Asia-Pacific
Economic Cooperation

Advancing Free Trade
for Asia-Pacific Prosperity

Food Systems and Services: Illustrative Case Studies on Horticulture Food Systems and Services in Mexico and Indonesia

APEC Policy Partnership on Food Security

August 2021

APEC Project: PPFS 01 2019T

Produced by
Ms Rachel Tay
Ms Maria Aurea Montemar
Spire Research and Consulting, Pte. Ltd.

For
Asia-Pacific Economic Cooperation Secretariat
35 Heng Mui Keng Terrace
Singapore 119616
Tel: (65) 68919 600
Fax: (65) 68919 690
Email: info@apec.org
Website: www.apec.org

APEC#221-PP-01.3

Abstract

One of the main goals of the APEC Services Competitive Roadmap (ASCR) is to progress the facilitation of services to improve the current food systems and create food security. To efficiently allocate resources, APEC needs to understand the impact of the services environment on food supply chain players, specifically to identify critical barriers and opportunities for services engaged in the food supply chain.

This paper examines two case studies, one from Latin America (Mexico) and one from Asia (Indonesia), with an in-depth exploration of the horticulture sector (fruits and vegetables). The study encompassed a mixed methodology and involved in-depth interviews with 96 supply chain players (e.g., farmers, distributors, processors, food service providers) in the Indonesian and Mexican horticulture sector.

The COVID-19 pandemic prompted supply chain players to engage in new services, such as technology-led services (e.g., social media platforms, e-commerce), storage facilities (e.g., cold chain), and alternative financing methods (e.g., Fintech) to adapt to the COVID-19 pandemic's disruptions. The COVID-19 pandemic exacerbated ongoing challenges faced by the horticulture industry, particularly in the areas of a shrinking workforce and financial access.

However, respondents argued that there were barriers to the uptake of services, such as insufficient funds to engage food service providers, an inability to meet prerequisites to qualify for government support, and a lack of awareness or knowledge about these services. Cognizant of such barriers, this paper identifies and discusses three areas of opportunities for policy-making and capacity building: 1) to improve the efficiency of the supply chain(s), 2) to upgrade transportation/logistical management, connectivity, and capacity, and 3) to improve the awareness, knowledge-building and technical know-how of farmers. The identification and analysis of these opportunities, drawn from the two economies (Mexico and Indonesia), may value add to other economies and sectors beyond horticulture.

Keywords: COVID-19 Pandemic, Food Security, Horticulture, Indonesia, Mexico, Supply Chain

Executive Summary

This paper identifies the following opportunities for policy-making and capacity building in the horticultural sector: 1) to improve the efficiency of the lengthy supply chain(s) 2) to upgrade transportation/logistical management, connectivity, and capacity; and 3) to improve the awareness, knowledge-building and technical know-how of farmers.

Additionally, this research identified two ongoing challenges faced by the horticulture sector that were further put in the spotlight due to the COVID-19 pandemic: 1) the shrinking workforce and an overreliance on manpower and 2) a lack of access to financial reserves.

Each of the opportunities and challenges will be addressed below, alongside suggested policy recommendations for implementation. However, it is advised that individual economies conduct their research to ensure that the policy recommendations can be translated into their context.

Opportunity 1: To Improve the Efficiency of Supply Chain(s)

The presence of lengthy supply chains was cited as a challenge, with fruits and vegetables changing hands multiple times and an excessive number of intermediaries separating farmers from downstream markets. Nearly a third of horticulture stakeholders interviewed in this research indicated that the lengthy supply chain structure was the main challenge.

With the social distancing restrictions imposed during the COVID-19 pandemic, farmers could not rely on intermediaries as before and were pushed to seek new markets (due to the closure of primary markets such as physical marketplaces, hotels, restaurants, and cafés) or consider new sales channels.

The implications led to a lower profit margin for farmers, an increased risk of food loss and wastage, and a lack of transparency and traceability.

One possible solution is to facilitate better access to new markets through the uptake and technical development of agricultural e-commerce platforms. An e-commerce platform with a user-friendly application (i.e., easy to use, mobile and desktop compatible, etc.) could help close the gap between farmers and downstream markets, reducing farmers' reliance on intermediaries.

E-commerce Initiative

Governments may bridge the gap between farmers and new (and wider) markets by optimising partnerships with existing e-commerce platforms to facilitate the creation of more efficient sales channels. These platforms should integrate information relevant (and more valuable than existing solutions) to both consumers and stakeholders and could serve as logistic solutions allowing disintermediation and shortening of the supply chain.

This would provide farmers with direct access to larger agribusinesses or consumers, improve food security, lead to greater supply chain efficiency, reduce the reliance on intermediaries, and diversify sources of income.

However, rural or less technology-savvy farmers may be unable to access or use an online platform. Thus, as a preliminary step, Governments are first advised to improve rural infrastructure.

Opportunity 2: To Upgrade Transportation/Logistical Management, Connectivity, and Capacity

Nearly one-fifth of stakeholders' expenditure is spent on transportation services. Transportation is viewed as an essential service that consumes significant proportions of stakeholder expenditure. Poor connectivity to rural areas, a lack of cold storage facilities, and a reliance on traditional transportation (e.g., open-air trucks) make it difficult for farmers to access their markets.

The impact of having less comprehensive logistics and transport infrastructure results in a high cost of transportation services for the first mile logistics, reduced access to markets, and an increased risk of food loss and wastage.

Two possible solutions to facilitate better and more efficient transportation could be developing integrated logistics parks or developing and improving transit infrastructure.

Improve Transit Infrastructure

Creating and enhancing strategically located road infrastructure can facilitate efficient and effective transportation networks and benefit stakeholders throughout the supply chain. This can be achieved by identifying zones of significant supply and demand under-served by current transport networks where roads can be built or upgraded. Upgrading plans can be prepared based on projections of future produce traffic.

The benefits include improved rural accessibility and more efficient transportation, which is important for perishables like horticulture. Logistics companies will see reduced transport and maintenance costs. On the other hand, building transportation infrastructure requires significant investment.

Build Logistics Parks

Logistics parks refer to industrial areas for activities related to transport, logistics, and distribution of goods [1]. Logistics parks should be built in alignment with other developmental planning areas, e.g., city-rural logistic planning. The parks should provide services for agricultural produce circulation, processing, transport, distribution, storage, and interconnect with existing logistic parks, agricultural production bases, wholesale markets, and distribution centres.

Rural markets, agricultural production collection points, and agricultural-input distribution centres could all be relocated to these logistics parks.

Not only will this facilitate efficient transportation and access to important services, but it will also support the operational requirements (e.g., stores, packing houses, electricity) needed to facilitate an e-commerce platform.

Nevertheless, the development of logistics parks will be dependent on the prior completion of other infrastructure such as connecting roads. These developments will also require significant investments of time, funding, and coordination efforts with the different parties involved.

Opportunity 3: To Improve Awareness, Knowledge-building, and Technical Know-how of Farmers

The two main barriers to the uptake of services are information dissemination (being aware of the existence and the benefits of services or skills) and a lack of knowledge on topics crucial to the horticultural sector's development, which were mentioned by 23% of the service providers interviewed.

The most common problem areas are 1) technology, 2) financing, and 3) modern farming techniques. Additionally, despite most stakeholders being aware of government support and efforts to promote farmer groups (such as in Indonesia), farmers' uptake for such support remains low, with only one-third of farmers becoming involved.

This could result in lower quality produce, inefficient and non-scalable businesses. Potentially, solutions could explore public-private partnerships to offer extension and training services to farmers or to promote agriculture mechanisation tool sharing.

To Offer Extension and Training Services to Farmers

Governments could engage influential farmer groups, associations, and private organisations to identify, develop, and conduct the most beneficial education programmes. Governments may consider deploying consultants to encourage and train farmers to use support programmes in the initial months.

Women farmers have significantly less access to agriculture extension services, highlighting the need to identify suitable channels of engagement that maximises women's accessibility.

Conducting an education and training programme not only contributes to food security and higher produce quality but also provides an opportunity to promote sustainable farming, which may mitigate environmental issues and prepare stakeholders for the upcoming global warming challenges.

Before implementing education programme(s), prior research on regional-specific needs may be needed to achieve better reach and effectiveness.

Promote Agriculture Mechanisation Tool Sharing

A third-party group would have the responsibility of leasing and maintaining farming equipment/tools to farmers. Larger farmer groups or governments can purchase large and expensive equipment cheaper through wholesale channels. However, farmers, especially those more senior and less tech-savvy, may need support (e.g., training) to utilise the new equipment/tools.

By providing farmers with easy access to previously unaffordable equipment, trial and observation of innovative equipment use could reduce the associated adoption barriers, and

over time encourage (other) equipment adoption. On the other hand, some form of financial participation may still be shouldered by farmers to use and maintain the equipment.

Challenge 1: Shrinking Workforce and Overreliance on Manpower

Before the COVID-19 pandemic, labour supply was an ongoing challenge for the horticulture industry, where stakeholders were faced with decreasing labour. There is a widespread lack of youth interest in farming, resulting in an ageing (and declining) workforce.

When the COVID-19 pandemic occurred, businesses had to adhere to large-scale social distancing measures. They had to overcome a reliance on a larger number of workers and the traditional manual procedures for processing and distribution. This led to decreased productivity, delays in delivery, and even closure of some establishments or factories.

To make up for the lack of a horticulture workforce, smart farming (including the adoption of automation and the provision of technology) can be a solution. This approach, driven by smart farming through digital technology, suggests that farmers can act as managers of their crops rather than labourers, to avoid repetitive, physically demanding, and tedious tasks in the field.

Thus, solutions to deal with the shrinking workforce include developing programmes to encourage the uptake of technological tools and automation practices, creating industry dialogues and collaborations to foster automation in food production and distribution, and encouraging seasonal work arrangements.

Develop Programmes to Encourage Uptake of Technological Tools and Automation Practices

Governments may stimulate the adoption of technologies that can improve horticulture sustainability by 1) ensuring coherence in existing technology-related policies, especially in the areas of agriculture, trade, environment, and R&D; 2) identifying the most suitable technologies for stakeholders; 3) analysing which are the most effective and efficient ways to disseminate information and encourage adoption and incorporation of technologies. Communication plans can be developed by utilising the most suitable channels for interaction and information dissemination.

To maximise the advantages of improved horticulture practices, training and education programmes should be rolled out to supplement communication outreach efforts. Agriculture extension officers should be available to provide support to facilitate the uptake of such practices.

Innovations may reduce farm operating costs, in the long run, boost efficiency and reduce the reliance on manual labour. These innovations may also attract young people to join the farming industry, as they tend to be more eager to learn and apply modern agriculture technology. Yet, there could be several difficulties in the early stages of technology adoption. Most smallholder farmers may not have enough capital to acquire certain technologies. Furthermore, fast adoption without sufficient identification and planning of automated practices may leave stakeholders vulnerable to a wide skills gap, where workers are not

competently trained to handle technological tools. Also, misuse can have substantial negative consequences such as loss of income or trust in the technology.

Enable Industry Dialogues and Collaborations to Foster Automation in Food Production and Distribution

Another solution is to facilitate a wider participatory dialogue involving private-public task forces or expert working groups amongst industry leaders, governmental organisations, and farming stakeholders, to drive the conversation on how best to adopt automation in food production and distribution.

Policymakers benefit from industry dialogue as they can reflect a broader range of issues and perspectives. Participating working groups or task forces collaborate to provide remedies to issues in an engaging space.

Effective industry dialogues require long-term objectives supported by intensive yet instructive research to identify which technology best practices should be adopted at different supply chain points. Without proper follow-throughs, such as the development of criteria to track adoption progress or time-bound key performance indicators, industry dialogue objectives can be short-lived.

Encourage Adoption of Seasonal Work Arrangements

Finally, it is possible to develop seasonal worker programmes to accommodate planting and harvest peaks to assist rural farmers when the supply of labour falls faster than demand (e.g., movement of city-dwellers to the rural farmlands). Most seasonal work arrangements utilise foreign workers; however, with the restrictions on movement introduced due to the COVID-19 pandemic, local workers can be used in replacement.

Encouraging the movement of local workers from the city to the rural farmlands serves as a remedy to the shrinking workforce and addresses population growth and urban migration. However, such local workers' current skillsets must either match or be improved to fit the available jobs in rural farmlands. It is worth acknowledging that the benefits can be sustained beyond recovering from the COVID-19 pandemic.

Challenge 2: Lack of Sufficient Financial Reserves

As supply chain stakeholders allocate their financial resources based on short-term market signals, less attention is often paid to building sufficient and sustainable financial reserves for emergency use. The COVID-19 pandemic highlighted businesses' need to be financially prepared for the long-term (years-long).

Aside from having less cash flow to continue daily operations and to survive until the next crop cycle, respondents from both economies ranked inadequate financial know-how as the main deterrent for the uptake of financial services.

Two possible solutions could be the provision of temporary financial relief support and collaborations with Fintech (Financial Technology) companies.

Immediate Provision of Financial Relief

Financial relief in the form of temporary interest-free plans or payment deferment can be rolled out quickly and efficiently to serve as safety nets for disaster-affected households. Ideally, this is accompanied by simplifying banking requirements (e.g., fewer administrative processes). However, recovery should focus on facilitating long-term resilience. It is important to prevent creating a reliance on interest-free loans, as these should only be temporary and short-term solutions.

Governments will be required to effectively communicate their programmes to less educated and less financially adept stakeholders/farmers or beneficiaries through economy-wide communications, education, and promotional campaigns.

Better financial access can also be provided to women in farming. Female farmers have significantly less access to farming finance, despite making up nearly 49% of rural farmers (in low-income economies). On average, women earn nearly 40% less than male farmers in rural areas.

Somewhat expectedly, better access to credit can stabilise a company's financial position, allowing it to operate even in times of long-term crises. However, one possible challenge is to prevent dependency on temporary support. It should be possible to explore opportunities for stakeholders to develop long-term plans in consultation with government agricultural officers.

Collaborate with Fintech Companies to Promote their Services as Alternatives to Traditional Lending.

Government regulations must cover the protection and encouragement of start-up innovation without compromising the development of traditional banking institutions, services, and products. Active public-private collaboration and engagement are required to identify opportunities to best manage the adoption of Fintech solutions while benefiting and safeguarding the interest of all stakeholders (e.g., farmers and lenders).

