

Agri Resilience through Vertical Farming in PH

by Ma. Nova R. Nguyen

Despite the Taal Volcano eruption, African swine fever, extreme weather conditions, and the COVID-19 pandemic, the Philippine crops sector proved to be resilient and grew by 3.3% in Q1 of 2021 as compared to the same period last year (Figure 1). Crops contributed an average of 55% to total value of production in agriculture from 2019 to 2021 [1], with livestock (17%) as far second, followed by fisheries (15%) and poultry (13%). Palay contributes the highest value followed by banana, corn, and vegetables & rootcrops in the crops sector (Figure 2). Palay and corn are one of the main sources of carbohydrates in the country while banana is a key export product. Vegetables and rootcrops constitute about 6% with top contributors including cassava (PHP24.7B), onion (PHP13.6B), sweet potato (PHP11.8B), eggplant (PHP7.1B), and tomato (PHP5.7B) in 2020 [2].

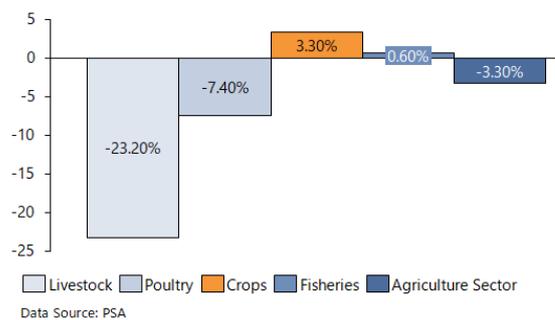


Fig. 1. Growth Rates of Value of Production in PH Agriculture and Fisheries at Constant 2018 Prices, 2020 Q1 vs. 2021 Q1

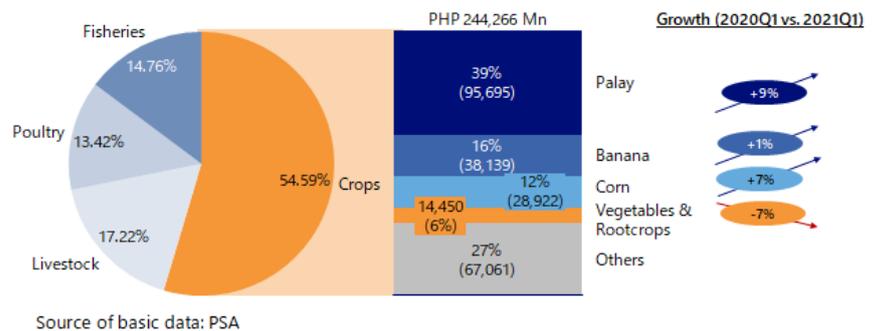


Fig. 2 Value of Production in PH Agriculture and Fisheries at Constant 2018 Prices, Average Shares from 2019Q1 to 2021Q1

The crops sector may have shown resilience, but regional and local resilience vary in terms of risks in supply stability. Locations with limited agricultural land rely on crop-producing areas for supply. Meanwhile, crop-producing areas experience low productivity from losses during planting, harvesting, and postharvest as well as reduction in agricultural land. Vegetables are highly perishable and therefore harder to stock compared with grains. Hence, the group has higher risks in terms of supply stability. In fact, dissecting the crops sector performance shows that vegetables and rootcrops suffered a drop in value by around 8% from 2020Q1 to 2021Q1 (Figure 2), and crop sector resilience was effectively driven by palay among others. While there are many subsectors under crops, the next sections will be devoted to issues and solutions focusing on vegetables and rootcrops.

Contributors to Risks in Supply Stability

Low agri productivity. Agricultural productivity is the amount of output (crops) produced with a given number of inputs (water, fertilizer, labor, equipment, etc.). In the Philippines, increasing crop productivity is hampered by many factors, including lack of suitable land for planting and crop losses during production and postharvest. Production losses are partly because of planting crop varieties that are susceptible to pests and diseases as well as exposure to extreme weather conditions. Uncareful handling, poor storage practices, and long transport period lead to rotting, insect and mechanical damage, and weight loss after harvest. Postharvest losses are estimated [3] to be up to 40% for eggplant; 11-38% for tomato; 29% for cabbage; and 7-12% for carrot. Globally, food losses in advanced and emerging economies are comparable but occur at different stages of the chain: in advanced economies, 40% of food losses happen at retail and consumption; in emerging economies, 40% of food losses occur during postharvest and processing [4].

Reliance on major crop-producing locations. There are varying conditions (e.g., elevation, temperature, soil fertility, etc.) needed to grow different crops. This makes certain locations fit for planting specific crops while other areas must import to get their supply. Moreover, highly-urbanized cities do not have the space and lack the incentive to use scarce land for growing vegetables. In many urban areas, land is used for residential and commercial purposes rather than agricultural use. Reliance on other communities means that vegetable supply of these areas is more susceptible to supply chain disruptions.

