels of vegetables	1.Clustering	A-5. Greenhouses are well utilized to increase production and income. C-2. All cold storages are fully used.
OBJECTIVE 2: Increase farmers' productivity and income by at least 5% per year	1. Farm clustering and consolidation 2. Modernization and Precision Agriculture 3. Vegetable breeding activities and researches 4. Access to finance 5. Access to or Presence of advisory services 6. Production Technologies 7. Marketing Assistance	A-1. Pest and diseases are controlled and yield and quality are enhanced A-3. Technologies that can endure flood or water shortage are introduced in lowlands. A-5. Greenhouses are well utilized to increase production and income. A-6. Farmers' access to finance improves B-1. Selling price fluctuation becomes smaller. B-2. Technologies that realize early or late shipments are introduced. B-4. Farmers' marketing channels become diversified.
OBJECTIVE 3: Reduce postharvest losses from 40% to 5% by 2025	1. Information dissemination 2. Modernization 3. Value addition	C-2. All cold storages are fully used. C-3. The amount of vegetable loss at the wholesale market decreases. C-4. Freshness and quality are kept throughout the supply chain. C-7. Successful processing businesses scale up to get more value-added. C-8. Markets of processed foods are developed.
OBJECTIVE 4: Ensure food safety	1. Promote Food Safety thru Good Agricultural Practices and/or Organic Farming 2. Institutionalize regulation measures	
OBJECTIVE 5: Encourage more youth and women participation into vegetable farming	1. Mentorship, Internship, Experiential Learning Activities (Youth Engagement) 2. Women Empowerment	
OBJECTIVE 6: Enhance KADIWA and expand access to international market	1.Mobilize partners and engage private sector partners 2. Export market development	B-4. Farmers' marketing channels become diversified.
OBJECTIVE 7: Increase per capita vegetable consumption by 5% over a period of 5 years	1. Promotion of vegetable consumption 2. Value addition 3. Policy formulation	D-5. Vegetable consumption increases C-7. Successful processing businesses scale up to get more value-added. C-8. Markets of processed foods are developed.
OBJECTIVE 8: Efficient communication and on time data monitoring	1. Strategic Communication and Extension 2. Digital Agriculture	B-4. Farmers' marketing channels become diversified.
OBJECTIVE 9: Ease of doing business	1. Agri-Business Corridors	

Source: Project Team

7.3 Platform for promoting vegetable value chain improvement

In the Project, FVC platform was launched as a group consisting of FVC stakeholders from the public and private sectors for the purpose of issue analysis, information sharing and business matching. The main purpose of the platform is for the stakeholders to analyze the current situation of vegetable value chain on their own, to discuss ways for improvement and the role of each organization. And, by sharing information through DA and the Project, and through the efforts to improve FVC, it is aimed to promote the improvement of the vegetable value chain by having stakeholders take possible measures from their respective standpoints. Although the activities of the platform will be worked out in details in the implementation phase of the Project, following are expected; (1) daily information dissemination and exchange of opinions using the Facebook page, (2) strengthening business partnerships through offline events, and (3) discussion on the creation of a framework for the development of the inclusive business model formed by the Project to other regions are.

Facebook Page

DA has set up a Facebook page for this project nicknamed Ka-Gulay, which is its brainchild. According to DA, Ka means "match" or "harmony" in Tagalog and is used in ways such as "*kasama* = together" and "*kasangga* = partner." *Gulay* means "vegetable" in Tagalog.

In the Philippines, the use of social media is thriving, with the number of hours used per day reaching five times that of Japan, and according to a survey result, the Philippines is the "world's number one" user (Figure 69, Nikkei Newspaper's article dated June 21, 2021).

Facebook is the most commonly used social media outlet, and according to the data portal information, it is used by 74.9% of the total population (Table 78), which includes people from children to the elderly. Considering the working population, this ratio will increase further; therefore, it is reasonable to use Facebook pages as a platform.

Ka-Gulay has already posted discussions held by the DA and JICA teams as well as the "Vegetable

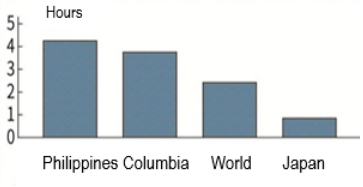

Figure 69: Internet users' (16-64 years old) communication time per day by social media

Source: Originally from "We Are Social" through Nikkei Newspaper's article dated June 21, 2021

Table 78: Social media users in the Philippines

	User (thousand)	Share (%)
Facebook	83,850	74.9
YouTube	56,500	50.5
TikTok	35,960	32.2
Instagram	18,650	16.7

Source: Digital 2022, Datareportal

Value Chain Stakeholders Workshop on Draft Roadmap" held in July 2022 in the Quezon and Benguet provinces, respectively. In the workshop, Ka-Gulay was introduced to the participants, who were told anyone could participate. In the future, when the implementation phase begins and the pilot project begins to move, it is expected that information on each activity will be shared with those involved in the vegetable value chain and that Ka-Gulay will further enhance its function as a common platform.

(3) Offline events

In addition to daily information dissemination and opinion exchange on the Facebook page, the Project Team proposed holding several offline events during the 4 years of the implementation phase to create a place for face-to-face interaction and information sharing. At the event, it is conceivable that the progress and issues of the pilot project will be shared and that the participants will provide information on their respective projects. Many of those involved in the vegetable value chain—including farmers—are businesspeople. Therefore, it is necessary to promote the participation of those involved in the vegetable value chain while making the event a place to provide information that is practical for business rather than just a social exchange. For example, by sharing the participants' business profiles, it is expected that new business partners will be discovered in the form of suppliers and customers.

(4) Consultative bodies

When the pilot project achieves a certain level of success and the project begins to show its presence in the region, a loose-knit consultative body consisting of representatives of the main related organizations will be formed and launched in the second half of the second year of the implementation phase. Many of the major players in the vegetable value chain have formed industry associations; therefore, they work with them to encourage their participation. Unlike the events in (2) above, in which individuals participate broadly, this body has member organizations registered in advance, which will recognize the overall issues. They transcend the individual business standpoint and take necessary actions to improve the vegetable value chain, considering overall optimization as well. Although there may be differences in interests depending on the business position, it is expected that as a body that operates in the same geographical region, it will continue to work to improve the vegetable value chain even after the end of the project while taking over its experience.

8 Proposed Pilot Projects

8.1 Process to create the proposed pilot projects

In the planning phase, qualitative, quantitative, and market surveys were conducted. As mentioned in Section 6.1, many existing successful cases were discovered through the expert team's knowledge and qualitative survey, and various suggestions for improving the vegetable value chain were obtained from them. Considering the other results of the qualitative survey, which were obtained almost simultaneously, preliminary candidates for the pilot project were prepared as described in Section 6.1.

Can the people involved in the vegetable value chain, especially the distributors in the production and consumption areas, who have rarely been targeted in the development project, play a role in improving the vegetable value chain in this project? To answer this question, we conducted a quantitative survey using microeconomic methods.

As a result of analyzing the business environment in which vegetable distributors are placed, most distributors, from upstream to downstream, are in a state of sufficient competition (some are in a state of excessive competition), and it is presumed that they would have a strong desire for improvement in cost reduction. The data from this survey confirms that they can be sufficient in conducting the implementation phase of this project. In fact, a qualitative survey confirmed the existence of wholesalers willing to cut costs.

Looking downstream, the market survey revealed the attitudes, preferences, and future expectations of consumers and food business operators regarding vegetables. As a result, the future potential of each vegetable item and the points on which general consumers and food business operators place importance when purchasing were clarified. Furthermore, a workshop was held in the Quezon and Benguet provinces to bring together people involved in the vegetable value chain, who were given an opportunity to think freely about the possibilities of measures from their standpoint and make proposals. The process and results are described in Chapter 7.

By broadly looking at the possibilities of the measures identified in Chapter 7 and further examining the proposed pilot projects described in Section 6.1, the pilot project proposals described in the next section were drawn.

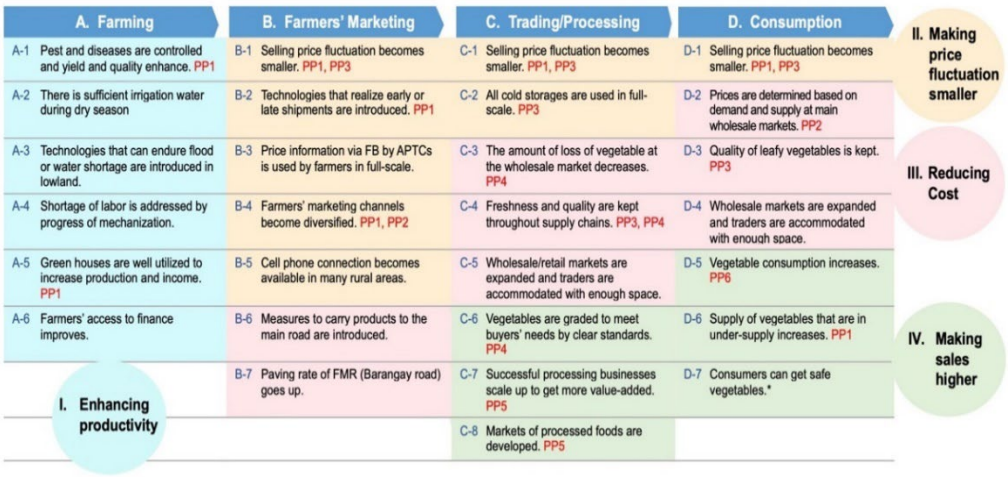

Figure 70: Objectives and proposed pilot projects

Source: Project Team

8.2 Objectives and proposed pilot projects

Figure 70 shows the relationship between these six proposals and the target image presented in Chapter 7. The six proposals cover a wide range of the target image, with the exception of some production technology improvement initiatives and infrastructure development. As mentioned, the pilot project plan starts with individual efforts and gradually aims at synergistic effects between projects, which will lead to improvements in the entire value chain and the construction of an "Inclusive Business Model" that benefits multiple stakeholders in the vegetable value chain. The draft of these pilot projects will be discussed with the Philippine side in JICA's detailed planning mission for the implementation phase, and the contents will be scrutinized.