One possible outcome is that Fintech has a greater reach to farmers who are uninsured and unbanked by providing wider access to basic financial services. Adopting Fintech solutions can aid governments to ensure and improve efficiency and stimulate competition in the economies' financial systems, ultimately benefitting farmers.

Contents

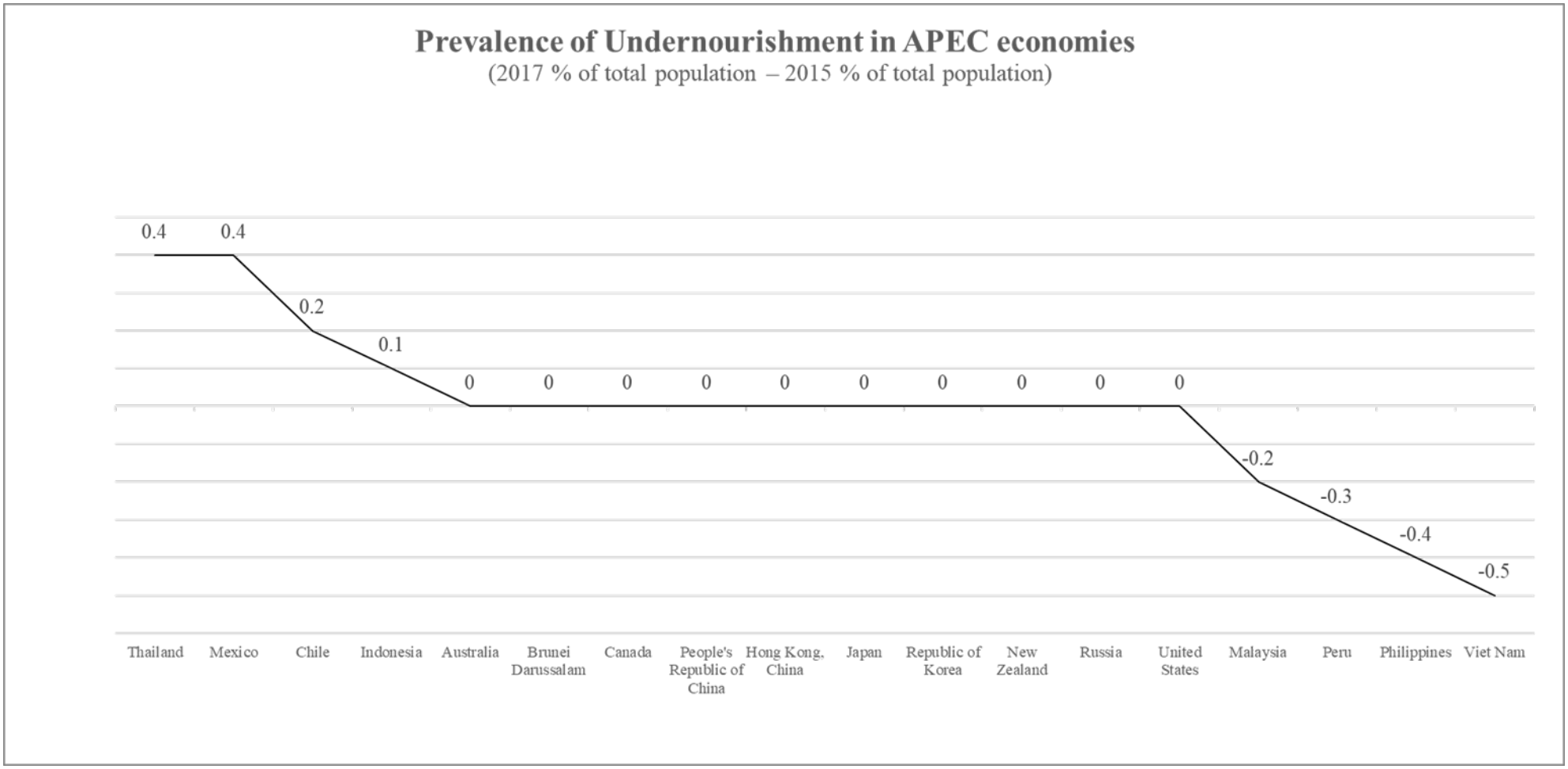
1 Introduction

In 2020, although food production in the modern world is enough to meet all the needs of the global population, 1.5 billion people are still unable to afford a healthy diet that contains the essential nutrients. In addition, goals to end food insecurity, hunger, and malnutrition by 2030 are not on track [2].

Currently, about 690 million people suffer from undernourishment, which is 8.9% of the global population [3]. These figures do not yet account for the additional number of undernourished people brought about by the COVID-19 pandemic. Preliminary projections suggest that 83 to 132 million people will be added to the ranks [3].

Specifically, the Prevalence of Undernourishment (PoU) across economies in the Asia-Pacific Economic Cooperation forum (APEC) is at an average of around 4.7% of the total population. Overall, most APEC economies have improved on or at least maintained their undernourishment levels. However, some economies (such as Thailand; Mexico; Chile; and Indonesia) are struggling to tackle the issue (see Table 1.1 for a breakdown of APEC economies, and Table A1 for the full data table). Particularly for Indonesia, the economy successfully reduced the prevalence of undernourishment between 2016 and 2017, but could not maintain such efforts as undernourishment cases increased the following year.

Table 1.1. Prevalence of Undernourishment (PoU) in APEC Economies



Source: FAO [4]

Another critical indicator is food security, which is defined by Food and Agriculture Organization (FAO) as "when people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life" [5]. There is a difference between undernourishment and food insecurity, with the former a measure of hunger [6]. There are four pillars of food security – availability, access, utilisation, and stability [7]. The FAO Food Insecurity Experience Scale (FIES) specifies two levels of food insecurity – moderate and severe – with the following definitions:

- **Moderate food insecurity** is used to describe a person without sufficient money or resources for a healthy diet, who is uncertain about their ability to obtain food, and has probably skipped meals or occasionally ran out of food.
- **Severe food insecurity** is used to describe a person who has run out of food and gone an entire day without eating.

The current average percentage of moderate food insecurity across the APEC economies stands at 14.7%, with the highest being Mexico (34.9% of the total population) and the Philippines (55.3% of the total population). At the same time, the average of severe food insecurity stands at 4.7%, and again the highest figures are in Mexico (11.5% of the total population) and the Philippines (17.6% of the total population). These data (2017-2019), have improved slightly from the period between 2014 and 2016. However, the improvement is only around 0.5% to 1.0%. It is noteworthy that despite the slight increment in the average food insecurity figures, there are economies that have succeeded in lowering their food insecurity figures (e.g., Malaysia). See Table A2 for a full APEC economy breakdown.

While there are some signs of optimism in suppressing or maintaining undernourishment figures, there is still a need to ensure that people everywhere have secure access to food. The task of ending food insecurity, hunger, and malnutrition remains challenging, especially since the food system is a complicated set-up of actors directly involved in the supply chain (e.g., farmers, processors) and those indirectly involved (e.g., food service providers). Thus, service providers perform an essential role in ensuring the continuity of the supply chain [8]. This is achieved by offering services that either the stakeholders are unable to host in-house or provide resiliency by offering professional advice or offering new solutions.

This report will examine the role of stakeholders from across the food system, analysing the role of farmers, distributors, processors, and food service providers, and creating a bottom-up perspective of food systems. The paper does this through an in-depth examination of the horticulture sector using a case study of two economies. The following section discusses the background to this research, outlining the research problem and the adopted methodology, and provides background information on Indonesia and Mexico. Following this, each economy is researched in detail, with a discussion of the study's results and the key topics that emerged from the research interviews. This report concludes with a series of recommendations that APEC economies may adopt to improve or value-add to their horticulture sector.

2 Research Background

APEC aims to develop the facilitation of services to improve the food systems across the region and ensure access to safe and high-quality food supplies across Asia-Pacific. This project aims to develop a shared understanding of the impact of the current services environment on those engaged in the food supply chain (e.g., farmers). The end goal is to improve food security and the regional food system, as well as help facilitate regional economic integration.

The horticulture (fruit and vegetable) sector is relevant to all economies and will be used for the two illustrative case studies analysed in this report. The overall research aims to provide a private sector perspective to uncover the significant barriers facing businesses when accessing or selling services in the food system. As discussed in more detail below, two economies – Indonesia and Mexico have been selected as case studies, as discussed in more detail below.

2.1 Research Objectives

The key objectives of this research are:

- To identify the barriers and opportunities faced by APEC economies in services within the food system, as well as their contribution to regional economic integration.
- To develop recommendations for policy setting and capacity-building activities that can improve access to food-related services, thereby improving food security and the regional food system, including regional economic integration.
- To understand how the COVID-19 pandemic has affected food security and food industry services in two case study economies, including measures to mitigate the impacts of the crisis.

To address the above key objectives, seven research objectives were identified, aiming to:

- Gather feedback from those involved in the food systems to establish a definition of services in the food system, to understand the benefits of this sector better.
- Identify the practices and approaches operating within the economy or region being studied.
- Identify the issues that enhance or limit success in food supply chains.
- Estimate the extent of the impact of these issues on the economies where they are reported, noting that the impacts can be negative or positive.
- Gain an understanding of the causes of these issues (to develop interventions to ameliorate negative or accelerate positive impacts).
- Identify the socio-cultural aspects of key decisions makers (such as priorities, the size of their businesses, gender, and regulatory regime) to help develop effective interventions within food systems.
- Develop a set of recommendations for policy setting and capacity-building activities.

2.2 Justification for the Selection of Indonesia and Mexico as the Case Study Economies

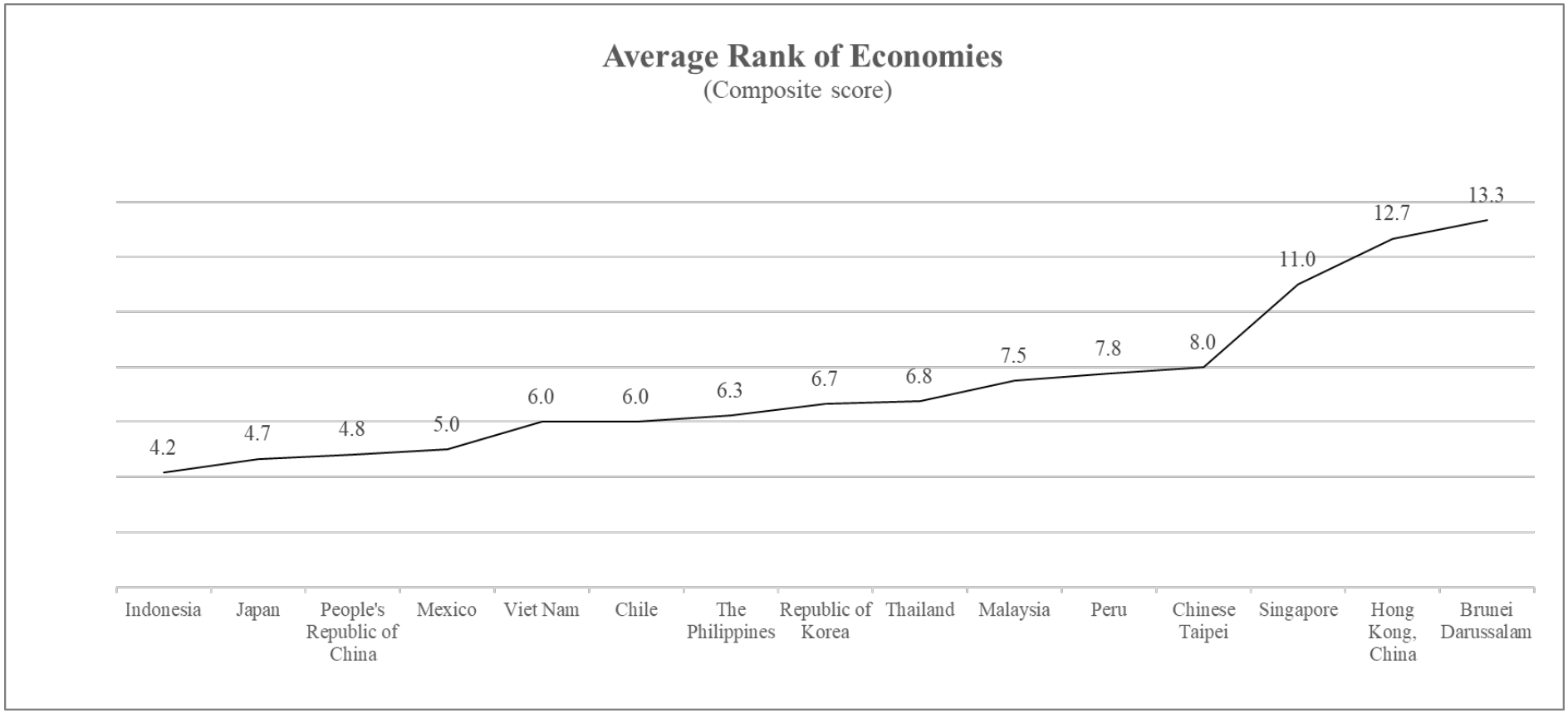
The means to meet the objectives of this project was to use two illustrative case studies from the horticulture (fruit and vegetable) sector. One of the case studies was chosen from Asia and one from Latin America to maximise the applicability of the results to other APEC economies. To clarify, the APEC economies represented in Latin America constitute: Chile; Mexico; and

Peru. Six criteria were used to identify and evaluate the economies most suitable for the illustrative case studies (see Table 2.2 in Appendix): 1) Size of Horticulture Sector, 2) Productivity of Horticulture Sector, 3) Importance of Agriculture to the Economy. 4) Efficiency of Food Systems, 5) Sustainability of Food Systems and 6) Technology Adoption.

2.3 Analysis of Criteria in Choosing the Two APEC Economies

The 15 APEC economies from Asia and Latin America were evaluated individually on the six criteria mentioned earlier and were each assigned a rank. The assigned ranks were averaged across the six criteria to obtain a mean rank score. The economy with the lowest average rank (closest to a value of one) was identified as most suitable for the case study. From the analysis, the APEC economies were ranked in the following order: Indonesia; Japan; People's Republic of China; Mexico; Viet Nam; Chile; The Philippines; Republic of Korea; Thailand; Malaysia; Peru; Chinese Taipei; Singapore; Hong Kong, China; and Brunei Darussalam. Thus, the two most suitable economies to act as case studies were Indonesia (for the Asian case study) and Mexico (for the Latin American case study) (Figure 2.1). See Table A3 for the comprehensive breakdown.