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Vertical Farming as a Solution

Various solutions are being undertaken to address the problems mentioned. Vertical farming, although not new, has been gaining popularity in the Philippines since the COVID-19 lockdown last year. Google Trends can show relative popularity of a topic within a given duration, with popularity measured from 0 to 100. When NRI examined the relative popularity of vertical farming in terms of YouTube searches from 2018 to April 2021, it found that interest in vertical farming peaked in April 2020 for Metro Manila and CALABARZON in March-April 2020, coinciding with the government-imposed lockdown (Figure 3). It seems that more people have become curious about how to build their own vertical farms due to perceived higher demand.

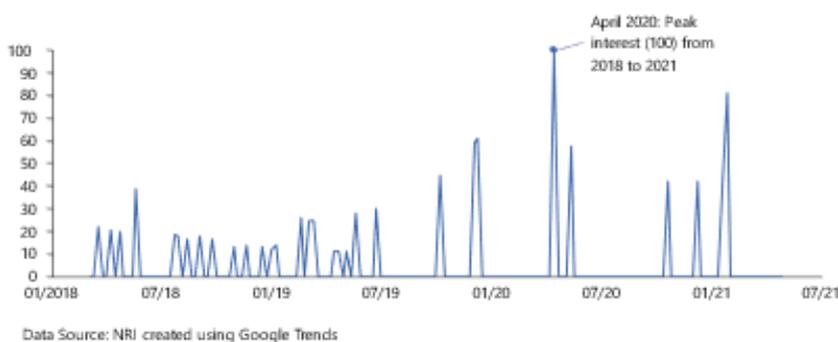


Fig. 3. Interest in Vertical Farming in Terms of YouTube Searches in the Philippines, 2018-2021



Vertical farming involves producing crops in upright layers while optimizing plant growth and inputs such as water, nutrient solution, and light. Vertical farming can incorporate soilless planting methods, namely hydroponics, aquaponics, or aeroponics. Some refer to it as “garage farming” as it can be set up at home. In essence, hydroponics involves replacing soil with nutrient solution for crop growing and is the easiest one to learn and adopt among the three; aquaponics is more complex as it combines hydroponics with raising aquatic animals; lastly, aeroponics involves spraying plant roots that are suspended in air with water and nutrient solution.

Startups with Vertical Farming

Future Fresh is an agribusiness startup in Metro Manila that produces vegetables inside 40-foot shipping container vans [5]. Through vertical farming with hydroponics, they grow arugula, kale, spinach, basil, parsley, Swiss chard, lettuce, and coriander. Customers can order online and have the vegetables, fresh from harvest, delivered directly to their homes.

Why do startups choose vertical farming? Here are some advantages and disadvantages.

Advantages

- **Controlled environmental conditions and inputs.** Because the environmental conditions are controlled inside the container van or other indoor facility, the crop losses due to natural disasters, pests, and diseases are avoided. In addition, a vertical farm can be established in locations with climate that is not suitable for planting certain crops. The controlled environment allows indoor farms to forgo the use of pesticides and reduce water use. In the case of FutureFresh, the startup is able to use 90% less water.
- **Localized markets cut transport distance and time.** Postharvest losses due to improper handling, poor storage practices, and long transport period are also minimized because vertical farms allow for localized markets. Other players along the chain typical in conventional farming are not necessary. With this, farms like Future Fresh can deliver straight to customers, just hours after harvest.

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Advantages

- **No soil and space management issues.** With hydroponics, farms can address issues of low soil fertility while vertical farming addresses the lack of space for planting. This creates attractive agribusiness opportunities that incentivize growing vegetables in cities especially in Metro Manila, where there is shortage of agricultural land.
- **Quality products and premium price.** Vertical farms that are successful in optimizing inputs to grow better quality vegetables can charge higher price for quality. Another source of premium for some vertical farms is selling of vegetables that are free from pesticides. For example, Future Fresh can provide not only fresher but also safer vegetables by not using pesticides and harmful fertilizers. With higher quality products and convenient service, vertical farms like Future Fresh can charge a premium for their vegetables.

Disadvantages

- **Potentially large upfront cost and longer payback period.** Having controlled conditions while beneficial has its corresponding costs. Vertical farming requires capital such as construction of greenhouse, shelves or tray systems, cooling system, lights, etc. that are not necessary in conventional farming. When researchers compared the payback periods for conventional and vertical farming for onion production in Nueva Ecija [6], they found that it takes a year to recover the cost in conventional farming while it takes three years for vertical farming with hydroponics.

The Future of Vertical Farming in the Philippines

The Philippine crops sector proved to be resilient amid the challenges in 2020. However, the extent of resilience in terms of risks to supply stability may vary geographically. Areas that do not produce their own vegetables rely on crop-producing locations. At the same time, crop-producing locations are marred by low productivity.

Migration to cities that have more job opportunities will further decrease the land attributed to agriculture in those cities. This, combined with extreme weather conditions and other disruptions, threaten the stability of vegetable supply especially in areas that do not produce their own crops. Given these factors, and with the growing demand for healthier options from increasing middle class in the Philippines, the demand for products from vertical farms are likely to increase.

Vertical farming requires higher upfront cost and takes longer before returns are enjoyed. It may not be a substitute to conventional farming, but it can help in addressing many of the issues in vegetable production and distribution especially in highly-urbanized cities.

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