8.3 Proposed pilot projects

8.3.1 Proposed Pilot Project 1:

Stable supply of major vegetables

Market price volatility is a key issue in the vegetable value chain. Agricultural production contributes to alleviating market price fluctuations by moving the production and harvesting periods of major crops and shipping vegetables of a certain quantity and quality when market prices are relatively high. The proposed interventions include promoting the production of varieties that can be cultivated throughout the year, crops that are becoming more marketable, and the appropriate use of greenhouses. Early and long-term harvesting using ready-made

seedlings with disease resistance is also effective. In addition, the demand for potatoes is growing in the restaurant industry, and building a system for obtaining highly disease-resistant varieties suitable for processing will also contribute to the promotion of contract farming in major restaurants.

In the following section, this pilot project proposal is explained for each of the three outcomes.

Outcome 1: Harvesting and shipping of vegetables are spread out by improving the production method.

A. Background

Currently, many varieties and cultivation materials are available in the Philippines. By making effective use of these resources and improving production methods, it is possible to promote the harvesting of vegetables. For example, the cropping season can be diversified, and harvest can be prolonged in greenhouses through temperature control and rain protection. However, in the Philippines, it is difficult to say that greenhouses are fully used in such a way. In addition, with regard to open-field cultivation, the introduction of crops and varieties that can spread throughout the shipping season, the extension of the harvest season through the effects of temperature control and rain protection, and the staggering of the crop season are rarely practiced in the Philippines.

In this pilot project, the long-term harvesting and off-season cultivation of tomatoes, cherry tomatoes, green peppers, and others will be attempted in greenhouses that have already been constructed and in open-field cultivation.

B. How was the idea for the pilot project developed?

Many greenhouses have been provided to farmers through the DA's High Value Crop Development Program (HVCDP); however, as a result of the Project Team's visit to Benguet Province in February 2022, it was confirmed that in some cases, they were not being used sufficiently. At the time of the qualitative survey, the number of greenhouses in Quezon Province was small. In some regions, vegetables can grow only once a year, and the harvest and shipping times overlap because the production season and varieties used are the same. As a result, the case of a crash in market price was confirmed.

According to interviews with Quezon province representatives of major seed companies, it is possible to harvest earlier or longer by using greenhouses, and varieties that can be cultivated in the open field during the off-season are being sold. In addition, qualitative and quantitative surveys have confirmed that crops that are similar to conventionally cultivated

vegetables but have excellent transportability and marketability have begun to be cultivated.

Outcome 2: Importance of high-quality seedlings is recognized in Quezon

A. Background

The use of excellent seedlings is essential for stable vegetable production. The key to improving yield and quality is the use of disease-free, healthy, and high-quality seedlings. Grafted seedlings that are resistant to pests and diseases can withstand seasonal environmental changes and achieve early and long-term harvesting and shipping, which contributes to mitigating price volatility. However, the farmers' awareness of the importance of seedling quality is low. Currently, many farmers produce vegetables by growing seedlings in parts of the field or by directly sowing crops that are desirable for transplant cultivation, and only few are able to produce high quality seedlings. Furthermore, the technology used to grow disease-resistant grafted seedlings is limited to professional seedling growers and farmers.

Therefore, the Project will demonstrate to the farmers the improvement of yield and quality of high-quality seedlings, including grafted seedlings, the alleviation of price volatility by early and long-term harvesting, and the profit increase associated with these in this activity. This would promote the farmers' use of high-quality seedlings. At the same time, for crops that do not require advanced technology, the Project will also demonstrate seedling production technology and show that profitability can be improved by promoting transplant cultivation. In particular, such activities will be conducted for crops that are currently cultivated by direct seeding but that can be improved in terms of profitability and shipment adjustment by promoting transplant cultivation.

B. How was the idea for the pilot project developed?

During the qualitative survey, the Project Team confirmed the existence of seedling producers and distributors, and the increasing demand for high-quality seedlings in Quezon Province. In addition, the information on a farmer who purchases seedlings in Pangasinan Province making a profit by delaying the production and shipment period was obtained. Afterward, the Project Team visited an affiliate of a major seed company in Quezon Province, a, and other seedling producers and sellers. There, it was found that the production and sales of disease-resistant varieties and healthy seedlings are progressing. Furthermore, it was confirmed that the labor needed to raise seedlings was reduced, that high profits is obtained by improving yield and quality and that early and long-term harvesting and shipping became possible. The company was planning to set up a demonstration farm in Quezon Province to

promote the understanding of high-quality seedlings and expand sales. It was also found that another seedling production company sells varieties for rootstock, and the number of farmers producing and selling high-quality seedlings and purchasing are increasing. In this way, it is possible to stabilize the yield and quality by promoting the production and marketing of high-quality seedlings and adjusting shipments by making the harvest timing early or longer.

Outcome 3: A network for producing seed potatoes for purposes such as processing is established in Benguet Province.

A. Background

Currently, most farmers repeatedly use imported seed potatoes. Imported seed potato is the main cause of increased production cost. In addition, because it is used repeatedly, there is a high possibility that the soil disease density increases. As a result of the spread of seed-borne viral diseases, yield and quality have been reduced. However, even though the demand for potato varieties suitable for processing is increasing due to the development of the restaurant industry in recent years, currently, cultivated varieties are not suitable for processing. For this reason, it is expected that BSU will construct a seed potato propagation system for processing using the tissue culture seedlings produced. In particular, if contract cultivation is established between potato farmers and major restaurant chains, it will be possible for farmers to reduce the impact of market price fluctuations and the construction of a stable and modern value chain.

B. How was the idea for the pilot project developed?

In a qualitative survey from March to April 2022, it was clarified that BSU's Northern Philippines Root Crops Research and Training Center (NPRCRTC) researched seed potatoes with high resistance to potato blight, which some farmers have used. In July 2022, when the Project Team visited potato producers, producers' associations, and seed potato producers, the NPRCRTC was researching seed potato production by tissue culture for each variety, including those suitable for processing. However, the number of farmers that can produce seed potatoes is limited. Although DA and BSU have been training for many years, there are currently two farmers who have obtained certification from BPI and one farmer who has obtained approval from NPRCRTC and is producing seed potatoes under the name of NPRCRTC.

However, in the Philippines, the restaurant industry currently requires a large number of potatoes, and the import volume is increasing. For example, Jollibee—the Philippines' largest food service company—needs domestically produced potatoes for processing and wants to test whether a laboratory-bred variety, Igorota, is suitable for processing. If it were possible to

produce seed potatoes, which now depend on imports, in Benguet, (1) farmers could reduce production costs and (2) diversify and expand sales channels by producing varieties for processing; (3) it would be possible to reduce the density of nematodes in the soil by renewing seed potatoes every year; and (4) farmers could avoid viral diseases and potato blight. Farmers, NPRCRTC and AMAD officials said that seed tuber production in Benguet is essential for its development as a potato-growing area.

Table 79: Outline of proposed Pilot Project 1
Stable supply of major vegetables

Target category in VVC	(A) Farming and (B) Farmers' marketing
Target areas	Quezon and Benguet
Objective	To mitigate price fluctuations through stabilizing the supply of major vegetables
Outcome	
Outcome 1	By improving production methods, harvest time of some vegetables is dispersed in Quezon and Benguet
Outcome 2	Importance of high-quality seedlings is recognized in Quezon
Outcome 3	A network on potato seed tuber production including varieties for processing is established in Benguet
Activity	
Activity 1	1.1 List the farmers who own a greenhouse and farmers' groups that grow vegetables in open fields. 1.2 Select farmers' groups with lead farmers to be trained. 1.3 Support the farmers financially to repair the greenhouse if necessary. 1.4 Hold producer meetings to consider and select target varieties, including tomato and pepper, according to the needs of distributors. 1.5 Conduct technical training including cultivation calendar for target crops and variety production. 1.6 Create a cultivation technology package and shipping plan as a group to avoid the peak shipping season. 1.7 Confirm profitability by planned production and shipment within the groups. 1.8 Conduct technical training.
Activity 2	2.1 Select the target areas for promoting high-quality seedlings, especially for Solanaceae and Cucurbitaceae vegetables. 2.2 Build a partnership with seedling companies, local seedling suppliers, and farmers' groups. 2.3 Select the target vegetables and appropriate varieties. 2.4 Select farmer(s) for whom demonstration farms will be set up. 2.5 Conduct technical training on target crops and varieties. 2.6 Organize a field day by inviting farmers and describing and demonstrating the importance of using high-quality seedlings.
Activity 3	3.1 Survey the quantity and quality of seed tuber production of each variety. 3.2 Select target areas for producing seed tuber and potato. 3.3 Build a partnership with NPRCRTC** of BSU, seed tuber producers, potato producers, and institutional buyers. 3.4 Form a seed tuber subcommittee. 3.5 Select varieties including those for processing. 3.6 Create manuals and organize a seminar on seed tuber production. 3.7 Prepare contracts between potato producers and major restaurant chains that have demands for potato for processing.