Figure 2.1. Analysis of Asian and Latin American APEC Economies



Source: *Spire analysis*

3 Methodology and Fieldwork

To achieve the objectives of the research, the study comprises of two main methods (1) primary research consisting of in-depth interviews (IDI) with key target respondents who are involved in or along the horticulture supply chain (ministries, trade associations, food farmers, food processors, food distributors, and service providers) (2) secondary research consisting of an analysis of published data and reports from authoritative sources (e.g., government publications).

For the interviewees, service providers were further broken down into five distinct areas – financial, transport and storage, retail and wholesale, business, and technology. A total of 96 respondents were interviewed (48 from Indonesia and 48 from Mexico) in July and August 2020 (See Table 3.1 for a summarised breakdown). A detailed breakdown of all respondents interviewed is provided in Appendix A, along with descriptive information about the respondents, such as their product specialisation, the company's annual revenue, job title, and whether they catered to the export or domestic market.

Table 3.1. 96 Respondents Interviewed in Indonesia's and Mexico's Horticulture Sector

Respondent Type		**Indonesia**	**Mexico**
Ministry		2	2
Trade Association		2	2
Farmers		11	10
Food Processor		5	6
Food Distributor		8	8
Food Service Providers	Financial Service	4	4
	Transport and Storage Service	4	4
	Retail and Wholesale Service	4	4
	Business Service	4	4
	Technology Service	4	4
	Total	48	48

The interviews were semi-structured, and professional moderators interviewed the respondents over the phone and in their local language. Each interview took about one hour to conduct. The discussion guide used in the interview included questions about the horticulture supply chain, government support, COVID-19 pandemic-related changes to the food supply chain, the perceived importance of services for food security, and more. Several experts (e.g., economists, ministries, and industry experts) were consulted through the course of the study to shape the report.

4 Indonesia Economy Profile

Indonesia is the largest economy in Southeast Asia and is one of the 12 founding members of APEC. Based on the Central Bureau of Statistics (BPS/ Badan Pusat Statistik) of Indonesia, the economy is home to 1,301 ethnic groups. It is the world's fourth most populous economy, with 271.3 million people as of 2021. With a Gross Domestic Product (GDP) of Indonesia Rupiah (IDR) 15,434.2 trillion (USD 269.2 million), and with GDP per capita reaching IDR 56.9 million (USD 3,911.7) in 2020 [9], Indonesia has charted impressive economic growth since overcoming the Asian financial crisis of the late 1990s. The economy has made noteworthy progress in poverty reduction, cutting the poverty rate to 9.8% in 2020, half of what it was in 1999 (World Bank, 2020e).

Jakarta, the largest city in Indonesia, is located on the island of Java. It is the economy's capital and home to 10.6 million inhabitants. Other populous areas include Surabaya, Bandung, and Bekasi –which are also located on Java Island. Before the COVID-19 pandemic, Indonesia maintained consistent economic growth, which gave the member-economy upper middle-income status [10].

4.1 Section 1: Horticulture Landscape

In 2019, the agricultural sector contributed 12.7% to Indonesia's GDP, behind industry (38.9%) and services (44.2%) [11]. Agriculture also accounted for 27.7% of the Indonesian workforce, although the sector's employment rate had seen a steady decline since 2017 (when it stood at 30.8%) [12]. According to an interviewed expert, the main contributing factors include decreasing paddy field size (hence decreasing revenue), increased productivity, harvest failures, and the financial attractiveness of industry and services.

4.1.1 Indonesia's Agriculture Land

Around 32.0% of Indonesia's land area is used for agriculture (equivalent to 60.2 million hectares), and this figure has been increasing over the past few decades [13].

In terms of geographic make-up, Indonesia is split into several agro-climactic zones suitable for producing a diverse range of agricultural produce. For example, a humid tropical climate with regular rainfall in Northern Java offers potential for the production of staple produce such as rice. At the same time, the more temperate highland areas, such as those located in Sumatra, are more favourable for growing horticulture produce such as bananas, oranges, and pineapples. However, despite the favourable agro-climatic zones for fruit crops, Indonesia is also subject to adverse weather conditions that damage crop growth. Most recently, a report by the World Food Programme [14] predicted an excess of rainfall during the dry seasons, which could detrimentally affect fruit farmers of watermelons and mangoes.

4.1.2 Primary Commodities

Oil palm fruit is the top commodity produced in Indonesia, followed by rice and maise [13]. A variety of horticultural produce is also included in the top commodities produced, such as bananas, mangoes, and other fresh fruits (see Table A4). Indonesia's domestic production of fruit and vegetables has not met rising (local) demand. Specifically, from 2000 to 2015, domestic fruit production grew by 2% annually, while the demand for fruit and vegetables grew annually at a rate of 2.9% and 2.4%, respectively [15].

The top horticultural commodities based on import value are garlic (USD 49.7 million), apples (USD 35.6 million), grapes (USD 31.2 million), and pears (USD 25.4 million) [13]. As the local production of fruits and vegetables does not meet consumer demand, there has been a trend of increasing horticulture imports [16]. These import commodities reflect a gap in satisfying local demand through local production, except pears that are not locally produced.

On the other hand, fresh coconut is the top horticultural commodity based on export quantity [13].

According to the Oxford Business Group [17], the economy's agricultural structure comprises of two types: large-scale plantations under the management of the government or private investors and smallholders using traditional farming methods. Large farms tend to cater to export-centred produce such as palm oil, while smallholders tend to focus on horticultural commodities for domestic consumption. On the other hand, majority of Indonesia's farmers (93%)comprise of small-scale, family-run farms [18]. According to the FAO, small family farming in Indonesia is generally carried out on plots of land averaging 0.6 hectares. However, there can be significant disparities across different regions.

4.1.3 Agriculture Labour

Number of labourers. As a supplier of farming input, agricultural labour (or workforce) plays a central role in the economy's growth. According to the Food and Fertilizer Technology Centre (2020), Indonesian agricultural labour comprises of the following sub-sectors: horticulture, food crops, estate crops, and livestock. The highest number of labourers, 48.7% of total agricultural labour (equivalent to 35.4 million people), work in the food crops sub-sector. This is somewhat expected, as the sub-sector plays the primary role in supporting the economy's food security. On the other hand, labour in the horticulture subsector was the smallest group in 2018 (See Appendix Figure A1).

Age distribution of agricultural workforce. While fewer people work in the horticulture sub-sector, the age distribution across labourers in agriculture is dominated by workers aged 25 to 59 years old (71.21%), followed by workers over the age of 60 (17.9%) and those aged between 15 and 24 years old (10.8%) [19]. Across the four sub-sectors, the average percentage of older labourers (18.0%) is higher than the young (12.0%). Currently, livestock and food crops have a slightly higher number of young labourers than other sub-sectors (21.3% and 21.2%, respectively). The Food and Fertilizer Technology Centre (FFTC) reported a trend of food crop labourers shifting to estate crops, horticulture, and even livestock. There has also been an observed decline in the agriculture employment rate over the past two decades, from 39.9% in 2000 to 26.5% [20]. This is possibly due to many young people viewing agricultural work as low-wage, manual labour, more suited to those with limited educational backgrounds, according to an article by the Jakarta Post [21].

Labour productivity, on the other hand, varies between agricultural sub-sectors. However, an observed trend is that horticulture has the highest labour productivity across the agriculture sub-sectors (see Table A5), with the lowest coming from food crops.

Farmer demographics. The average smallholder household in Indonesia consists of five to six household members who, on average, achieved a primary school level of education (six years of education) [18]. According to the Indonesian Central Bureau of Statistics (BPS), in 2018 there were significantly fewer female (11.3%) horticulture farmers than male (88.7%) [22]. The top produce coming from male-led horticultural farms are mushroom, tomato, watermelon, apple, and jackfruit, while for women, the produce includes kale, chayote, salak, avocado, and rambutan.

4.1.4 Food Security and Sustainability

Indonesia has seen some improvement in its food security and sustainability as the economy has managed to modestly reduce the prevalence of undernourishment in the population, from 9.3% in 2015 to 9.0% in 2018 [4]. However, having access to sufficient, safe, and nutritious food that meets the needs and preferences of the population is an ongoing process. While progress has been made, hunger and malnutrition are still prevalent.

Based on the Food Insecurity Index [3], Indonesia has managed to reduce the percentage of those who suffer from severe and moderate food insecurity. This can be seen from the drop in severe food insecurity figures, which was previously 1.0% of the total population in 2016 to 0.8% by 2019. The figures on moderate food insecurity mirror the same trend, with 7.6% of the total population affected in 2016, dropping to 7.0% by 2019.

Indonesia's modest improvements should be recognised, but it should be noted that there is still significant room for progress, especially with the COVID-19 pandemic posing an increased risk of malnourishment in vulnerable groups like children [23].

A sustainable food system supports food security by optimizing natural and human resources in a culturally acceptable, environmentally sound, economically fair, and viable manner [24]. As a benchmark, economies applying sustainable practices can be assessed through the Economist Intelligence Unit's (EIU) Food Sustainability Index 2018 [25]. The Index ranked 67 economies based on indicators that measured the sustainability of food systems across three categories: food loss and waste, sustainable agriculture, and nutritional challenges. Indicators ranged from the impact of water management, land ownership laws, protection of smallholders, public support to research and development, rural banking penetration, farmer income, and access to financial aid. Attaining a higher score (and thus a lower ranking) meant that an economy was on the right path to implementing a sustainable agriculture system.

As shown in Table 4.1, all of Indonesia's scores are lower than the global averages, indicating that Indonesia is amongst those economies with less favourable conditions to address economy-wide food loss and waste, sustainable agriculture, and nutritional challenges.

Table 4.1. Indonesia's EIU Food Sustainability Index Scores

EIU Food Sustainability Index 2018				
	Overall Score	**Food Loss and Waste**	**Sustainable Agriculture**	**Nutritional Challenges**
Indonesia	Rank: 60*	Rank: 53	Rank: 56	Rank: 56
	Score: 59.1**	Score: 61.4	Score: 61.1	Score: 54.9
World Average	Score: 66.4	Score: 68.9	Score: 67.7	Score: 62.6

Source: EIU [26]

**Rank 1 = top economy with most favourable conditions.*

***Normalized scores 0 to 100, where 100 = most favourable conditions*

4.1.5 Indonesia's Agriculture Ministry

The Ministry of Agriculture (MoA) oversees the development and the administration of food sovereignty or the people's ability to access sufficient food, along with the right to determine food and agricultural policies and promote farmer welfare [27]. Indonesia's approach to food security focuses on achieving two primary outcomes: (1) food sovereignty (*kedaulatanpangan*) and (2) food self-reliance (*kemandirianpangan*). The average MoA budget for agriculture has increased since 2012, but the budget has reduced from USD 2.45 billion in 2015 to USD 1.5

billion in 2019. Similarly, the overall food security budget has decreased since 2015, when the budget was USD 8.4 billion [28]. It is worth noting that the combined government budget for food security across all ministries was USD 6.8 billion in 2019.

Among the MoA's roster of work units are the Directorate General of Horticulture and the Food Security Agency. The latter aims to coordinate and formulate policies to increase the diversification and stabilisation of food security, while the former aims to accelerate horticultural production in a safe and environmentally sustainable manner. The complete list of MoA's Work Units is shown in Table A6 in the Appendix.

4.2 Section 2: Horticulture Supply Chain

This section elaborates on the Indonesian horticulture supply chain. Specifically, the aim is to understand 1) export and domestic market structures from the respondents' eyes and 2) the perceived challenges associated with the current structures. This section also provides an insight into the impact of the COVID-19 pandemic on the horticulture supply chain.

4.2.1 Domestic Supply Chain

The respondents spoke about multiple supply chains for the domestic market in Indonesia, with numerous direct or indirect structures. The most common structure discussed was the indirect supply chain, which involves multiple intermediaries between the farmer and the end consumer, and where the produce changes hands numerous times (Figure 4.2). In this supply chain, the intermediaries are known as 'collectors' or 'distributors' who purchase a farmer's produce, and then transport and sell it to wholesalers. The produce is then moved on to modern or traditional retailers before reaching the end consumer.

The intermediaries help build a network between farmers and other stakeholders such as traders. Smallholder farmers generally do not have the necessary connections or capacity to deal directly with wholesalers, retailers, or other stakeholders in the supply chain. The farmer-intermediary relationship creates a culture of dependence and solidarity, due to a lack of information on alternatives to the use of intermediaries.

Yet this structure, as discussed later, gives rise to several problems, from farmers perceiving that they are not earning their fair share of the profit margin to potentially increasing the risk of damaging the produce (Figure 4.2).

Figure 4.2. Most Common Supply Chain in Indonesia for Domestic Market (Indirect)

Source: Spire conducted interviews, 2020

On the other hand, direct supply chains (which do not have intermediaries and are less common) were considered by the respondents to provide a better and shorter route to markets. Though it may seem that intermediaries play a crucial role in ensuring the continuity of the supply chain (such as linking farmers with other actors like wholesalers in the supply chain), the structure of a direct supply chain allows for wholesalers, retailers, and processors to collaborate directly with farmers to negotiate and set up agreements. Farmers will be able to earn their fair share of the profit and minimise spending on intermediaries.

4.2.2 Export Supply Chain

Unlike the domestic supply chain, the export supply chain has just one overarching structure (*Figure 4.3*). Fruits or vegetables collected from the farms are delivered to specific export distributors. After the distributor assesses and approves the produce, it is then transported to the forwarder, who makes the necessary arrangements for the produce to be sent overseas.

Figure 4.3. Most Common Supply Chain in Indonesia for Export Market

Source: Spire conducted interviews, 2020

Farmers involved in the export market, in contrast to the majority of those catering to the domestic market, have fixed contracts with exporters stipulating the target volume commitment. In most cases, exporters pool together the fruits or vegetables from multiple farms to achieve the target volume. Due to the geographic landscape of Indonesia, farmlands are often situated in far-off rural areas that are difficult to access, forcing collectors to travel to multiple far-flung locations to collect the produce. Another main difference between the export and domestic market is that the export farmers need to possess mandatory certifications to prove they meet adequate sanitary and phytosanitary standards. Based on interviews with the farmers, certifications require a certain level of capital investment and need to be renewed (with intervals ranging from monthly to annual renewals). Export is therefore a more challenging market to enter than the domestic market. For more information, read in the below section on *Difficulty to enter the export market due to lack of capital.*

4.2.3 Fundamental Supply Chain Issues

4.2.3.1 Horticultural supply chain issues perceived by farmers, food processors, and distributors

Farmers, food processors, and distributors face numerous challenges when dealing with and operating within the supply chain. As revealed through the interviews, the top three challenges faced are (1) fraudulent activities, (2) the supply chain structure, and (3) logistics management (Figure 4.4).

Figure 4.4. Horticulture Supply Chain Challenges perceived by Farmers, Food Processors, Distributors, Government Officials and Trade Associations in Indonesia (n=24)

Source: Spire Conducted Interviews, 2020

Note. Irrelevant or non-applicable responses were excluded (n=4). Other challenges include produce quality (4.0%), environmental concerns (4.0%), low profitability or unevenly distributed profits (4.0%), and price volatility (4.0%). The remaining responses were categorised under 'others' (17.0%). Graph percentages may not add up to 100.0% because the verbatims were multi-coded.

Fraudulence (42.0%): The respondents perceived fraud as the primary challenge, which covers various unregulated practices conducted by some stakeholders, but primarily by intermediaries. These intermediaries have the capital and contacts within the network, offering them flexibility and influence in their work. These unregulated practices come at the expense of farmers, especially the smallholders that cater to local markets. The respondents shared several examples of unregulated practices, ranging from hoarding produce to price manipulation and pressuring farmers to sell below market price. Some of these intermediaries were perceived to be part of horticultural commodity groups that conduct fraudulent practices to gain better margins. For instance, a wholesaler can misrepresent the produce grade and inflate the price by packaging and branding substandard fruits as premium local produce. Consumers can be misled into purchasing what they believe is a premium (and locally produced) fruit. However, this can create issues with branding and marketing, as the substandard products may lead consumers to favour imported fruits and vegetables over local ones.

Structure of supply chain (38.0%): The second most discussed challenge was the indirect supply chain structure due to multiple intermediaries. Though these intermediaries are facilitating trade, they are sometimes perceived to take advantage of a farmer's reliance on them, allowing them to extract a higher profit margin. Some farmers, especially smallholders, do not have the means of reaching consumers themselves and rely on intermediaries who only purchase fruits or vegetables if their conditions (e.g., price expectations) are met. Another potential issue is that with numerous intermediaries involved, the produce changes hands multiple times. This increases the time produce spends during transportation, leading to a compromise in its quality and risking its chances of spoilage.

A shorter supply chain would enable farmers to earn their fair (higher) share of the profit margin and minimise the risk of food loss and wastage. Additionally, a direct supply chain provides more visibility and control on production, processing, and distributing procedures, increasing transparency and traceability. This is important for the standardisation of quality procedures at different stages across the supply chain. Identifying at which stage contamination or poor agriculture practice emerged enables one to hold the associated person accountable.

Logistics management (33.0%): The third most cited challenge was the current logistics situation in Indonesia. The discussions focused on issues around costly transport services, poor connectivity to rural areas, and the lack of cold chain capabilities to maintain the quality of the produce. On the latter, cold storage is still considered a relatively new and under-utilised process. For many respondents, cold storage services and transportation costs are not affordable due to fuel price increments, illegal fees during travel due to fraudulent practices by some intermediaries, and inadequate infrastructure.

In terms of connectivity, ideal farmland locations (e.g., land with fertile or compatible soil) are usually located in rural areas far from the markets and export centres. Due to the lack of logistics infrastructure (e.g., well-paved roads connecting to rural areas), export collectors have to travel long distances to pick up produce from multiple locations to meet the export volume quota. Supply chain players believed a lack of a centralised agricultural area to source produce led to Indonesia's export processes being slow compared to regional neighbours (e.g., Thailand).

The World Bank's Logistics Performance Index (LPI) is a global benchmarking measure of the performance of the logistics supply chain (both international and domestic). The maximum score of five on the LPI indicates that an economy has a comprehensive list of critical logistical

infrastructures. In contrast, a score of zero means that the economy lacks a substantial number of vital logistical infrastructures. Indonesia has an LPI score of 3.1 lower than the Asian APEC average of 3.5. Indonesia is ranked at 15th place out of the 21 APEC economies (a lower rank indicates a better logistical environment). There is clear room for improvement in Indonesia's logistics and distribution infrastructure [29] (See Appendix Figure A2 and for more detailed information about the LPI, see Table A7).

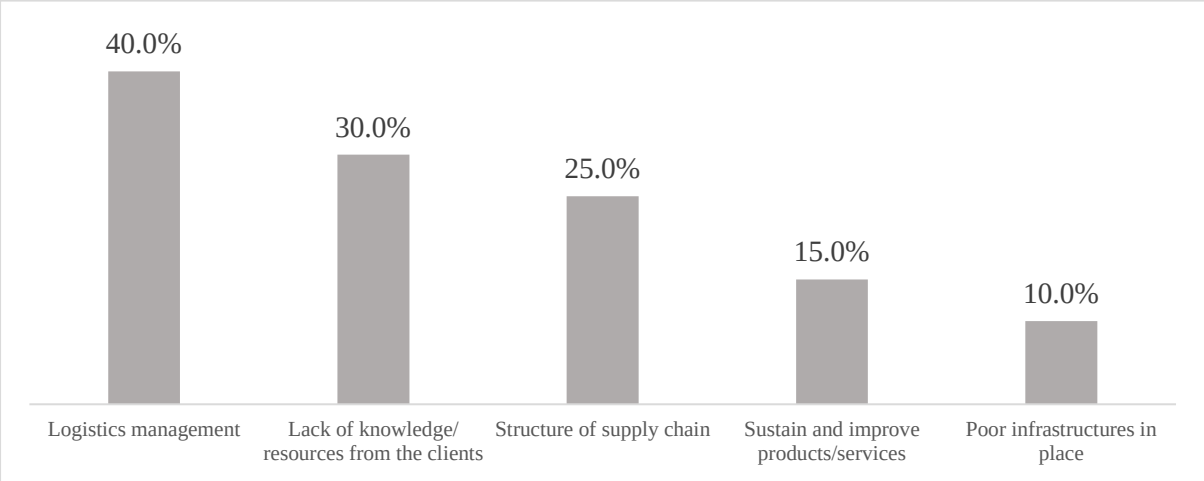
Difficulty to enter the export market due to lack of capital: Though not highlighted in Figure 4.4, it is worth noting that a handful of smallholders found it difficult to enter the export market, as they lacked the knowledge of good agriculture practices. This led to farmers being unable to meet the requirements to obtain mandated certifications for processes, as they could not farm quality produce or meet mandatory international sanitary standards. Capital or investment is required to obtain certifications. More often than not, most smallholder farmers cannot afford such an investment as the current (default) supply chain structure hinders farmers from earning enough income. Having limited means or capital becomes a barrier not just in exporting but also in adopting new technology and research to maximise productivity and improve quality to match international standards.

> *"The production of Indonesian horticultural commodities continues to increase from year to year but has not been matched by a strengthening of its marketing system, it is necessary to strengthen market intelligence and international trade diplomacy to be able to dominate the international markets such as Malaysia; Thailand; the Philippines; and Viet Nam, because many systems are still carried out in conventional ways. There is no single system that makes it easier for horticultural players to connect with relevant regulators such as customs, director-general of trade, etc."* – ***Distributor***

4.2.3.2 Horticultural supply chain issues perceived by service providers

Among the issues experienced by horticulture service providers (e.g., transport, business, etc.) in dealing and operating within the supply chain, respondents found that the top three areas of concern were (1) logistics management, (2) a lack of knowledge/resources from clients (e.g., farmers and other agri-businesses), and (3) the supply chain structure where multiple intermediaries are prevalent (Figure 4.5). Overall, across all interviewed respondents, including the previously mentioned upstream stakeholders, the top mentioned issues were the structure of supply chains and logistics management. Rather uniquely, food service providers met challenges on the services front, where they had to deal with clients who lacked knowledge or resources.

Figure 4.5. Horticulture Supply Chain Challenges Perceived by Service Providers in Indonesia (n=20)



Source: Spire conducted interviews, 2020

Note. Other challenges include a lack of certification (5%), price volatility (5%) and limited or inefficient use of technology (5%). The remaining responses were categorised under 'others' (15%). Graph percentages may not add up to 100% because verbatims were multi-coded.

Logistics management (40.0%): More food service providers perceived logistics management as a primary challenge, in contrast with the farmers, processors, and distributors who ranked this issue third. Logistics management includes the timely delivery of produce, as well as best practices in handling, labelling, packaging, and storage to ensure the produce retains its quality. Similar to the points mentioned above, food service providers discussed the increased costs in transportation and a lack of logistic infrastructure as key problems in Indonesia.

Lack of knowledge/resources from the clients (30.0%): The second most cited problem from the food service providers, notably from the technology, transportation/storage, and retail/wholesale segments, were concerns over their clients' or customers' (e.g., farmers and other agri-businesses) lack of knowledge or technical know-how towards practising modern techniques, as well as insufficient understanding of logistical issues such as packaging and transportation handling, product development, or price regulations. It is also believed that farmers are unfamiliar with developing their competitive advantage, causing them to fall behind when their products are compared to imported produce.

Additionally, service providers also observed knowledge gaps from the government's side. According to the respondents, policies have usually targeted staple production; however, other aspects that may address specific needs (e.g., strengthening the roles of farmer groups such as Gabungan Kelompok Tani) have often been overlooked.

Structure of the supply chain (25.0%): Similar to the sentiment of supply chain players, the lengthy supply chain structure was also considered a burden to the service providers. Service providers shared that the lengthy supply chain structure with multiple intermediaries led to high prices of horticultural goods for end consumers. To add, farmers were usually considered the most vulnerable in terms of profit distribution, while some intermediaries earned a much larger margin as they had more influence over the selling price.

4.2.4 The Horticultural Supply Chain and the COVID-19 Pandemic

COVID-19 was a global disruptor that brought an economic and social standstill to Indonesia. Several sectors, including those in the food system, were hit hard by disruptions to cash flow and business operations as the COVID-19 pandemic spread. A large-scale social restriction (Pembatasan Sosial Berskala Besar or PSBB) was implemented to limit people's movements. This included 14-day quarantine measures and work from home arrangements with exemptions to particular industry sectors providing 'essential' services. Such companies were those in the sectors of food, health, and energy, to name a few [30]. According to the World Bank [31], there was also an observed increase in the economy's unemployment rate from 3.62% in 2019 to 4.11% in 2020.

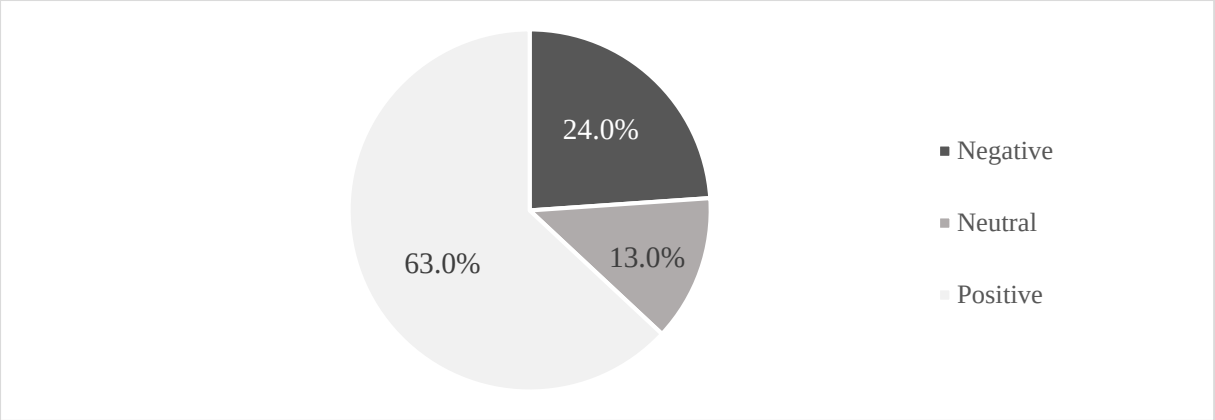
The COVID-19 pandemic not only highlighted the importance of the Government's prioritisation of people's welfare and the need to create food security, but also the immense responsibility of the food supply chain's stakeholders and service providers in identifying ways to adapt and stay resilient. The developments that occurred were a trend in the uptake of a more efficient and direct supply chain that minimised the number of intermediaries involved, and focused on the need for improvements throughout the supply chain process. On the latter, the government is continuing to address distribution issues, promote farmer health and welfare, and improve company risk management and business continuity strategies.

The following few sections aim to assess the COVID-19 pandemic's impact (both positive and negative) on the horticulture supply chain and evaluate the respondents' outlook towards the horticulture sector.

4.2.4.1 Perceived Impact of the COVID-19 Pandemic on the Supply Chain

During the interviews, supply chain stakeholders and food service providers gave insights into the implications of the COVID-19 pandemic on the supply chain. The majority of respondents (63.0%) viewed the impact positively and saw the COVID-19 pandemic as a trigger for opportunities to improve and develop a more efficient supply chain. On the other hand, 24.0% viewed the impact to be negative as some businesses fell. The remaining 13.0% of the respondents remained neutral (Figure 4.6).

Figure 4.6. Perceived Impact of the COVID-19 Pandemic on the Supply Chain in Indonesia (n=46)



Source: Spire conducted interviews, 2020
Note. Excluding *n*=2 "Did Not Answer" responses. Respondents categorised as 'Positive' could also provide negative comments and vice versa.

Positive (63.0%): The factors that supported the perceived positive impact of the COVID-19 pandemic included:

- **Increased collaboration between private stakeholders and the Indonesian government** demonstrated the sector's collective endeavour to manage the disruptions caused by the COVID-19 pandemic. One example was the creation of the Pasar Tani website – MoA's B2B E-Commerce platform shared by Gapoktan (farmer groups) and Indonesian Farmer Stores. This platform provides users with useful information on the forecasts of agricultural produce demand, data on total stock, transaction volume, delivery status, payments, and future expectations for implementing cashless transactions. According to an interviewed expert, the measure's effectiveness is limited in its reach since the dissemination of the information is limited to certain groups in Java and Sumatra (at the expense of the other regions).
- **Uptake of online channels** by stakeholders connected farmers directly to consumers, which improved their earnings. Respondents pointed out that online channels had been introduced before the COVID-19 pandemic. However, most supply chain players were conservative and avoided online channels, opting to stick to their current (familiar) processes. The social distancing restrictions pushed many stakeholders to form direct links with farmers and end consumers through online channels such as e-commerce platforms and social media, capturing a much broader market than before.