Source: Project Team

8.3.2 Proposed Pilot Project 2:

Promotion of smooth e-trade in B-to-B e-commerce vegetable wholesale market

A. Background

Vegetable distribution can be broadly divided into (a) traditional distribution through traditional wholesale markets and (b) modern distribution centered on contract farming by institutional buyers and farmer groups. First, while traditional marketing still accounts for a significant portion of the vegetable trade, it contains many stakeholders and generally suffers from inefficiencies and high costs. Uncertainty in price determination has also been noted for large-scale wholesale markets in Metro Manila. However, it seems difficult to directly improve issues related to market functioning because vested interests have been strong for a long time.

Next, we discuss the challenges of contract farming, which is central to modern marketing but is a hurdle for small-scale farmers; it may not be possible to comply with fixed-time fixed-quantity shipments stipulated in contracts because it is not possible for small-scale and resource-limited farmers to cope with changes in various conditions, such as weather and economic situations. For example, in February 2022, a representative of a group of contract growers in Benguet Province visited by the Project Team said, “We have contracted only about half of our production capacity.” Since contract farming does not have a supply-demand adjustment function, buyers also face challenges, which means that unless one has a contract with a large number and variety of farmers, one may not always be able to obtain the desired vegetables. The Project Team was told by a modern distributor that it would have no choice but to purchase from a traditional wholesale market if contract farming was in short supply.

However, according to the qualitative survey, few cases of agricultural production technology support in the Philippines regarding agricultural digitalization efforts still exist. However, B-to-B e-commerce sites are growing in terms of agricultural product distribution. This is a system in which many farmer groups as sellers and many institutional buyers buy and sell vegetables on one EC site. If the number of participants reaches a sufficient level, it will become possible to regard the supply and demand adjustment function of the traditional wholesale market as electronic. With this method, small-scale farmers have the freedom to (a) sell a large amount at once and (b) not need fixed-time fixed-quantity shipments such as contract farming and sell products when they are ready to ship. At the same time, institutional buyers are given the freedom to buy what they want when they want it, which can be a revolutionary initiative in the sense that modern distribution will have a supply and-demand adjustment function through DX. This function is the greatest advantage of the traditional

distribution market; however, some challenges must be resolved to reach that level.

B. How was the idea for the pilot project developed?

As a result of interviewing the CEO of Insight SCS, which operates the B-to-B EC site "Deliver E," the Project Team confirmed that they would like to collaborate with this pilot project to expand their business. Currently, only three buyers of vegetables are listed on Deliver-E, but there seems to be an outstripping supply at present. Thus, it will be a cooperation for the expansion of the supply side farmer's group in Benguet and Quezon provinces for the time being. Mayani, an e-commerce site for B-to-B vegetable trading, has worked with 73,000 farmers and 240 buyers. From interviews with the company, it was found that there are issues in terms of distribution and transportation from farmers to the company's own warehouse and that the construction of a cold chain is recognized as a particularly important issue.

In general, B-to-B e-commerce sites face two major problems. First, there are not enough sellers and buyers. If the number of both sides does not reach a sufficient level, it will be difficult for the site to perform its function of balancing supply and demand. Mayani already seems to have a certain number of buyers, but Deliver-E still has the number of buyers in a single digit. To grow into a full-fledged electronic wholesale market, it is necessary to further increase both the supply and demand sides. To increase the number of farmers—especially in rural areas of Benguet province— it would be better to let disposers unite the farmers to communicate in the EC site as mobile signal does not reach many places. Disposers work at the BAPTC in La Trinidad, which has good signal coverage; thus, they can participate in B-to-B vegetable trading while staying connected with the farmers in their own group. The participation of such disposers in the pilot project is judged appropriate based on the results of a quantitative survey using macroeconomic methods.

Some of Benguet's disposers are "over-competitive," are not profitable enough, they and may be interested in working with this pilot project to boost trading volumes.

The second issue is how the quality of vegetable sellers sell on EC sites is guaranteed. Traditional distribution is based on the face-to-face relationship of trust between a seller and a buyer. By buying from a specific person who knows it well, the problems are minimized. However, many wholesale vegetables in plastic bags are neither weighted nor graded, and the process relies on a face-to-face relationship of trust that says, "If you buy from that person, you will be fine." What will happen if commercial transactions are digitized? The quantity and quality of vegetables would no longer be guaranteed by face-to-face trust and would only be

displayed on EC sites; thus, various problems may occur. Therefore, the key to the development of B-to-B vegetable trading sites is how to build a system that guarantees the quantity and quality of vegetables on display and how to minimize problems. This system includes improving farmers' awareness to provide information on the quantity and quality of vegetables, developing and training appropriate methods for displaying information, disseminating information to institutional buyers, and dealing with problems when they occur. By promoting this pilot project together, the DA will acquire know-how to support new approaches through DX, in addition to the promotion of modern distribution, which is the promotion of contract farming.

Table 80:Outline of proposed Pilot Project 2

Promotion of smooth e-trade in B-to-B e-commerce vegetable wholesale market

Target category in VVC	(B) Farmers' marketing and (C) Trading and processing
Target areas	Benguet and Quezon provinces and Metro Manila (National Capital Region [NCR])
Objective	To support B to B e-commerce vegetable wholesale markets for promoting direct trading between farmers and institutional buyers without contracts
Outcome	
Outcome 1	Active farmers' groups become able to sell vegetables through B-to-B EC sites in a more reliable manner in such aspects as packaging and labelling.
Outcome 2	B to B EC sites increase the numbers of farmers' groups.
Outcome 3	B to B EC sites increase the number of institutional buyers.
Outcome 4	DA makes a support policy on demand and supply adjustment functions of electronic wholesale markets.
Activity	
Activity 1	1.1 Conduct surveys on active institutional buyers, which have bought vegetables at EC sites, regarding required packaging and labelling and other conditions for smooth B to B e-trade. 1.2 Improve packaging and labelling methods, and address other issues. 1.3 Train active farmers' groups that have sold vegetables at EC sites on more reliable packaging and labeling and other requirements.
Activity 2	2.1 List farmers' groups that are interested in direct selling at EC sites. 2.2 Train farmers' groups that are interested in direct selling at EC sites on reliable packaging and labeling and other requirements. 2.3 Prepare a profiling template of vegetable farmers' groups and their produce.
Activity 3	3.1 List institutional buyers that could be buyers at EC sites. 3.2 Send the profiles of farmers' groups to potential buyers listed. 3.3 Call for participation in networking events between potential buyers and farmers' groups in Benguet and Quezon.
Activity 4	4.1 Review DX promotion policies by DA. 4.2 Make a support policy on demand and supply adjustment functions of electronic wholesale markets.

Source: Project Team

8.3.3 Proposed Pilot Project 3:

Capacity building for vegetable cold chain

A. Background

Farmers produce and sell their crops simultaneously, resulting in oversupply and sharply lower market prices. However, onions and other products that can be stored for a long period are stored in large-scale refrigerators, and the timing of shipment is adjusted to prevent oversupply and price drops.

However, the freshness of leafy vegetables is not well maintained in the vegetable value chain. Consumers cannot enjoy freshness, which may hinder their increased consumption of vegetables. Vegetables sold in Manila, including supermarkets, are generally transported at room temperature, and the decline in freshness is remarkable. However, it is not difficult to imagine that the need for fresh vegetables will increase along with economic growth and an increase in wealthy people.

The cold chain system staggers the timing of shipments to reduce price fluctuations, and by pre-cooling leafy vegetables, it is possible to prevent their freshness from declining and extending their shelf life. As a result, the loss in the distribution process is suppressed, and it is possible to meet consumer needs for freshness.

However, since the introduction of a cold chain increases distribution costs, it is essential to secure high-priced sales destinations. Additionally, quality improvement requires a series of appropriate actions from field to retail.

B. How was the idea for the pilot project developed?

Many lettuce and other leafy vegetables that the Project Team saw in supermarkets and restaurants in Metro Manila were not fresh. The main reason for this appeared to be that it was not pre-cooled at the place of production and was instead transported at ambient temperature.

A person in charge of a refrigeration equipment manufacturer who was interviewed in March 2022 said:

For example, cabbage is transported at room temperature and the damaged outer layer is peeled off, so it becomes smaller at stores in Manila and produces more waste. Ice is used for fish. However, during transportation, it exceeds the cooling temperature and loses freshness. The Philippine cold chain market is still small at the moment, but there is a huge need, and there is no doubt that it will gradually expand.

From this point of view, the Project Team expects that cold chain development will progress

at a considerable pace in the Philippines in the future.

In April 2022, the Project Team visited an onion cold storage facility jointly established by 17 cooperatives with 1,200 onion farmers in the Nueva Ecija province. Refrigerating the onions harvested in February and March every year and gradually shipping them until December, while monitoring market conditions, has contributed to leveling out prices. The World Bank PRDP, which appreciated this, said that it would support the organization in building more cold storage.

However, although DA is exploring ways to promote the cold chain, knowing how to support it is not necessarily sufficient. DA made a series of remarks, such as "I don't really know where to build the cold storage."

In addition, the CAR regional office of the DA requested that "AMAD has the budget to build a cold storage, but we would like to get technical support for management know-how in this pilot project." In particular, a request was made for knowledge about a refrigerator with a humidity control function that is effective for carrots and cabbage, a special product of Benguet, which is more difficult to maintain than onions and potatoes. Cabbage and carrots are expected to have high market potential as both general consumers and food business operators rank among the top items that they would like to increase their consumption and purchase according to this project's market survey results.

From the above, it is likely that the hardware construction itself can be covered by the DA budget and that of other donors; however, software aspects such as location decisions, cold storage usage plans, and operational management support know-how are greatly lacking, with a high need for support. Refrigerators are expected to contribute to three major goals of improving vegetable value chain by (a) "reducing costs" and "increasing added value" by pre-cooling leafy vegetables to keep them fresh for a longer period of time and (b) "alleviating price volatility" by staggering shipping times through long-term refrigeration.

However, it may take more than a year for the DA and others to secure a budget and construct cold storage. Therefore, during the first and second years of the implementation phase, the project will work with DA to conduct surveys of successful cases both inside and outside of the target area while working toward the development of the draft of "Cold Chain Development Assistance Guidelines," which include crop selection, location decisions, and break-even point calculations. After creating a draft plan and building cold storage in the second or third year, it is expected that actual operational support will be provided.

Table 81: Outline of proposed Pilot Project 3
Capacity building for vegetable cold chain construction

Target category in VVC	(C) Trading and processing
Target areas	Benguet
Objective	To increase farmers' income by shipping vegetables in more dispersed timing through a cold chain system and by making the shelf life of leafy vegetables longer through pre-cooling
Outcome	
Outcome 1	A draft of "Cold Chain Development Assistance Guidelines" is developed.
Outcome 2	Data of trial shipping are consolidated.
Outcome 3	The "Cold Chain Development Assistance Guidelines" are finalized.
Activity	
Activity 1	1.1 Collect information on the use of cold storages and reefer vans in areas other than Benguet. 1.2 Collect information on the use of cold storages and reefer vans in Benguet. 1.3 Collect information on types of vegetables that can be stored in cold storage and pre-cooled and their methods. 1.4 Collect information on high-end markets for vegetables in Metro Manila (National Capital Region [NCR]). 1.5 Collect the following information on vegetables: production (cropping calendar, produced quantity, long term trend); sales prices (monthly, long-term trend); and shipped quantities. 1.6 List relevant farmers' groups and select (a) partner group(s). 1.7 Discuss standards on deciding the location of cold storage. 1.8 Conduct consumer interview at Manila for willing to pay for fresher vegetables 1.9 Calculate break-even points of each crop in price, destination, and month. 1.10 Develop a draft of "Cold Chain Development Assistance Guidelines" based upon the information in 1.4 and 1.5.
Activity 2	2.1 Make a partnership agreement between the farmers' group(s) and a buyer. 2.2 Implement various types of shipment trials. 2.3 Collect data on the trials including the following: cost, time, quality of delivered crops, and sales. 2.4 Consolidate the data and recalculate break-even points for various cases.
Activity 3	3.1 Finalize "Cold Chain Development Assistance Guidelines" by incorporating lessons learned on the trial cold chain system. 3.2 Hold a seminar to share the guidelines.

Source: Project Team

8.3.4 Proposed Pilot Project 4:

Minimizing loss by improved packaging of vegetables in wholesale supply chain

A. Background

Farmers bring their produce to wholesale markets in bare or plastic bags, and quality deteriorates due to physical shocks and rain during transportation. When vegetables packed in plastic bags are loaded onto trucks of wholesalers in the wholesale market in production areas, and when they are unloaded from trucks in the wholesale market in Manila, they are subjected to physical shocks, resulting in scratches and damage. Vegetables rot when stored for a long time in sealed plastic bags. However, the use of refrigerated trucks has been limited.

Thus, the freshness of vegetables is compromised, physical damage occurs, and losses occur. Although the extent of the loss has not been measured, people involved in the value chain expressed the view that "10% of the loss definitely occurs." In a vegetable trading business with a small profit margin, a loss of 10% cannot be ignored. In the retail market, the loss at the time of purchase is added to the selling price. Consumers eventually cover the invisible costs of losses.

B. How was the idea for the pilot project developed?

During the survey in February 2022, the Project Team exchanged opinions with BAPTC's truck wholesalers to determine if there were any good packaging materials to replace the conventional packaging of plastic bags. At that time, a truck wholesaler suggested that they would like to use the stackable plastic crate with handles used in Japan (Stackable Plastic Crate with Handles, hereinafter referred to as "SPlaC").

In the March 2022 survey, the Project Team interviewed and observed the physical damage and spoilage of vegetables at the APTC and municipal market, learning that a different type of plastic box was used only for tomatoes, that it was difficult to

Figure 71: SPlaC

When loading vegetables inside, SPlaC can be piled up with the handles being extended to protect vegetables (photo above). When nothing is inside, SPlaC can be stacked with saved spaces in the truck

Source: Project Team

collect plastic boxes and that second-hand cardboard boxes were used in some cases.

From late June to early July 2022, the Project Team conducted a feasibility study on introducing handled plastic boxes, purchasing plastic boxes with handles from Japan and bringing them to the Philippines. A focus group discussion was held at BAPTC in Benguet province with distributors, farmers, disposers, market operators, DA-AMAS staff, and DA-AMAD staff. They discussed the introduction of SPlaC to reduce vegetable losses and costs and add value in line with grades. In Quezon province, the Project Team met with foundation representatives and distributors at the Sentrong Pamilihan wholesale market. Responses differed between the two places, but the outcome of discussions—mainly at the Benguet BAPTC—was reflected in the framework of the pilot project.

Results of the discussion at BAPTC in Benguet

In the discussion at the BAPTC, opinions were generally positive about the introduction of SPlaC. The following were expressed:

(1) Regarding who owns the SPlaC, it is better to start with the ownership of the truck wholesaler.
(2) Starting with Suki (trustful relationship among relatives and friends) is safer.
(3) If truck wholesalers succeed in using SPlaC, they will try it out with the farmers.
(4) The disposal of plastic bags is an environmental problem; therefore, using SPlaC will be a solution.
(5) If SPlaC is used, a trial of grading can be possible.
(6) If the farmer sorts vegetables in the field, divides them into grades, and ships them in SPlaC, the value belongs to the farmer.
(7) It is necessary to measure cost-effectiveness.

Quantitative microeconomic research conducted by the Project Team found that traditional distributors, including Benguet's truck wholesalers, were "well competitive" and that they were willing to cut costs. Based on this, making traditional distributors—including truck wholesalers—bearers of PP was judged to be highly relevant.

Results of the discussion at Sentrong Pamilihan wholesale market in Quezon

In Quezon province, several years ago, the necessity of reducing plastic bags and post-harvest loss became an issue within the foundation, and a "collapsible plastic box" different from the abovementioned SPlaC was trialed. However, compared to plastic bags, "collapsible plastic boxes" (a) are heavier, (b) take up more space on trucks, (c) cost more, and (d) are more complicated to handle (especially when loaded on a three-wheeled motorcycle). No significant

reduction in post-harvest loss was observed, and it did not lead to dissemination. However, some distributors, particularly modern buyers, use collapsible plastic boxes. By including them, it is possible to demonstrate a comparison with SPlaC. Local governments should be responsible for promoting the ban on the use of plastic bags; therefore, in addition to the economic analysis, a comparative analysis of the environmental burden (waste disposal problem) will also be included.