  > *"During the COVID-19 pandemic, there was a lot of decline from the processing and hospitality industry sector, because many of our customers stopped their production or operational activities, and we started to take advantage of online sales such as social media and expanded sales areas outside the Bandung area such as Sulawesi, Bali. And Sumatra for traditional markets" –* ***Distributor***

- **Enhanced distribution channels to meet the demand of horticultural produce** both locally and internationally through exports, while adhering to the hygiene measures to control the spread of COVID-19. Consumer demand increased as fruits and vegetables were recognised as sources of vitamins needed to boost immunity against illnesses. Enhancements mostly came in the form of government-granted flexibilities with permits, or the relaxation of administrative requirements needed when goods are distributed, to

quicken processes (e.g., imports of onions and garlic no longer require import certification requirements).

Negative (24.0%): Nearly a quarter of respondents saw the COVID-19 pandemic impact negatively. The reasons included:

Market's inability to absorb the surplus in production and regulate sudden price drops which were unfavourable to farmers. The surplus in some produce resulted from supply chain players adopting a more conservative approach during the COVID-19 pandemic, where they purchased a lower quantity than before. This left some farmers with the need to find alternative channels quickly to sell their produce before spoilage. As this was not possible, a substantial amount of wasted produce had to be discarded.

- **Decreased labour productivity** due to COVID-19 pandemic skeletal workforce measures and casualties in agricultural labour.
- **Delays in deliveries** due to enhanced checkpoints to accommodate hygiene or sanitation measures imposed by the government. This not only resulted in higher costs for logistics providers (hygiene and healthcare costs plus extra time spent transporting goods), but also compromised the quality of the produce being delivered.

4.2.4.2 Perceived Resilience of the Supply Chain to the COVID-19 Pandemic's Impact

Apart from establishing what was expected of the supply chain, considering the disruptions caused by the COVID-19 pandemic, respondents were asked for their opinion towards the supply chain's resilience (Figure A3 in Appendix). A large majority (97.5%) of respondents considered Indonesia's supply chain resilient, despite some of the challenges discussed above.

Reasons for Perceived Resilience:

- **Supply chain is resilient (97.5%):** Almost all respondents agreed that the supply chain was and will be resilient over the long term. The most common factor contributing to its resiliency was the notable role of technology-based solutions (e.g., e-commerce) in improving the efficiency of the supply chain by bridging the gap between farmers and end consumers through direct sales. Given the social distancing restrictions, including the closure of the hotel, restaurant and café (HORECA) sector, transacting through digital platforms was not only the safest way to conduct business, but it was also the most pragmatic, as a broader market could be captured.

  In retrospect, the respondents believed that the supply chain was quick to recover from the COVID-19 pandemic shocks as ensuring a consistent food supply (including horticultural produce) was the Government's focus in its COVID-19 Economic Stimulus Programme. This led to relaxed and streamlined processes in food distribution channels, not only for the retail and wholesale sector but also for consumers.

  Some other positive responses focused on 1) the Government's collaborative approach in integrating a regional food logistics system to work around large-scale social restrictions and area closures, 2) flexibility provided by Fintech companies to access capital, 3) the increased demand of horticultural produce associated with Vitamin-C, and 4) subsidies provided for insurance premiums.

  Overall, the supply chain's resilience can be attributed to the Indonesian Government's shift in priorities to ensuring a sufficient food supply, the willingness of the sector to adapt,

and the new norm of digital integration in the daily operations of the supply chain players and food service providers.

- **Supply chain is not resilient (2.5%):** Though there was an overwhelming indication that the supply chain will remain resilient (only one respondent felt otherwise), there were still several concerns faced. One was due to the perceived price irregularities resulting from a change in supply and demand for produce. Furthermore, the economy-wide social distancing and hygiene measures caused an increase in company expenses to cover costs in swab tests, protective gear, and food-grade sanitation solutions. Several factories were also forced to close or operate with a skeletal workforce which reduced the productivity of some processors.

4.3 Section 3: Services Engaged in the Horticulture Supply Chain

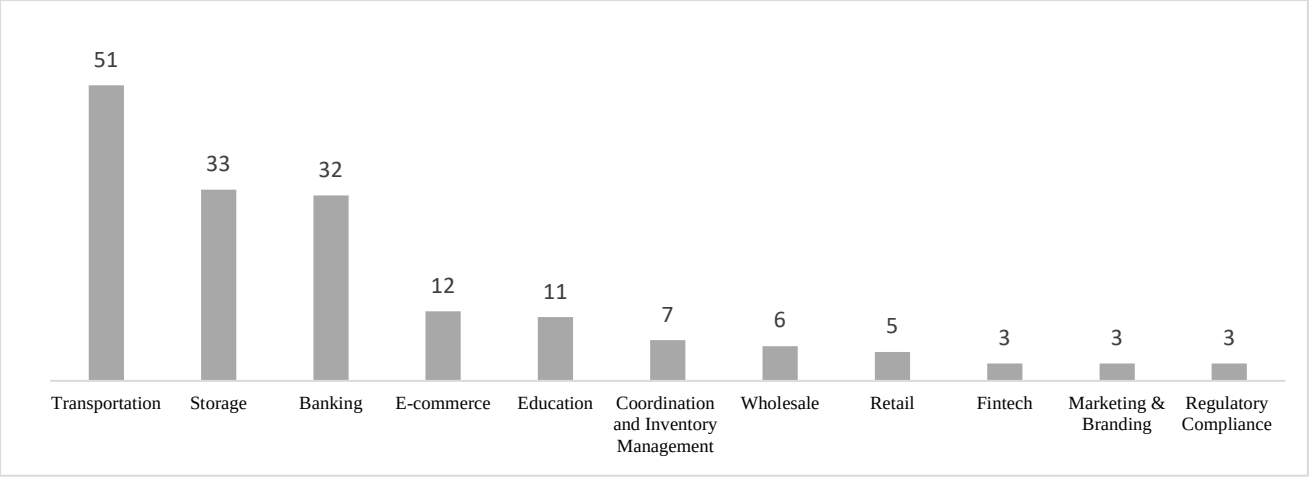
This section addresses the role of food services in the supply chain. The respondents (food service providers and stakeholders such as farmers, processors, and distributors) shared their perspectives and opinions about services engaged in the horticulture supply chain.

4.3.1 Perceived Importance of Various Services to Food Security

Services play an essential role in ensuring the continuity of the food supply chain, although each economy may have different characteristics that make certain services more critical. Comparatively, some services were perceived to bring little value to the resiliency of the supply chain, with issues ranging from structural factors, such as culture or the regulatory environment, to unique events such as the COVID-19 pandemic. In particular, the horticulture sector shares key traits across economies that make specific services highly important. For example, services to preserve the quality of fresh produce are essential as fruits and vegetables are perishables.

During the interviews, the respondents ranked their top three services for ensuring food security in the horticulture sector. The top three responses were transportation, storage, and banking (Figure 4.7).

Figure 4.7. Services Importance Scoring in Indonesia (Calculated) (n=28)



Source: Spire conducted interviews, 2020

Note: 1) Services not in the graph did not appear in any of the respondent's top three most important services. 2) To ensure that rankings accurately presented all of the respondents' scores, services that were ranked first were given a score of three, second a score of two, and third a score of one. The maximum possible score for any service is 72, while the lowest score is 0.

4.3.1.1 Top Three Services and Reasons for their Importance

Transportation Services. Transportation was especially crucial to nearly all respondents due to its role in connecting the supply chain from upstream to downstream. It is common for produce not to be consumed or processed in the same area that it was harvested. Produce is therefore usually sold to intermediaries for further distribution, either to domestic or export markets. Furthermore, effective transportation services are responsible for quality produce reaching the buyer or consumer on time – a trait critical in the horticulture sector. Any delay may risk potential spoilage or wastage of fresh produce. An example of an Indonesian transport company can be found in Table A8.

Storage Services. Storage services complemented transportation services and are crucial in alleviating unnecessary food wastage, as horticultural produce requires specific storage

standards (e.g., cold storage) to maintain quality and prolong shelf-life. Additionally, storage plays a vital role in inventory management, enabling greater flexibility in managing demand and supply. Any additional flexibility in product management is highly beneficial given the inflexible nature of horticultural supply chains, and allows supply chain players to meet increased market demand or buffer against supply constraints during unfavourable weather.

Banking Services. Access to capital or credit through banking services is essential for the daily operations of the supply chain and provides an opportunity to innovate or upgrade current processes. This is especially important for small-scale farmers, who need cash flow to pay workers and make essential purchases during production cycles. It also allows supply chain players to invest in, expand, and upscale their respective businesses. The ease of access to capital from financial institutions and credible Fintech organisations is critical. If farmers do not receive the financing required to run their operations, not only are they unable to farm, but they may also resort to informal financial channels that may jeopardise their business or leave them with unviable debt.

According to the World Bank [32], Indonesia ranks 13th out of 17 APEC economies (there was no data for Brunei Darussalam; Republic of Korea; Papua New Guinea; and Chinese Taipei) for account ownership at a financial institution/mobile money service provider. An economy ranked first has the highest percentage of the population (above 15 years old) with an account, underscoring Indonesia's relatively low rate of banking penetration when compared to the other APEC economies. Just under half of Indonesia's population (48.9%), over the age of 15 years old, has a bank account.

4.3.1.2 Services in the Face of the COVID-19 Pandemic

The majority of respondents had a positive outlook despite the COVID-19 pandemic's negative effect (Figure 4.6). Businesses that managed to tide through the difficult period did so by adopting of new solutions to deal with the restrictions brought about by the COVID-19 pandemic (e.g., closure of hotels, social distancing measures). Interestingly, the COVID-19 pandemic proved to be a constructive disruptor to the horticulture industry, as it gave rise to opportunities to improve the efficiency of the supply chain. Services, in particular, played an integral role in ensuring the resilience of the industry during the COVID-19 pandemic. Below is a list of services the respondents found useful in helping them deal with the challenges brought about by the COVID-19 pandemic:

Storage Services. Storage services were indispensable in the initial phase of the COVID-19 pandemic as demand and supply became unpredictable. One notable reason was the fear-induced panic buying in response to restrictive measures to control the spread of COVID-19, creating volatile fluctuations in demand for food products. The circumstances instilled an appreciation for the value of storage facilities in some supply chain players, as these services enabled better inventory management amid market unpredictability. For example, when demand was low, farmers could continue production since excess produce could be stored to preserve the quality for future periods of higher demand.

Technological Services. Technological services experienced a surge in adoption during the COVID-19 pandemic, driven by necessity amid supply chain disruptions and the untenability of offline retail channels. Farmers were forced to transition from traditional distribution and retail methods (e.g., reliance on intermediaries) to managing their sales using online channels. Widespread adoption of e-commerce platforms (e.g., Pasar Tani) brought about secondary benefits. On top of securing sales, these platforms empowered farmers to sell directly to

consumers and claim an additional profit margin that would have otherwise gone to intermediaries. Similarly, other online channels such as social media (e.g., Facebook) allowed farmers to market and sell their fruits and vegetables directly to consumers. However, technological services were not an immediate solution for all stakeholders, especially smallholders, due to limited access and understanding of operational advantages.

Financial Services. Financial services, of which Fintech is a crucial sector, provided a sorely needed alternative to traditional financing routes during the COVID-19 pandemic. Constrained by the sharp economic downturn, traditional financial institutions limited credit financing. Thus, many farmers did not have the requisite financial liquidity for their operations. However, the COVID-19 pandemic did lead to a greater uptake of newer financial service channels. For example, a commonly known technology-driven financial service is a crowd-financing platform that allows funders to invest in particular crop harvests. Although the uptake of financial services was relatively low (limited by less financially-savvy farmers), there has been a gradual uptake during the COVID-19 pandemic as stakeholders were forced to find an alternative to receiving financing from the banks. An example of an Indonesian financial institution can be found in Table A9.

4.3.1.3 Reported Service Expenditure by Supply Chain Players

On average, the respondents reported spending 39.0% of overall expenditure on in-house and outsourced services. The services that the respondents spent most on are ranked in Table 4.2.

Table 4.2. Top Services Based on Expenditure

Rank	Service Type	% of total service expenditure (average)
1	Transportation	17.1%
2	Banking	12.1%
3	Human Resource	8.3%
4	Storage	8.1%
5	Software	6.8%
6	Marketing and Branding	6.3%
7	Wholesale	5.1%
8	Ecommerce Platforms	5.1%
9	Retail	5.0%
10	Others (Combined)	26.0%

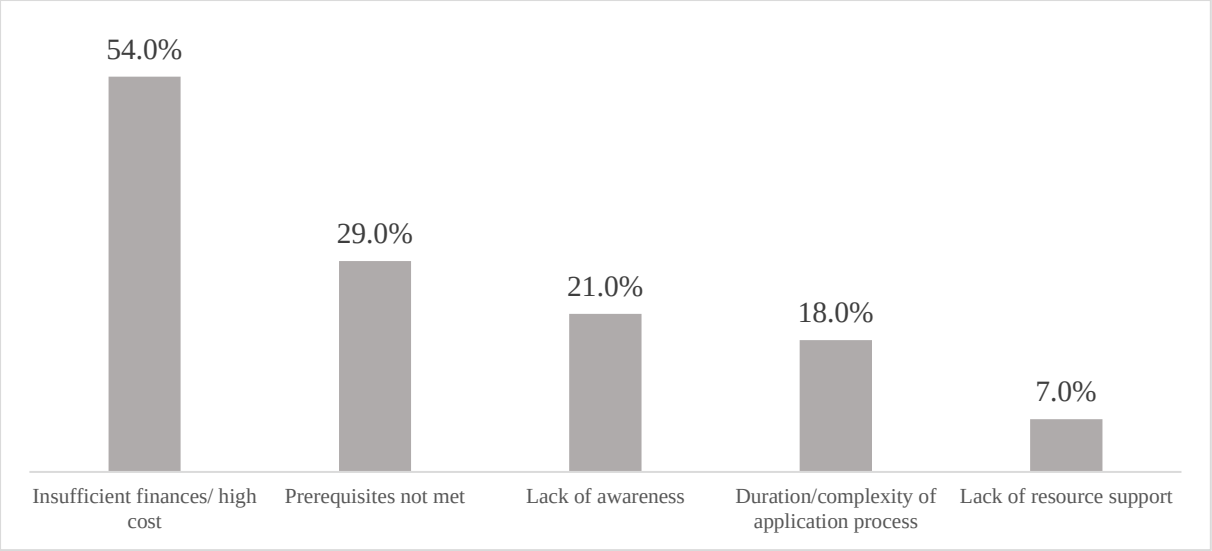
Source: Spire conducted interviews, 2020

Based on the data collected, there is an overlap between the services perceived to be essential and the services utilised by the respondents. Both transportation and banking services are amongst the top three services for both categories. On the other hand, although storage is ranked in the top three for its importance to the supply chain, it is only ranked fourth in expenditure. Possibly because respondents did not want to spend more on storage, perhaps not realising the benefits of having access to good storage facilities (lack of awareness).

4.3.2 Main Challenges in the Uptake of Services

Stakeholders within the supply chain revealed several challenges when it came to engaging services. Examples included issues around accessibility, affordability of specific services, difficulty in meeting pre-requisites, and a lack of know-how in multiple knowledge areas (Figure 4.8).

Figure 4.8. Barriers to Engagement of Services for Farmers, Food Processors, Distributors, Government Officials and Trade Associations in Indonesia (n=28)



Source: Spire conducted interviews, 2020
Note. The remaining responses were categorised under 'others' (4%). Graph percentages will not add up to 100% because verbatims were multi-coded.

High cost to engage services (54.0%): Slightly more than half of the respondents indicated that the main barrier to the uptake of services was the high cost. Although there could be significant benefits from investing in certain services, supply chain players may perceive them to be risky. This was most applicable to technological and business-related services, such as marketing and branding. While services such as transport and storage were perceived to be essential services with direct impact, technological and business-related services were not seen in the same light. Possibly, some of the supply chain players prioritised short-term benefits over long-term benefits.

Inability to meet pre-requisites to qualify for service-related government support (29.0%): Nearly a third of respondents said they could not meet the requirements to apply for government-subsidised services (Figure 4.8). Requirements are varied and numerous but usually encompass the following: being a Micro-Small Medium Enterprise (MSME), owning a farm card and bank account, and being part of a farmer's group or collective. Other difficulties related to the farm cards mentioned by interviewed experts included: farmers not receiving the farm card, not knowing how to use the card, or simply the card being held by the head of the farmer group.

For the latter, small-scale farmers are discouraged from joining groups or collectives (e.g., Kelompok Gabungan Tani) due to challenging administrative processes and a failure to meet the requirements (e.g., proof of business legality). For example, the requirement of owning a bank account is not as commonplace in the member economy [32]. Given that only half of the population aged 15 and above own a bank account of some sort, some supply chain players cannot apply for government support. (See Section 4.4).

> "*Sometimes banks ask many difficult requirements for farmers, such as the legality of land and having to have a business entity so that small farmers who do not have these documents have difficulty getting financing from banks*" – **Farmer**

Lack of awareness and understanding of value-add services (21.0%): Around one-fifth of respondents indicated that a lack of awareness was a barrier to the engagement of services (Figure 4.8). In addition to a reluctance to pay for high-cost services, there could also be an unwillingness to engage with food services due to a lack of insight and understanding into the potential benefits (e.g., reducing overall operational costs) of such services.

Furthermore, low levels of education, where farmers have on average six years of formal education [18], and relative isolation from being based in rural areas, may contribute to a limited understanding of the benefits of investing in various services. Since the majority of Indonesia's agriculture farmers are small family-run businesses, the adoption of services may be hindered by the farmers' tendency to abide by the methods passed down from previous generations. A reluctance to change is a complex issue to tackle in the short term.

The lack of knowledge and understanding is pervasive across various service areas, such as:

- ***Financial Services.*** The respondents demonstrated a limited ability to understand and access capital through financial institutions comprising banking, insurance, and Fintech. Some information areas that they lacked an understanding of were cash flow-related risk management and insurance solutions. Furthermore, a small subset of the respondents argued that the application process for financing support was too complicated and time-consuming (Figure 4.8), further discouraging them from applying.

- ***Storage Services.*** According to the respondents, proper storage facilities, such as cold storage, are relatively underutilised in Indonesia. This may stem from a lapse in understanding the importance of cold storage for inventory management or preserving produce quality during transportation, or may be due to cost constraints.

- ***Business Services.*** Farmers did not see the need to invest in research and development, nor in marketing and branding. Many lacked awareness of what support was available for engaging with such business services, especially in the rural parts of Indonesia. This low awareness, coupled with a firm adherence to traditional farming methods (particularly amongst small-scale and family-run farms), adds layers of difficulty to the role of business service providers to educate their farmers.

- ***Technology Services.*** Despite the Government's push for digitalisation in Indonesia [33], some supply chain players operate in rural areas with no access to internet infrastructure. The percentage of Indonesia's population using a smartphone (smartphone penetration rate) is at 70% [34]; thus, an estimated 30% do not have such access. They are therefore not aware of and do not utilise any technology services. Even if the fundamental barriers of infrastructure could be resolved, service providers would still need to overcome the obstacle of convincing and persuading farmers to transition from traditionally taught methods to more data-driven, science-backed methods. The latter, for example, could include using technology to determine the most suitable horticulture produce to plant based on present soil conditions. Subsequently, it would also be essential to teach these farmers how to utilise online channels such as e-commerce platforms and social media, which would allow them to sell directly to end-consumers.

Service providers echoed sentiments similar to that of other stakeholders. The main challenge was the lack of awareness and understanding of value-adding services.

> "[They] *must be aggressive in educating about digital literacy, especially to farmers because their level of education is low so they need special education for them to build their trust in using our services.*" – **Financial Service Provider**

> "*It takes extra effort to build awareness and educate farmers of the importance of educational services, because many of the farmers are comfortable with conventional farming methods*." – **Business Service Provider**

4.4 Section 4: Government Support for Horticulture and Agriculture

According to Indonesia's Food Law (2012) [35], the approach to attaining food security is through food sovereignty and food self-reliance. The objectives can be populated into 12 targets that the Ministry of Agriculture has set out to achieve (See Figure A4 in Appendix).

The agricultural development objectives set from 2020 to 2024 covered the following:

- Increasing production and productivity of strategic foods
- Developing agricultural quarantine systems
- Expanding economic-based agricultural infrastructure
- Enhancing human resource and farmer empowerment
- Improving agricultural science and technology innovations
- Achieving institutional bureaucratic reform

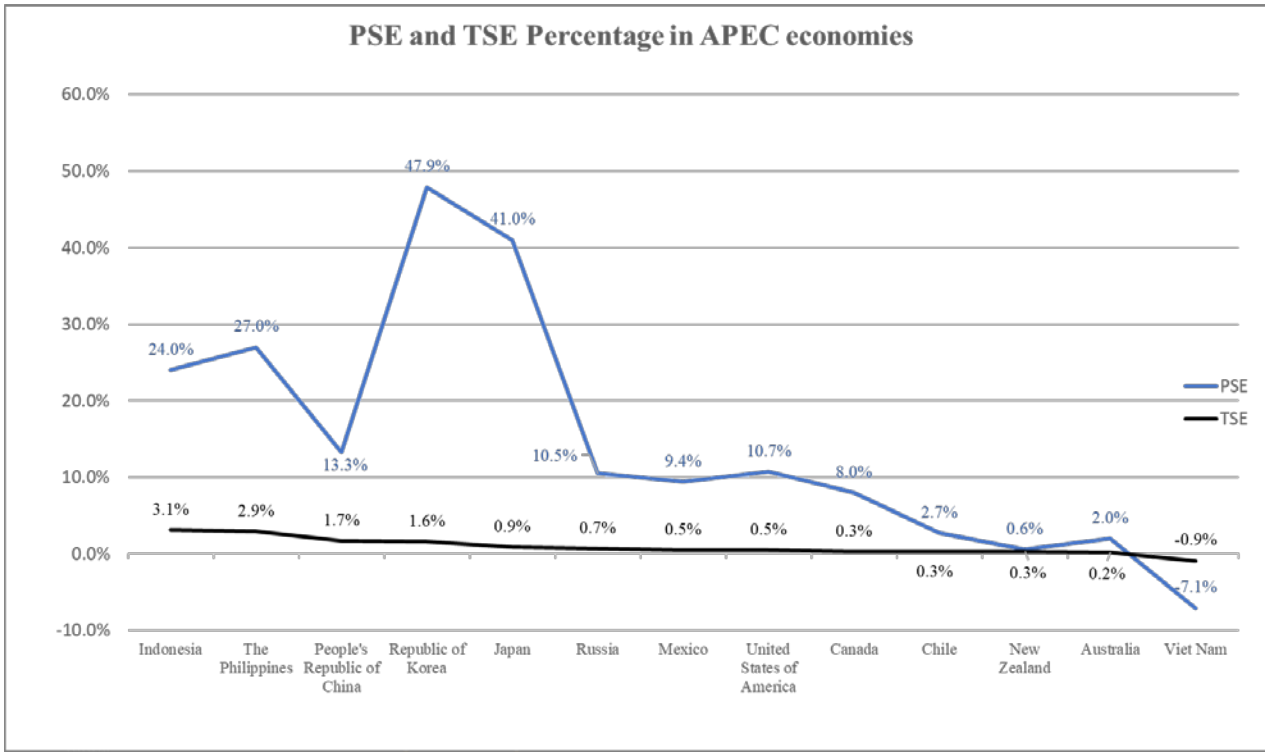
In terms of government support, the main form provided to farmers has been market price support and budgetary transfers for variable inputs (e.g., subsidies on fertilisers, seeds, credits). Currently, fertiliser subsidies make up the largest component of the agriculture budget allocated by the government. However, the market price support scheme for rice is one of the essential forms of agricultural support to the farmers [28].

Presently, Indonesia has a Total Support Estimate (TSE) of 3.1%, where TSE is the percentage of an economy's GDP accounted for agriculture public support [36]. The TSE can be further broken down into three main categories of support:

1) **Producer Support Estimate (PSE)** – the percentage of a producer's revenue from agriculture policies; a share of gross farm receipts including support (individual).
2) **General Service Support Estimate (GSSE)** – the percentage of total support given to agriculture farmers through general support (e.g., research, infrastructure, agriculture health services) as a group.
3) **Consumer Support Estimate (CSE)** – the percentage reflects the share of the total value of consumption expenditure on domestically produced commodities from the total consumption.

In contrast to the other 14 APEC economies, Indonesia's TSE score has increased over the past decade due to improvements in the sub-category scores on the PSE. Overall, Indonesia's TSE score of 3.1% places well above the average of the other 14 APEC economies (~0.9%). Similarly, for the PSE, Indonesia's score of 24.0% reflects an improvement from previous years and a significant (positive) standing compared to the other 14 APEC economies with an average of 14.6% (See Fig. 4.9).

Figure 4.9. PSE and TSE Percentages in APEC economies



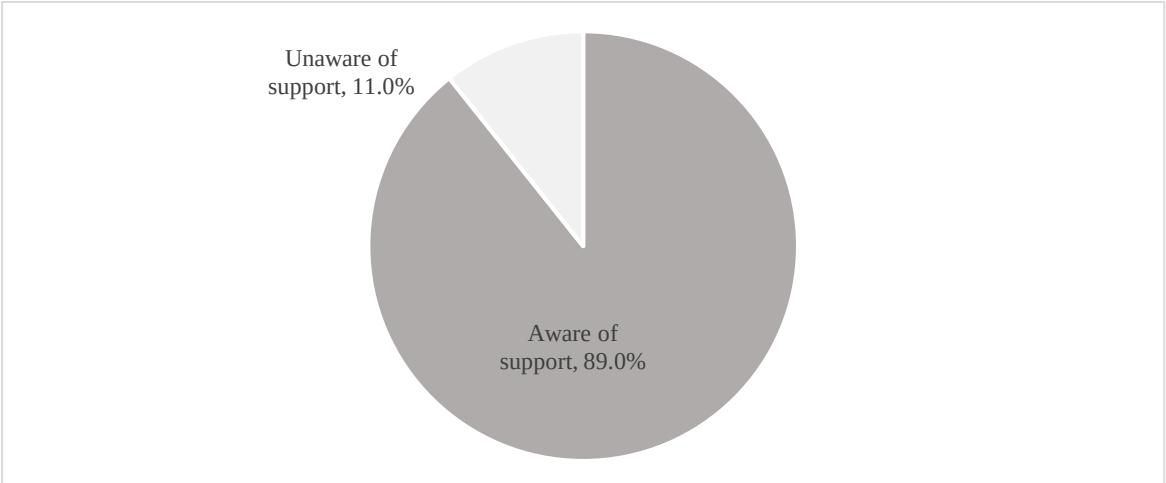
Source: OECD [36]

Note: Data not available for seven APEC economies: Brunei Darussalam; Hong Kong, China; Papua New Guinea; Peru; Singapore; Chinese Taipei; and Thailand.

4.4.1 Views on Government Support

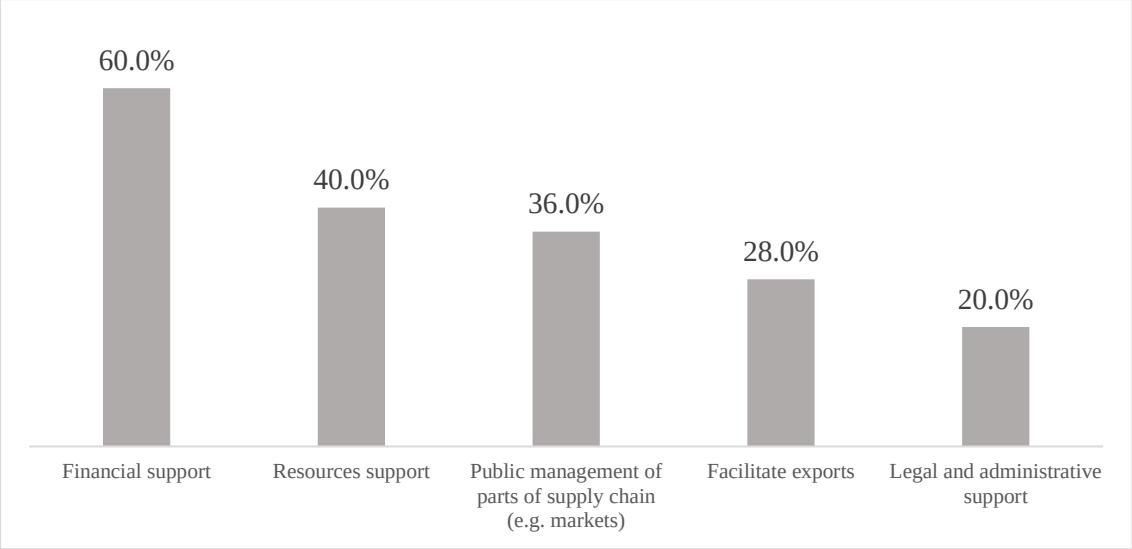
A high majority of respondents (89.0%) reported being aware of at least one form of government agriculture support (Figure 4.10). Of the respondents who were aware, financial (e.g., People's Business Credit/KUR) and resource (e.g., fertiliser and seed subsidies) support were most commonly identified (Figure 4.11).