Table 82: Outline of Proposed Pilot Project 4
Minimizing loss by improved packaging of vegetables in wholesale supply chain

Target category in VVC	(B) Farmers' marketing and (C) Trading and processing
Target areas	Benguet and Quezon
Objective	1. To verify economic feasibility of using stackable plastic crates with handles (hereafter SPlaC) in a certain supply chain and quantify the minimization of vegetable losses by SPlaC as improved package 2. To make a model to disseminate the use of SPlaC in the entire supply chain from farm to wholesaler in Metro Manila (National Capital Region [NCR]).
Output	
Output 1	Groups of the supply chain from disposers to wholesalers in Metro Manila (National Capital Region [NCR]) are formed to use SPlaC.
Output 2	Use of SPlaC is proven as a practically, economically, and socially acceptable package in the vegetable supply chain from APTC.
Output 3	Groups of the supply chain from farmers, disposers, and to wholesalers in Metro Manila (National Capital Region [NCR]) are formed to use SPlaC.
Output 4	Use of SPlaC is probed as practically, economically, and socially acceptable package in the vegetable supply chain from the farm.
Output 5	Make a plan to disseminate SPlaC in vegetable supply chains through other APTCs nationwide with a budget, and merge the plan with the Roadmap.
Activity	
Activity 1	1.1 Organize a workshop with disposers, truck wholesalers, and wholesalers in Manila (Divizoria/Balintawak), all of whom wish to reduce vegetable loss, to explain a verification study on the use of SPlaC. 1.2 To conduct the verification, select groups of disposers, truck wholesalers, and wholesalers who want to reduce vegetable loss by using SPlaC. 1.3 Design a verification study to use SPlaC with the parties above in the supply chain to determine the feasibility and extent of cost reduction.
Activity 2	2.1 Conduct the verification study for six months and acquire relevant data. 2.2 Monitor smooth returning of SPlaC from wholesale markets in Manila to truck wholesalers. 2.3 Monitor the control plot of the supply chain using plastic bags to obtain the same data for comparison. 2.4 Measure the total weight of wasted plastic bags after use in the control plot. 2.5 Analyze the results of the verification. 2.6 Organize a workshop to inform the parties of the results, and to identify lessons learned and recommendations. 2.7 If the results are economical, practical, and socially acceptable, then share the results with all the stakeholders in APTC.
Activity 3	3.1 Organize a workshop with farmers, disposers, truck wholesalers, and wholesalers in Manila (Divizoria/Balintawak), all of whom wish to reduce vegetable loss, to explain the verification study on the use of SPlaC.

	3.2 To conduct the verification, select groups of farmers, disposers, truck wholesalers, and wholesalers who are keen on reducing vegetable loss by the use of SPlaC. 3.3 Design Grading Standards (GS) of target crops based on the current practice of sorting on farm or at APTC, develop a practical template by discussing it with the farmers, disposers, and wholesalers, and agree on how to use the template and SPlaC on farms when sorting. 3.4 Calculate farmers' handling and marketing cost per kg including sorting, grading, putting products in three different-colored SPlaC according to the grade, and transporting to APTC. 3.5 Calculate the predicted farm gate price by adding profit of the farmers to the above calculated handling and marketing cost, as a price reference. 3.6 Share the calculation results of 3.4, 3.5, and 3.6 with farmers, disposers, truck wholesalers, and sub-wholesalers. 3.7 Design a verification study to use the SPlaC with the parties above in the supply chains to determine the feasibility and extent of cost reduction and benefit of grading.
Activity 4	4.1 Conduct the verification study for six months and acquire relevant data. 4.2 Monitor smooth returning of SPlaC from wholesale markets in Metro Manila (National Capital Region [NCR]) to farmers. 4.3 Analyze the results of the verification. 4.4 Organize a workshop to inform the parties above of the results and identify lesson learned and recommendations. 4.5 If the results are economical, practical, and socially positive, then share the results with all the stakeholders in the APTC.
Activity 5	5.1 Plan dissemination activities to use SPlaC for other APTCs nationwide. 5.2 Figure out a budget for implementing the dissemination plan. 5.3 Make a concept paper to explain the dissemination plan with the budget to share with development partners. 5.4 Merge the plan with the Roadmap

Source: Project Team

8.3.5 Proposed Pilot Project 5:

Strengthening agro-processing businesses for more added value to vegetables

A. Background

Agricultural processing adds value to vegetables and greatly contributes to the vegetable value chain improvement target of "increasing added value." Vegetables, in particular, are mostly everyday items with low palatability and are less likely to add value compared to other agricultural, livestock, and fishery products, such as fruits, meat, and seafood. In this sense, agro-processing, which adds value to vegetables, is an important approach for improving the vegetable value chain.

The Quezon and Benguet provinces have several successful cases of agricultural processing businesses led by multipurpose cooperatives and companies, many of which, however, struggle to expand the scale of their businesses to bring additional value. These include issues such as the unstable procurement of agricultural raw materials, low levels of processing technology, inadequate hygiene management, and unknown marketing methods. However, based on the results of the market survey, new processed food businesses that are likely to have latent demand are also conceivable.

B. How was the idea for the pilot project developed?

From the qualitative survey, the following current situation and issues in the food processing business were identified:

(1) The Project Team visited a small local processing company that produced cassava chips in Calasiao Township, Pangasinan province. To procure fresh and inexpensive local cassava, the company conducts business with five farmer groups, contributing to the diversification and stabilization of farmers' sales channels.

(2) The Project Team visited a multi-purpose cooperative that processes Chinese cabbage into kimchi in the Atok municipality, Benguet province. In the past, it was limited to the production of Chinese cabbage; however, it is now processed into kimchi, which greatly improves profits. The Project Team revisited the union in July and confirmed that although it wanted to increase production, there were challenges in new product development and marketing.

(3) The Project Team visited a multipurpose cooperative that produces ginger tea in the municipality of Dolores, Quezon province. The cooperative procured ginger from local farmers, processed it, and sold it to Seven-Eleven via a wholesaler. The Project Team revisited in July and knew that it wanted to expand the business, but some issues arose

with marketing and other matters. Site visits revealed that there was room for improvement in terms of hygiene management.

(4) The Project Team visited a small-scale processor that produced dried taro stems in Palayan, Nueva, Ecija province. It contracted with taro growers in 15 villages, dried their stems, and sold them to Dizon Farm, a major modern distribution company. Farmers improved their profits by cultivating taro, which can be grown without using much fertilizer, amid soaring fertilizer costs.

(5) The Project Team visited a group of farmers producing various processed products in the municipality of Urdaneta in Pangasinan province. It was found that fresh vegetables that did not sell well were processed into cooked dishes and other items to reduce waste and add value.

(6) When the Project Team visited supermarkets in Manila, it observed that there were fewer variations in processed food than in Japan.

(7) The market survey revealed a high consumer demand for cut vegetables, frozen vegetables, and dried vegetables. In particular, 60.5% of general consumers answered that they “buy cut vegetables at least once a week.”

Agricultural processing was supported by DA and DTI. However, among the five aspects necessary for business support—(a) procurement of raw materials, (b) manufacturing technology, (c) hygiene management, (d) packaging and labeling, and (e) branding and marketing, it was found that support was limited to (b) and that the overall business was not comprehensively supported.

Table 83: Outline of Proposed Pilot Project 5

Strengthening agro-processing businesses for more added value to vegetables

Target category in VVC	(C) Trading and processing
Target areas	Benguet and Quezon
Objective	To strengthen existing agro-processing businesses, identify new agro-processing businesses, and make a guideline for inclusive FVC support
Output	
Output 1	Existing successful agro-processing businesses become able to expand their work.
Output 2	New agro-processing businesses are identified and get started.
Output 3	A guideline to support agro-processing businesses comprehensively is created.
Activity	
Activity 1	1.1 Invite existing successful agro-processing businesses that find it difficult to in scale up themselves. 1.2 Identify bottlenecks for scaling up businesses such as raw material procurement, processing technology, hygiene management, marketing and branding. 1.3 Select relevant model agro-processing businesses, and help them remove bottlenecks through continuous consultations.
Activity 2	2.1 Identify new potential processing businesses that are promising by surveys on both the demand and supply sides. 2.2 Identify innovators that are keen on starting such business. 2.3 Help the innovators find investors. 2.4 Help the innovators make business plans. 2.5 Help the innovators start businesses.
Activity 3	3.1 Summarize supporting activities in Activities 2 and 3. 3.2 Create a draft guideline on how to support agro-processing businesses comprehensively. 3.3 Check the alignment between the draft guideline and existing public support schemes. 3.4 Finalize the guideline, and disseminate it through a seminar.

Source: Project Team

8.3.6 Proposed Pilot Project 6:

Promotion of vegetable consumption

A. Background

According to the National Institute of Food and Nutrition, 27 million Filipinos are "overweight or obese," with the "overweight or obese" population having increased from 20.2% in 1998 to 36.6% in 2019. Some experts believe that one of the reasons for this is the low consumption of vegetables, which are rich in fiber, vitamins, and minerals. According to FAO statistics, the per capita supply of vegetables in the Philippines is lower than that in neighboring countries. According to the FAO, the recommended average annual vegetable intake for adults is 87.6 kg, whereas the annual vegetable consumption in the Philippines is 63 kg, which is approximately 25 kg short of the required intake.

B. How was the idea for the pilot project developed?

Regarding vegetable consumption, interviews and observations were conducted mainly in Metro Manila. The following conclusions were drawn:

a. Interest in nutrition and health seems to be growing, especially in recent years, but the rising prices of vegetables seem to discourage people from going out of their way to buy vegetables instead of meat.
b. Many middle-aged people say that they do not like vegetables, and it is possible that parents who are in a position to instruct young people to eat vegetables also have problems with their eating habits.
c. In addition, low-income people tend to choose low-cost, quick-filling meals such as instant noodles and rice.
d. According to influencers, it is difficult for city dwellers to allocate time for cooking, and they often rely on so-called "ready-made meals" or delivery services. It is thought that opportunities to consume vegetables will decrease even more than home cooked meals.
e. Consumers seem to have a strong impression that vegetables are expensive.

In addition, almost all members of the Project Team experienced the following through their daily meals during their on-site stay.