Figure 4.10. Awareness of Government Support for Horticulture Supply Chain in Indonesia (n=28)



Source: Spire conducted interviews, 2020

Figure 4.11. Known Types of Government Support for Horticulture Supply Chain in Indonesia (n=25)

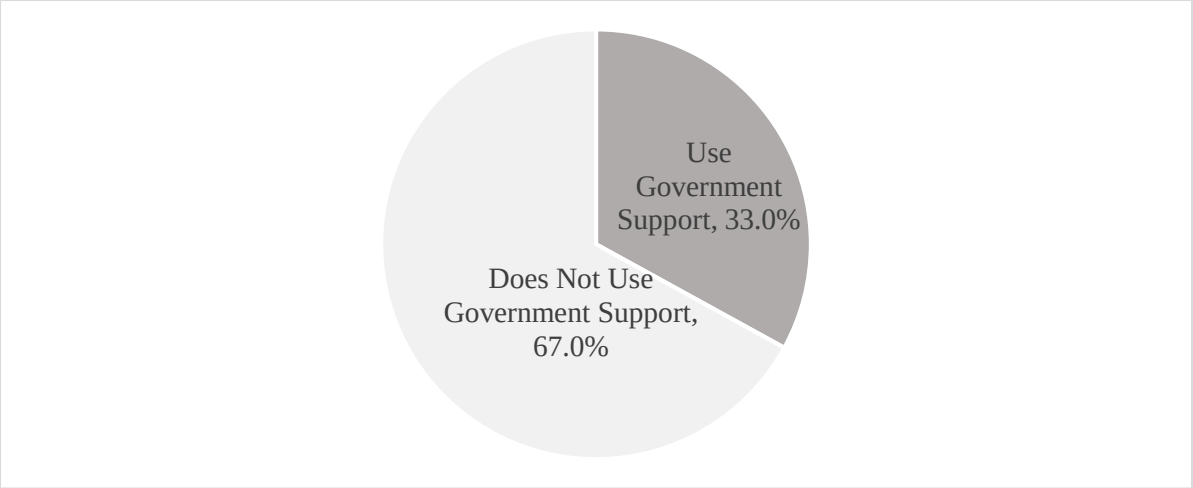


Source: Spire conducted interviews, 2020

Note. Excluded n=3 respondents who indicated they were not aware of any government support. Other types of support include government investment in supply chain operations (14.0%), marketing advertisement (11.0%), training and education (7.0%) and risk management for farmers (7.0%). The remaining responses were categorised under 'others' (11.0%). Graph percentages may not add up to 100.0% because verbatims were multi-coded.

Subsequently, among respondents aware of government agriculture support, only 33.0% indicated using any form of government support (Figure 4.12). A key barrier to using government support stemmed from the respondents' failure to qualify (53.0%) (Figure 4.13). According to respondents, they perceived government support to be mainly for farmers compared to other stakeholders (e.g., distributors, processors). Additionally, most of the support offered was targeted at smallholder farmers. Furthermore, a small proportion (16.0%) of respondents mentioned that the government support application process was too complicated, posing a barrier to their ability to make use of government support. The main challenges in accessing government services include processes being too complicated, problems with accessibility and affordability, difficulty in meeting pre-requisites, and a lack of know-how in various knowledge areas.

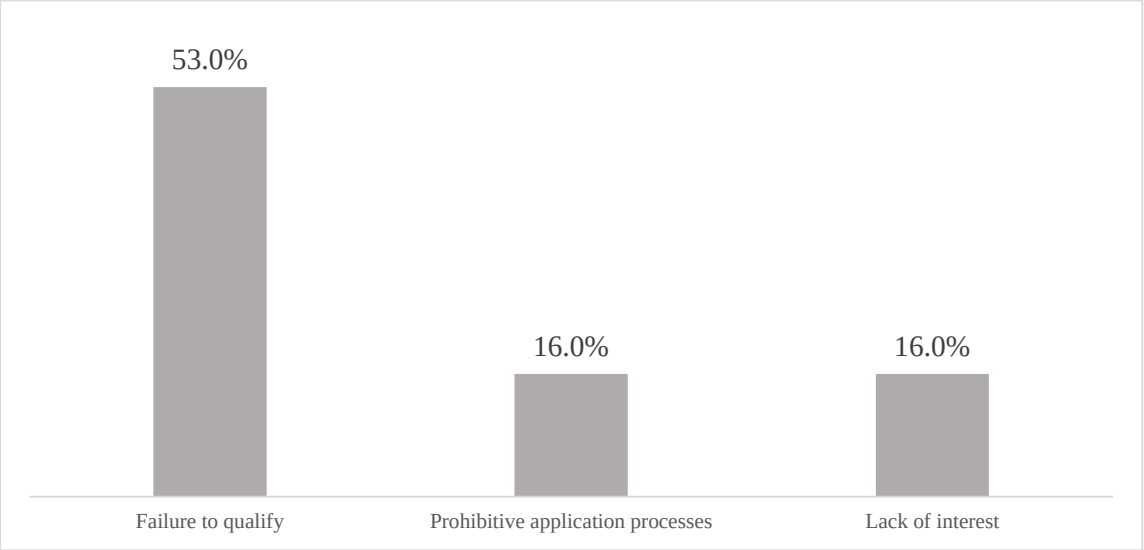
Figure 4.12. Use of Government Support by Farmers, Food Processors, and Distributors in Indonesia (n=21)



Source: Spire conducted interviews, 2020

Note. Irrelevant or non-applicable responses were excluded (n=3). Reasons for using government support include sizeable financial, administrative or other benefits (86.0%, n=7) and new opportunities (43.0%; n=7).

Figure 4.13. Reasons for Not Using Government Support for Farmers, Food Processors, and Distributors in Indonesia (n=17)



Source: Spire conducted interviews, 2020

Note. The remaining responses were categorised under 'others' (16.0%). Graph percentages may not add up to 100.0% because verbatims were multi-coded.

4.4.2 COVID-19 Pandemic Government Support and Measures

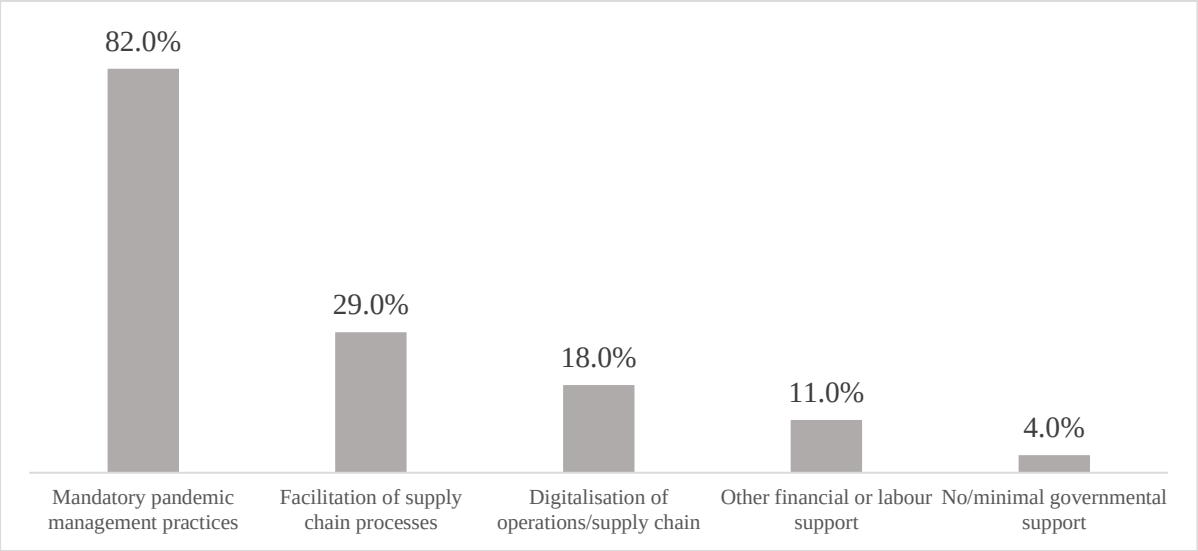
Ensuring food sovereignty and self-reliance was essential for the government to bolster economic shocks caused by the COVID-19 pandemic. The following policy responses (not comprehensive) are tools that have been used to enable the agriculture sector to function through the crisis:

<u>Agriculture-linked policies:</u>

- **Stimulus package aimed at increasing government expenditures** across the economy. The stimulus package added support to industries and enterprises (IDR 220 trillion or USD 14 billion) for the economic recovery programme.
- **Simplification of access to Kredit Usaha Rakyat** (People Enterprise Credit and Ultra Micro Credit for SMEs) where administrative requirements to apply for loans such as business permits, tax registration numbers, and additional collateral documents were eased.
- **Additional funding and resources worth IDR 6.1 trillion (USD 386.3m) to establish a policy to assist existing loans** where interest and debt payments can be delayed by six months.
- **Tax measures, including corporate tax allowances and income tax reductions,** were granted to workers from the processing industry. The process of value-added tax restitution to 19 identified (essential) sectors, including agriculture, was fast-tracked. Also, those with existing loans had a six-month delay on interest and debt repayments.
- **Reduction of export and import restrictions** on chosen commodities, including those supporting the manufacturing, food, and medical industry.
    - E.g., imports of onions and garlic no longer require import certification requirements.
    - E.g., The National Logistics Ecosystem's (NLE) export-import services enhanced the sector's export and import processes.

A majority of respondents (82.0%) were aware that the government had implemented general measures to prevent the spread of COVID-19 (e.g., social distancing, temperature screening, and mask-wearing (Figure 4.14)). Nearly a third of respondents (29.0%) also reported being aware of governmental measures to keep the food supply chain operating. For example, these measures included (but were not limited to) ensuring small-scale farmers could still access fertiliser and seed subsidies and subsidising transport service providers to maintain mandatory hygiene measures.

Figure 4.14. Government COVID-19 Measures Identified by Farmers, Food Processors, Distributors, Government Officials, and Trade Associations in Indonesia (n=28)



Source: Spire conducted interviews, 2020

Note. The remaining responses were categorised under 'others' (4%). Graph percentages may not add up to 100% because verbatims were multi-coded.

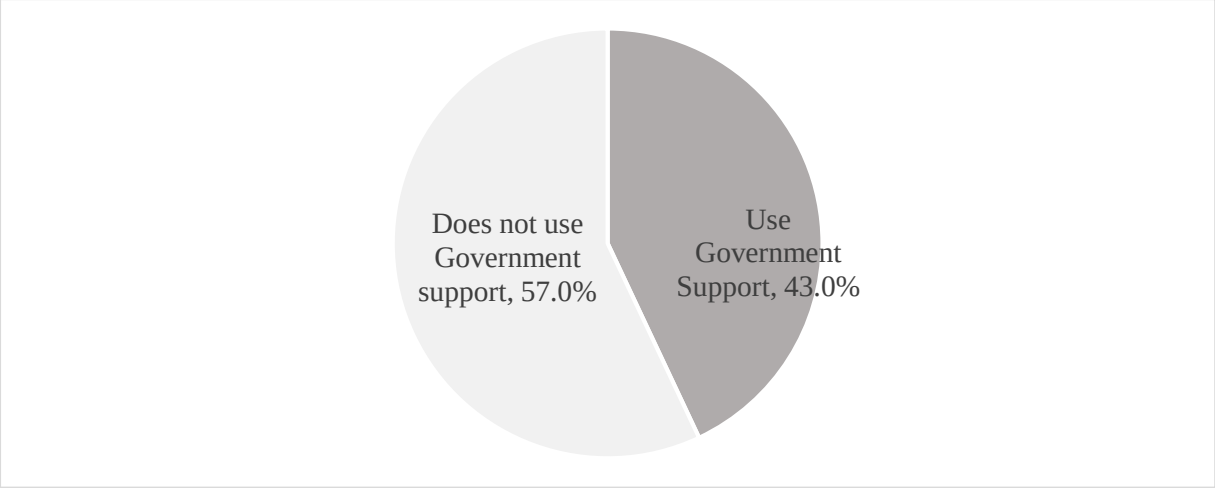
Participants also reported being aware of government efforts to digitalise operations (18.0%), aligned with supply chain players' voluntary uptake of technology services (see Section 4.3). This included support for utilising e-commerce platforms for farms to sell products directly to consumers, the uptake of Fintech as an alternative source of financing, and direct marketing to consumers through social media platforms such as Facebook.

4.4.3 Views on Government Support for Engaging Food Service Providers

Currently, on top of providing minimum purchase prices (e.g., rice and sugar) and subsidies on variables inputs (e.g., fertiliser), Indonesia also subsidises the engagement of services that deal with irrigation, research and development, and marketing and promotion [28]. Additionally, the Ministry of Agriculture (MoA) also distributes agricultural machinery such as tractors, water pumps, excavators, cultivators, and transplanters to farmers groups.

All respondents were aware of the existence of government support to engage service providers. Some 43.0% of respondents indicated they were using at least one form of government support to engage services related to the food system (Figure 4.15).