(1) Often, there are no vegetables on the side of the plate.

(2) The variety of vegetable-based menus is limited when compared with other countries.
(3) The freshness of raw vegetables is particularly poor.

It is easy to imagine that vegetable consumption is low. Nevertheless, the Project Team was not sure about how to target the campaign, what media to conduct it with, and what content to approach. For example, what motivates consumers to consume more vegetables? Effective approach methods and content will differ depending on whether it is "promotion of health, prevention of obesity," "beauty, diet," "exploration of unprecedented deliciousness," or "pursuit of cool lifestyle." Therefore, a detailed consumer survey should be conducted during the first stage of the pilot activity. As it is difficult to grasp the whole picture through individual interviews, it is necessary to adopt a method similar to market research that collects a certain number of responses.

Table 84:Outline of Proposed Pilot Project 6

Enhancement of vegetable consumption

Target category in VVC	(D) Consumption
Target areas	Manila
Objective	To increase consumption of vegetables
Output	
Output 1	Consumer's demand for vegetables is stimulated.
Output 2	Recipes for vegetables that fulfill diverse preferences of consumers are developed and promoted.
Output 3	Consumer's access to vegetables in the target areas is enhanced.
Activity	
Activity 1	1.1 Identify the key factors that prevent the people of the Philippines from consuming vegetables, and propose trigger points for intervention. 1.2 Raise awareness of the health benefits of vegetables through online and in-person campaigns regarding digestive health, benefits for skin care, and other aspects. 1.3 Enhance the role of parents in motivate children and youth to consume more vegetables through online and in-person campaigns in cooperation with influencers, TV and radio programs, churches, supermarkets, hospitals, health posts, and schools.
Activity 2	2.1 Develop recipes for tasty vegetable dishes, and promote them through online and in-person campaigns in combination with 3.1. 2.2 Develop recipes for vegetable dishes that can be easily recognized as healthy, and promote them through online and in-person campaigns in combination with 1.1 and 1.2. 2.3 Promote recipes for vegetable dishes in which people can take pride as pinoy, or Filipino, through online and in-person campaigns.
Activity 3	3.1 Develop recipes for vegetable dishes that can save cocking time or last long to fit urban lives, and promote them in combination with 2.1. 3.2 Promote "Farm-in-home" (backyard garden) for low- to middle-income households to increase their daily access to vegetables. 3.3 Develop recipes with vegetables for institutional food suppliers such as restaurants, canteens, or supermarkets in cooperation with such parties.

Source: Project Team

Annex 1: Summary of successful cases

Information of successful cases										
Case No.	Title	Sub-sector/Case write	Province	City / Municipality	Category	Innovator	Action	Result	Profit	Supporter
1	Markeitng thru e-commerce platform	Marketing / Jay	Nueva Ecija	Talavera	O - Developing new sales channels; R - Developing smart food chain	Norman Verano, Farmers Association of Caputican	Participated in the supply chain of a digital platform called Agro-Digital to market his agricultural products.	Stable price of commodities	higher profit	DA
2	NVAT price monitoring system	Marketing / Jay	Nueva Vizcaya	Bambang	I - Better market information system	NVAT (N. Vizkaya APTC)	Daily updating of buying price in NVAT and dessimination thru Facebook	updated price information for farmers	profit for farmers	
3	Production of hardened seedlings	Horticulture / Algin	Pangasinan	Villasis	A - Higher production by private support	Levi Cobardo, owner of Farm Levi	Production of hardened seedlings that are sold to the farmers.	With access to Farm Levi's seedlings, the farmers can shorten their production time as they do not have to prepare their own seedbeds and seedlings anymore	Profit for innovator, profit for farmers	
4	Onion Sorting Guide	Marketing / Jay	Nueva Ecija	Talavera	D - Improved post-harvest technology	Josephine Balajadia	Categorized onions into three types based on popular demand in the retail market	Segmented buyers	higher profit	
5	Vegetable value chain ordinance	Marketing / Jay	Camarines Norte	Vinzons	L - Strengthening wholesale market	Provincial government of Camarines Norte	Passed a local law to require wholesale trading of vegetalges be done at the APTC	System for wholesale trading	*Not fully implemented*	
6	Free Stalls in PAPTC for non- member farmers	Marketing / Jay	Pangasinan	Urdaneta	G - Improved Collection System	Pangasinan Agri-Pinoy Trading Center (PAPTC) Urdaneta, Pangasinan	The PAPTC is facility where vegetable traders are occupying all ofthe 300 stalls. As such, no farmer can bring products to the facility with all the stalls occupied by traders.PAPTC provided initially 2 stalls to be managed by the provincial federation of farmers association thru one of its member-organization, the Urdaneta City Organic Farmers Association.Through the 2 stalls,farmers can bring their produce and sell them directly to traders. The association managing the stalls charge 5%commission fromall sales they have facilitated. Farmers were ableto sell directly to traders and this gives motivation to add 2 morestalls for the farmers. Currently,Pangasinan farmers can directly bring their harvest and allow the association to sell it for the market price	More farmers who are not tied to traders are bringing their produce to PAPTC and selling it through the association	Farmers not linked to any trader benefits the most because they can sell their produce at the market price. This benefit is not available to farmers who are indebted to the traders and have to deliver their products at a lower price, or whatever price thetraders would tell them.	The Department of Agriculture supported the move to allocate the 4 stalls to the farmers association
7	Provincial Jail Feeding	Marketing / Jay	Camarines Norte	Daet	O - Developing new sales channels	Camrines Norte Provincial Jail	Provided in-house preparation of meals for its 301 inmates.	More nutritious food	Maximized funds allocated for food	
8	Recognition of Value Chain Actors	Marketing / Jay	Camarines Norte	Talisay	Q - Sales promotion of vegetables	Labo MPC/CM APTC	Annual recognition of top buyers and sellers in the CamNorte APTC	increased patronage of the APTC	higher profit for traders, more income for APTC	DA
9	Mushroom production and processing	Horticulture / Jocelyn	Quezon	Candelaria	B - Production on market trends; P - Value-added by processing	Ronaldo Palomera, Association of Mushroom Agri Growers (AMAG)	Organic mushroom growing and processing of mushroom preserves	In just an area of 36 sq. meter, 5-10 kls. of Oyster Mushrooms are harvested daily. Aside from selling fresh mushrooms, he also into processing mushrooms such Mushroom Chili Oil and Mushroom Atsara. There is now a high demand of mushroom in the market but the supply is low.	Profit for innovator and association members	Retailers, distributors of processed products

10	Kimchi Processing	Marketing / Connie	Benguet	Atok	B - Production on market trends; P - Value-added by processing	Topdac Multi-purpose Cooperative (TMPC)	One member of TMPC, who started Gift of Grace Food Manufacturing (GGFM), a local start-up enterprise in La Trinidad, trained 12 members of the TMPC in June 2021 on kimchi processing. Since then, they have been processing and selling kimchi. These members have been cultivating Chinese cabbage (commonly known as womboc or pechay Baguio) through these years.	The members processed kimchi from their harvested Chinese cabbage. They buy the packaging materials at Php 9.00 per pack from GGFM for 500 grams of kimchi per pack. The GGFM buys the packaged kimchi from TMPC @ 109 per 500 grams and distributes to various supermarkets (Puregold, Robinsons, Savemore and SM) in Baguio City, Ilocos, La Union, Pangasinan, Pampanga, Tarlac, Nueva Ecija, Nueva Vizcaya , Isabela and Bulacan. GGFM also tapped individual distributors.	Profit for innovator	GGFM, DAR, DTI
11	Agrizkaya Display Center	Marketing / Jay	Nueva Vizcaya	Bambang	P - Value-added by processing	Agrizkaya Cooperative Federation	Maintained display center for processed fruits and vegetables.	increased sales for processed vegetables	profits for processors	DA and DTI
12	Same as Case no. 2									
13	Establishment of RIC	Marketing / Jay	Pangasinan	Urdaneta	F - Organizing Farmers ; P - Value added by processing	Rural Improvement Club (RIC) of Labrador	The club is a women's organization with 30 members. They partnered with the Kagampat Farmers Association (KFA) in implementing an integrated vegetable production program.The RIC operates a 3-hectare demonstration farm for the KFA where they produce various vegetables. Commodities harvested are sold tothe market and those that cannot be sold are processed. At present, the processed vegetables produced by the RIC includes home-made noodles, ginger tea in small bags, and ready-to-eat foods like dumplings and embutido. The monthly output averages 3000 packs of noodles at 250 grams/pack and 1,000 packs of ginger tea at 200grams/pack. The sales of the noodles are mainly in their own operated'lomihan'or noodle house. The rest are sold to walk-in buyers and through online selling	The RIC has implemented an integrated production process whichensures there will be minimal waste. This increased the take homeincome of farmers. It also offers income opportunities to women whoare involved inprocessing	TheRICorganization earns in the process; the farmers have minimalwaste thus earning more; women earn through the processing ofcommodities	DTI and DA
14	Barcoding system for transaction at wholesale market	Marketing / Jay	Quezon	Saraiya	I. Better market information system J. Weight/quality-based trading N. Introducing traceability system R. Developing Smart Food Chain	Sentrong Pamilihan Pang Agrikultura sa Quezon Foundation (SPPAQ)	To ensure transparency and error-free documentation, buying and selling is conducted through a barcoding system. Each farmer, trader, and commodity is assigned with a barcode. Information of producers, crops, quantity, sold amount , buyers are all digitalized and printed out for transaction.	Error-free and faster transaction.	Efficiency is the main benefit. Trust is also developed among the stakeholders.	DA, Japanese firm (E-support Link)
15	Value addition by processing and enhancement of farmers' associations/cooperatives	Marketing / Takeshi	Pangasinan	Calasiao	P. Value-added by processing F. Organizing farmers	Ms. Joann M Casil "Ann's Cassava"	A SME processing company produces cassava chips using local cassava procured from 5 farmers' associations in the province. Cassava chips are sold to resellers in municipal markets, street food vendors, and the exhibit shop in SM Mall in Urdaneta. The company prefers working with farmers association over traders, primarily because of lower price and freshness.	Enhancement of trading business of farmers' associations. Stable cash income for farmers	Ann's Cassava, Farmers' associations, individual farmers	DOST (providing a financial support for the new grinding machine)

16	Addressing price fluctuation through differentiation of transplanting and harvesting timing	Marketing / Takeshi	Pangasinan	Villasis	B. Production on market trends	Ms. Juanita Racoza, a trader in Villasis Municipality, Pangasinan	The trader buys eggplants from 10 local farmers in the same Barangay, and supplies them to Divisoria, Balintawak, and Urdaneta, etc. In order to better manage the price fluctuation in the market, the trader provides seedlings to the 10 farmers in different timings and allocate harvesting quota at different timing to each farmer.	The price fluctuation is better managed, and farmers get relatively consistent farm gate prices.	Ms. Racoza, local eggplant farmers	A local nursery in Villasis providing quality seedlings in timely manner upon the order by the trader.
17	Stable income through contract farming	Marketing / Takeshi	Pangasinan	Aguilar	D. Developing new sales channels F. Organizing farmers	Jollibee, Farmer Association in Aguilar (the name is unconfirmed)	A farmers' association supplies tomatoes to Jollibee through contract farming. Planned and coordinated cultivation is carried out so that the required amount can be supplied constantly. Taking advantage of the hilly topography, the farmers in the association grow a medium-sized variety of tomatoes for salad as per Jollibee's request throughout the year.	Stable income for farmers and supply of tomato for Jollibee	Jollibee, Farmers' Association, and farmers	PRDP, DA
18	Stable income from farm management by contract farming	Marketing / Jay	Benguet	Bugias	D. Developing new sales channels F. Organizing farmers	Peakless Mountain Farmers Association	Making with contract with North Point (wholesale and repacking) to supply cabbage and carrot. The group plans cropping and shipment considering order from the firm. The group members keep regulation of the group.	Stable cash flow	Stable cash flow	DA, North Point
19	Vegetable grading system	Marketing / Jay	Quezon	Sariaya	G - Improved Collection System	Sentrong Pamilihan Pang Agrikultura sa Quezon Foundation (SPPAQ)	The foundation is a private institution managing the operations of the trading center in Sariaya, Quezon. It is a wholesale vegetable facility where farmers bring their produce and traders come to buy in bulk.The foundation recognized the informal grading system of commodities in the trading center. There are three main categories of products: Good–the highest category for any commodity; Medium (Semi)–commodities with qualities that are below the Good category; and, Reject–commodities that cannot qualify for selling in the trading center.	Both farmers and traders accept the grading and agree on the price of commodity as the fair value of the product	The farmers benefit as the fair value of their products are reflected	The stakeholders such as the traders and the farmers both supported the innovation
20	Price information sharing by mobile phone for farmers in poor internet areas.	Marketing / Jay	Benguet	La Trinidad	I. Better market information system	Benguet Agri-Pinoy Trading Center (BAPTC)	BAPTC shares price information through FB. In some areas, farmers face difficulty to access due to weak internet connection. Thus, it partnered with SMART Communications to set up a text messaging platform "INFO CAST". Information can be sent through the text blast technology to the farmers.	Farmers can access prices on real time. BAPTC is encoding phone numbers of farmers, targeting 5,000.	Farmers can project value of their commodity and plan shipment.	SMART. It provided one account to BAPTC for "Infocast".
21	Value addition by processing and participation in modern value chain	Marketing / Furuichi	Quezon	Dolores	P. Value-added by processing	Pinagdanlayan Rural Improvement Club Multi-purpose Cooperation	The Coop buys ginger from farmers or produce in coop's farm and process the raw materials to powder. It sells the processed produce to PROMINEX VENTURE under contract. The firm repacks and wholesales to convenience store like Seven Eleven.	Stable management of farmers and the Coop.	Stable management of farmers and the Coop.	Food faire by DTI (?)
22	Development of a new sales channel which is closer to communities	Marketing / Takeshi	Pangasinan	Urdaneta	D. Developing new sales channels	Mrs. Christina Fernandez, an owner of a Sari-Sari store	A line of Sari-Sari stores was established on the main road by residents living nearby during the COVID-19 pandemic. The stores sell vegetables and fruits, offering an easy access for residents in the nearby communities and people driving on the road.	Vegetables and fruits are made available in the vicinity of communities	Sari-Sari stores owners, residents/ consumters	N/A
23	Selling fresh vegetables at Sari-Sari Store	Marketing / Furuichi	Quezon	Dolores	O. Developing new sales channels Q. Sales promotion of vegetables	Mrs. Marilou Malveda, Sari-Sari store owner Tel: 091486631250	She started Sari-Sari store in 2019 when COVID-19 pandemic occurred. In 2020, she started selling alive Tilapia and vegetables.	People residing around the store buy vegetables in morning time.	Sale from vegetable a day is between 300 and 500 PHP.	An operator of tricycle delivering vegetables on order, a business partner.
24	"Patronizing" trading system to overcome problems in the wholesale market	Marketing / Takeshi	Pangasinan	Urdaneta	A. Higher production by private support, B. Production on market trends, C. Financing, G. Improved collection system	There is no individual innovator. It is said that the trading system has developed many years ago.	Traders in Pangasinan APTC and farmers have adopted a trading system, in which the trader provides inputs in cash or in kind to the farmer, and undertakes the tasks of harvesting, sorting, packing and transporting (to PAPTC) on behalf of the farmer, and all these costs are deducted later from the payment to the farmer when he/she sells crops to the trader.	The system enables farmers to take part in the wholesale market by fulfilling the market requirements	Traders, farmers	N/A

25	Use of refrigerators at retail shop	Marketing / Furuichi	Quezon	Canderalia	D. Improved post-harvest technology ?? M. Introducing cold-chain system??	Mr. Roel Manibo A wholesaler cum retailer at Pamilihang Bayan ng Canderalia Tel: 09209668837	He buys vegetables from Divisoria Market every day and keeps them in 2 refrigerators and cooler boxes. He is very conscious about freshness of perishable vegetables.	There are many loyal customers who buy from him.	Probably, he gets more profit than the other retailers in the Market.	Refrigerators are his investment. Mr. Jojip of Divisoria Market is his business partner. His service is helpful to the innovator.
26	Use of agricultural tramline system (ATS)	Infra / Kuwahara	Benguet	various mucinipalities	G. Improved collection system, H. Building infrastructure	DA, LGUs, etc	The government is installing ATSs and farmers groups are operating and maintaining.	ATSs contribute to reducing transportation costs and productivity increase.	Farmers	DA, LGUs
27	Use of Potato Micro tuberlets	Horticulture / Jocelyn	Benguet	Atok	A - Higher production by private support	Johnny Butangen	The innovator is a GAP trained farmer. He has been using potato micro tuberlets as planting material but stopped in 2019 when the laboratory which mass produced these potato micro tuberlets had closed due to the pandemic .	The use of potato micro tuberlets will ensure good planting materials thereby producing good quality potatoes which can ensure higher yield as compared to recycle and imported seedling materials. Also, the use of store-bought seedlings can be harvested within 45 days after transplanting as compared to self-germinated seeds which can take one week to recover after transplanting and could take 50 - 65 days before they can be harvested.	Profit for innovator	GAP, DA
28	Onion Consolidation	Marketing / Jocelyn	Nueva Ecija	Bongabon	B - Production on market trends;	Jeffrey Bibat	The innovator is an onion farmer at the same time consolidator of onions. He buys directly from onion farmers in Nueva Ecija and Pangasinan, then deliver them as far as in the Visayas (Tacloban City) and in Mindanao (General Santos City, Davao de Oro and Davao del Norte) twice a month	The innovator is of great help in disposing harvested onions which experienced oversupply in both aforementioned provinces instead of leaving them in the field to rot due to a very low price in the market	Profit for innovator, onion farmers	
29	Peddlers of Farm Ready Vegetable Seedlings	Horticulture / Jocelyn	Pangasinan	Villasis	A - Higher production by private support	Seedling peddlers	Husband and wife are peddlers of ready-to-plant vegetable seedlings which they bought from FarmLevi Seedling Farm at Villasis, Pangasinan. They sell vegetable seedlings such as tomato, eggplant, hot pepper, grafted ampalaya and upo, pechay and cabbages to farmers, housewives, schools or to whoever want to plant vegetables in the locality.	Farmers as well as enthusiasts in vegetable production will beassured of the quality of the seedlings because they are raised underproper nursery management,thereby guaranteed with highproduction yield provided proper cultivation methods and practicesare given tothe seedlingswhen they already transplanted to the field	The innovator will get more profitby peddling the seedlings not onlyin the locality but in the neighboring municipalities as well. Farmerswill alsoget more profit byhaving quality seedlings that cancontribute tohaving higher yields.	
30	Establishment of Barangay Agricultural Extension Worker (BAEW)	Marketing / Joseph	Camarines Norte	Daet	I - Better market information system	Engr. Abad, Provincial Agricultural Office (PAO)	Implemented the Barangay Agricultural Extension Worker (BAEW). A barangay base worker to coordinate projects of DA in barangay level.	1.The farmers will have more easier access to technical advisory through the barangay agricultural extension worker 2.Dissemination of information will be more efficient and effective through the Barangay Agricultural Extension Worker.	Both PAO and the farmer will benefit from this initiative	DA

31	Greenhouse production of Romaine lettuce and strawberry	Marketing / Jocelyn	Benguet	Atok	B - Production on market trends; O - Developing new sales channels	Johnny Butangen	Farmer grows Romaine lettuce and strawberry in a controlled condition inside the green house.	Year-round yields of lettuce and strawberry.	The innovator will get more profit by producing better quality of harvested commodities and higher yields. Being a supplier of strawberries to Vizco's Restaurant, the innovator will not suffer from fluctuation of price because these strawberries are bought for a fixed price.	Constitutional buyers; retailers
32	Home-based processing of Salabat	Marketing / Connie	Camarines Norte	Daet	P - Value-added by processing	Luz Payla, Manager Camarines Norte Development Cooperative	Spearheaded the organizing of home-base processing of Ginger ("Salabat") for their members	1.1 Members are having additional income because of the project on ginger processing and they are happy of the result 1.2 Women member are impowered because of the project. 1.3 The cooperative has potential business activity for this project	Both the Coop and its members gain their objectives of developing an additional revenue stream because of the project	DTI and DOST for providing technical advisories and training on processing.
33	OneStore Project	ICT / Joseph	Benguet	La Trinidad	R - Developing Smart Food Chain; O - Developing new sales channels;	DOST : Alicia A. Balacua, Senior Officer	She is the program officer of implement DOST program in the province of Benguet particularly OneStore Project, an eCommerce APP with a physical store.	1. More MSMEs are adopting the program and availing assistance from DOST – Financial, Technical and Machineries 2.Individual farmers are given the opportunity attend technical skills training in processing of vegetables and other farm product 3.Because of the OneStore Mobile App. Many MSMEs are connecting with the right market 4.End Consumer can access OneStore products through the mobile APPP	MSMEs and individual farmers are benefiting from this project	•The DOST Benguet Regional Office •ADB, WB and JACA
34	Processing and e-commerce of organic products - Agrizkaya MPC	ICT / Joseph	Nueva Vizcaya	Bayombong	B - Production on Market Trends; R - Developing Smart Food Chain; O - Developing new sales channels; P - Value added by processing	Eden Lacar, Manager of AgrizKaya Multi-Purpose Cooperative	She spearheaded the organic farming. Develop partnership with DOST and other Agencies for the OneStore Hub.	•Members are encouraged to do processing activities •Members increase their potential income •Vegetable and other process products are being market through e-Commerce APP. •Coop are being known for this project and potential investor-partner are signifying their intensions of partnering. •Members can provide premium price on their organic produce as well as the coop.	Both the members and the coop gain from the project	The members, Officers and Staff of the cooperative, Cooperatives within the Federations of NV, DOST and DTI

35	Consolidation and trading activities of Multi Purpose Cooperative	ICT / Joseph	Benguet	Buguias	G - Improved Collection System	Joaquin Geronimo M. Depalog, Jr, Manager of Lengaoan Indigenous Farmers Multi-Purpose Cooperate	1.Provide immediate action for the needs of its members by offering a Computer or Gadget loan for online classes of their children during the height of Pandemic. 2.The Coop is also functioning as Consolidator/Trader to protect it members from the exploitation of some traders.	1.1The children of its members were able to attend online classes. 2.1The coop assures its farmers of buying their produce at fair price and also generates income in the process.	Both the Coop and its members gain from these activities	
36	Development of a Vegetable-Base Price	ICT / Joseph	Nueva Ecija	Bongabon	I - Better Market information ; J - Weight/quality-based trading	Jayson L. Leonardo, Municipal Agricultural Officer	In the process of developing a Vegetable-Base Price to establish the price of vegetables and for traders not to officer price below the set vegetable-base-price to farmers. The project will also involve the LGU as the main buyer of farmers commodity.	•It will ensure the farmers that during overproduction of vegetables prices of their produce will not be priced below the set vegetable-base-price. This will stabilize the price vegetables in the area •LGU to fully support the farmers by buying the produce of their farmers at fair price. •Farmers will be protected from the dramatic fluctuation of vegetable prices	Both the farmer and LGU will benefit from the project	Farmers support the innovator
37	Installation of Solar-powered irrigation system	Infra / Algine	Nueva Vizcaya	Dupax del Sur	H - Building infrastructure	Santos Bunagut,President-Balzain Upland Development Association (BUDA)	The BUDA was granted an SPIS by DA	The initially idle land owned by the BUDA which was dedicatedfor fruit bearing trees can now be cultivated with vegetables because of access to irrigation.	The farmers are starting to plant high value crops such as tomatoesand eggplants which they cannot cultivate previously.	The MAO supported the proposal to the DA so they can beawarded with an SPIS. The MAO pursued the farmers to plant vegetables as profiting from fruit bearing trees takes a longer time whereas vegetables can be harvested much earlie
38	Installation of Agricultural Tramline System (ATS)	Infra / Algine	Nueva Vizcaya	Kayapa	H - Building infrastructure	Agusto Paay, president of Acacia Highland Farmer's Association	Sustainable operation of an agricultural tramline system byemploying fees in the use of the ATS.	The ATS is still in good working condition even after 5 years ofoperation. The farmer's association was able to generate enoughfunds to pay for the ATS'operator and cover the maintenance of theATS. The farmers continue to use the ATS for its intended purposeas well as transfer persons from one end to the other	The farmers are able to generate more profit due to less productdamages and faster travel time to the nearest FMR	The ATS was provided by DA-HVCPD but the O&M system inplace was determined by the association
39	Cold storage for Onions	Infra / Algine	Nueva Ecija	Palayan	M - Introducing cold-chain system	Arnel Llamas (Manager-09173144480),KASAMNE (Katipunan atSamahan ng mga Magsisibuyas sa Nueva Ecija) and Palayan CityCold Storage	The farmer's association was able to put up a cold storage facilityand because of their subsequent good practices, they were selectedas the operator of anothercold storage facility from PRDP.	The total capacity of KASAMNE's facility including the one fromPRDP is 360,000 bags of onions or around 10 million kg of onions.These onions can be stored for at least 6 months and sold when thesupply is low	Onion farmers benefit a lot from timing the price and supply ofonion due to access to the facility	The PRDP granted one building but the 2 buildings solely came from the investment of KASAMNE

40	Agri-finance of vegetables and Organic farming	ICT / Joseph	Benguet	Baguio City	R - Developing Smart Food Chain	Dante T. Frias, Program Manager, Jaime V. Ongpin Microfinance Foundation, Inc.	He spearheaded the development of a new product for Agri-finance of vegetables and Organic farming which are now on its pilot stage. This is in partnership with a professional consulting firm, who provided technical assistance in the development of agri-microfinance product package for small hold vegetable farmers, the design of which suits to the needs and conditions of the farmers and seasonality of their crops. Prior to product development, demand and supply study was conducted and commodity profile for each crop was developed. This became the basis in the design of a product package that has already been pilot-tested and ready for roll-out. The package is a combination of loans, savings, micro-insurance, financial education and linkage to technical support from government agencies such as DA..	•This will increase the Agri-finance portfolio of JVO while it will also potentially increase the outreach of farmer-members availing of this new products and services •The potential risk for non-payment will be minimized since the product was designed incorporating risk analysis process. •Through financial education, farmers are financial capability are improved to efficienctly manage their personal and household finances. •Since organic produce caters to a very specific targe market segment, JVO can add premium pricing on its produce. •Target market will be assured of product quality. Since the production and handling of the will be done professionally.	Both the MFI and its Members will get more profit.	•The whole organization supports the innovator. •The consulting firm, ACCESS Advisory.
41	Small and medium size tramline development by producers	Infra / Kuwahara	Benguet	Atok	D. Improved post-harvest technology H. Building infrastructure	Farmers Mr. Ayson Alsaen, 09486835129 Mr. Kelcid Gubat, 09128593390	Some farmers designed and fabricated tramline by use of second hand motorbike and vehicle. Small system with 25kg carrying capacity for 150m line is costing php 25,000. Large one with 75 kg for 450m of 3-line costs php 160,000h.	Reducing burden and time to transport produce		Their own effort. Fabrication by local fabricators.