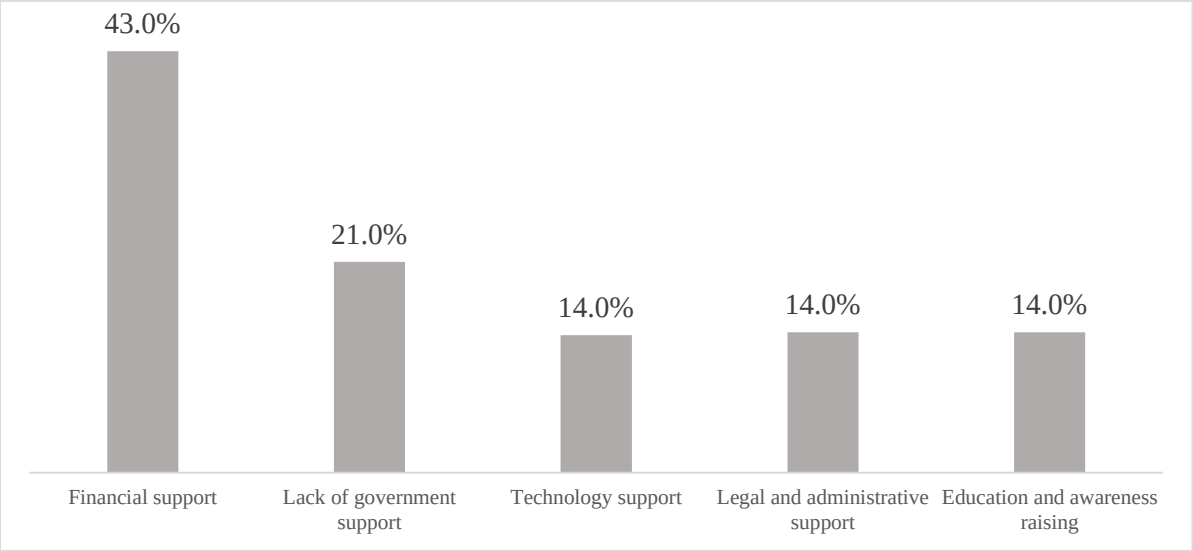
Figure 4.15. Use of Government Support for Engagement of Services in Indonesia's Horticulture Sector (n=44)



Source: Spire conducted interviews, 2020
Note. Irrelevant or non-applicable responses were excluded (n=4).

Upon further review, most respondents who did not use government assistance indicated a lack of government support for engaging food service providers. Farmers, particularly those producing staple commodities (e.g., rice), received more help and support. Furthermore, according to the respondents, there was little to no government support for engaging certain services, such as developing a cold supply chain, which is vital to retain the quality of the produce and minimise food waste during transportation. Of the support that the respondents were aware of, most cited the financial support (43%), which usually came in the form of formal credits with lower interest rates (Figure 4.16).

Figure 4.16. Awareness of Types of Government Support for Engagement of Services by Farmers, Food Processors, Distributors, Government Officials, and Trade Associations in Indonesia (n=28)



Source: Spire conducted interviews, 2020

Note. Other types of government support include research and innovation (7.0%), direct supply chain management (7.0%), and resources support (4.0%). The remaining responses were categorised under 'others' (4.0%). Graph percentages may not add up to 100% because verbatims were multi-coded.

However, as identified in Figure 4.13, there were two main challenges associated with accessing financial support. Many respondents did not meet the government-mandated requirements, and many said the application process was too complicated and time-consuming (Figure 4.16).

One challenging government-mandated requirement brought up by respondents related to the need for administrative documents. In some instances, banks required farmers to submit evidence that they owned the farmland to qualify for financial support. However, Indonesia's land management system is structured so that most small-scale farmers normally lease but do not legally own their farmlands, resulting in default disqualification for many smallholders. In other cases, farmers were required to submit numerous administrative documents to qualify for support, such as business legality documents, company bank statements, and taxpayer identification numbers. Producing these documents can be challenging and may deter farmers from applying for capital. Instead, farmers may be forced to take a disproportionate risk in accepting informal loans from sources that lack credibility.

Finally, the respondents reported awareness of government support for adopting technology, legal and administrative, and education services (14.0%; 14.0%; 14.0%). Amidst the government's push for digitalisation [37] an agriculture e-commerce platform was created for all supply-chain players to facilitate the supply chain's efficiency and bring the farmers closer to consumers. Furthermore, other technological support included the uptake of Fintech as an alternative for financing and utilising of a mobile application that connected farmers with other vital stakeholders, marketers, and certification bodies to encourage and support improvements to the supply chain.

4.4.4 Public and Private Initiatives Identified by the Respondents

In addition to determining the awareness of government support, the respondents provided

specific programme names where possible. Overall, these programmes were constituted either by government agencies or private companies to support the government's objectives to uplift and facilitate agriculture and horticulture. Table 4.3 contains a list of the programmes the respondents were able to name, sorted according to the overall service importance (based on reported expenditure, see Table 4.3).

There are two additional lists of programmes: (1) where the respondents could not recall the programme name but described it enough for identification (indirect); and (2) a list that included programmes obtained through desk research. In Table A10, these three programmes (e.g., direct, indirect, and desk research) have been collated. These lists are not intended to be a comprehensive review of all programmes or initiatives present in Indonesia.

Table 4.3. Programmes Mentioned Sorted by Service Importance

Ranked Services by Expenditure (sorted by highest to lowest)	Number of Programmes per Service	Programme Names
Transportation Services	**0**	*No identified p programme under this service.*
Banking Services	**2**	**Kredit Usaha Rakyat** (KUR) People's Business Credit [38]
		Pembiayaan Ultra Mikro (UMI) Ultra Micro Financing
Storage Services	**2**	**Perum BULOG** services (Indonesian Bureau of Logistics)
		National Logistics Ecosystem Portal (NLE Portal)
Human Resource Services	**0**	*No identified programme under this service.*
Software Services	**0**	*No identified programme under this service.*
Wholesale Services	**0**	*No identified programme under this service.*
E-commerce Services	**1**	**Toko Tani** (Online Indonesian Farmer Shop)

Overall, the respondents were most aware of support programmes for banking, storage, and E-commerce services. However, there is a possible gap in either the availability or awareness of support in some categories. For instance, the respondents could not name any programmes in the categories of transportation, human resources, software, or wholesale, despite these being considered as important services.

This could suggest barriers to information dissemination and outreach. As such, there would be merit in improving the support programmes' awareness campaigns to aid stakeholders in need. It could also potentially mean a demand for such support, however many stakeholders are simply unaware of what is available.

5 Mexico Economy Profile

Mexico is the second-largest economy in Latin America and is among the world's 15 largest economies [39]. The member economy consists of 32 autonomous federal states, an abundance of natural resources, a rich cultural history, and almost 130 million people. Despite the presence of strong macroeconomic institutions and being relatively open to trade (compared to other similar economies), over the last three decades, Mexico has made slow progress in terms of growth, inclusion, and poverty reduction [39]. With a GDP of USD 1.3 trillion in 2019 [40], Mexico's economy grew at an average of 2.0% annually between 1980 and 2018. The modest growth rate reflected limited progress relative to high-income economies.

5.1 Section 1: Horticulture Landscape

Mexico's GDP is comprised of the primary (agriculture), secondary (industry), and tertiary (services) sectors. In 2019, the agriculture sector contributed around 3.5% to GDP, significantly lower than industry (30.2%) and services (60.5%) [41]. Despite a modest contribution, agriculture plays a crucial role in the Mexican economy by enabling stronger trade ties with the USA [42]. The Mexican agriculture sector has two sides: (1) subsistence farming in the rural areas and (2) highly competitive export farming. While both groups cater to horticultural production, large-scale farmers often invest in new technologies to boost the production and exports of fruits and vegetables and use more advanced farming techniques than small farmers [43]. This allows them to sell to international food markets, which require higher standards, more onerous governmental restrictions, and foreign consumers that enjoy a wide choice of suppliers who come with their demands and preferences. Farmers that rely on the domestic market employ more traditional methods of cultivation and harvesting, which can be more labour intensive than those that cater to the export market. There is a direct split in the farmer demographics in Mexico, where half of the farmers are small-scale (e.g., farmers working on land plots smaller than 2ha) [44].

5.1.1 Agriculture Labour

In 2020, the agriculture sector accounted for 12.4% of Mexico's overall employment, while the industry and services sectors accounted for 26.2% and 61.4% respectively [45]. In terms of age distribution, the 2017 National Agricultural Survey reported that middle-aged (46 to 60 years old at 37.8%) and elderly (61 years old and above at 38.7%) workers make up the majority (76.5%) of the workforce (see Table A11 in Appendix) [46].

In 2020, the number of females working in the agriculture sector (including agriculture, livestock, forestry, fishing, and hunting) was at 12.0%, with the remaining 88.0% of the workforce being male [46]. Compared to the past three years, there has been a slight increment of 1% to 2% in females working in the agriculture sector, but still significantly lower than males.

While agriculture accounts for the smallest employment share across the three sectors, there has also been an observed decline in the agriculture employment rate over the past two decades, from 17.4% in 2000 to 12.4% in 2020 [20]. This is possibly due to social and demographic changes (such as rising education levels) that influence workers' choices in pursuing non-farm-related occupations in Mexico or farm-related work in the USA that attracts higher pay, and allows for the development of more valued skills [47].

5.1.2 Agricultural Topography

With a total land area of 128.45 million hectares, it has been estimated that 80.0% of land in Mexico is for agriculture, which can be further broken down into permanent meadows and pastures (60.0%), arable land (18.0%) and land under permanent crops (2.0%) [48].

Mexico's diverse topography and varying climates enable a wide variety of agricultural produce. For instance, the State of Sonora in Northern Mexico is one of the most agriculturally important economic areas [49]. Sonora's temperature can reach 50.0°C in the summer but it is a highly productive area for vegetables, barley, soya, cotton, and fruits like grapes and citrus, to name a few. It was also where Nobel Peace Prize winner Norman Borlaug first grew the high-yielding varieties of wheat, leading to the Green Revolution.

Other notable locations for vegetable production are Sinaloa, Zacatecas, Guanajuato, and Chihuahua, while the more temperate states of Michoacán, Durango, Veracruz, Colima, San Luis Potosi, and Oaxaca are areas of high fruit production [50].

5.1.3 Primary Commodities

In 2018, sugar cane was the main commodity produced in Mexico, and almost half of the top 20 commodities produced accounted for horticultural goods [51]. Oranges, tomatoes, chillies and peppers, bananas, avocados, mangoes (including mangosteens and guavas as per FAO groupings of indicators), potatoes, onions, and watermelons were among the top commodities. See Table A12 in Appendix.

In terms of export value, horticultural produce accounted for almost half of the top commodities [51]. Avocados, tomatoes, chillies and peppers, lemons and limes, cucumbers and gherkins, orange (in juice), mangoes, mangosteens and guavas, as well as frozen vegetables and fruits (prepared) were among the top fruits and vegetables exported. See Table A13 in Appendix. The avocado was Mexico's top exported horticultural produce, and Mexico was the leading exporter of avocados worldwide with an export value of about USD 2 billion [52].

5.1.4 Top Trading Partners

In terms of general commodity exports, the USA is Mexico's top trading partner [53]. From a logistical perspective, Mexico shares a 2,000-mile border with the USA, which is highly beneficial for trade relations. Japan comes in as the second top export partner, followed by Venezuela and Canada (Table A14).

The USA and Canada are among Mexico's notable trading partners as they are all part of the North American Free Trade Agreement (NAFTA). NAFTA took effect in 1994 and eliminated tariffs on the majority of goods produced by the signatory economies. The trade liberalisation contributed to the development of horticultural management and trade among the partners.

5.1.5 Protected Horticulture

Protected horticulture has gained popularity in Mexico as farmers can overcome vulnerability to environmental elements by using greenhouses, shade mesh, and high and low tunnels. The practice helps maximise crop growth and minimise the impact of climate change or unwanted weather conditions. Protected horticulture is a specialised system that can yield higher quality produce free of damage from pests, diseases, and other climate factors at any time of the year. In a 2020 study commissioned by the Embassy of the Kingdom of the Netherlands [54], Mexico

had the sixth-largest protected horticulture surface in the world dedicated to vegetables, berries, ornamental plants, nurseries, and flowers. The practice of protected horticulture is currently widespread in Mexico's 32 states and extends to more than 42,000 hectares of protected area economy-wide, valued at over USD 6.5 billion.

In terms of employment, the protected horticulture sector has generated more than 450,000 jobs. The sector's growth has increased the need for skilled or specialised labour and given rise to more modern farming methods [54].

5.1.6 Food Security and Sustainability

Mexico faces several food security challenges that hinder the population's access to sufficient, safe, and nutritious food. An example of Mexico's ongoing food security challenge stems from the farmers' socioeconomic situation [55]. As previously alluded to, around half of all farmers are small-holders with low income, small plots of land, and low use of agricultural inputs. In the 2007 National Census of Agriculture, 50.0% of farmers engaged in maise production owned less than 1.5 hectares of land, while large-scale farmers made up 4.0% but produced 50.0% of the total maise production. The diverse technologies used by the farmers resulted in contrasting productivity [56].

Hunger and malnutrition are prevalent in Mexico, and there has been an increase in the numbers of people suffering undernourishment, from 6.4% of the population in 2016 to 7.1% in 2018 [4]. According to the FAO Food Insecurity Experience Survey (FIES) [3], Mexico's population has experienced increasing rates of severe and moderate food insecurity. The member economy's severe food insecurity figures worsened from 8.0% of the total population in 2016 to 11.5% in 2019. Likewise, moderate food insecurity rose from 27.4% of the population in 2016 to 34.9% in 2019. The increasing numbers signify a need for further improvements in the economy's overall food security strategy.

As a benchmark, economies applying more sustainable practices were assessed through the EIU Food Sustainability Index [26]. The index ranked 67 economies based on indicators that measured the sustainability of food systems across three categories: food loss and waste, sustainable agriculture, and nutritional challenges. Indicators ranged from the impact of water management, land ownership laws, protection of smallholders, public support to research and development, rural banking penetration, farmer income, and access to financial aid. A lower-ranking score signified that an economy was on the right path to implementing a sustainable agriculture system.

As seen in Table 5.1, all of Mexico's scores (except sustainable agriculture, which was considered high) are within the "medium" category – indicating that Mexico is among the economies with less favourable conditions to address the economy-wide challenges.

Table 5.1. Mexico's EIU Food Sustainability Index Scores

EIU Food Sustainability Index 2018				
	Overall Score	Food Loss and Waste	Sustainable Agriculture	Nutritional Challenges
Mexico	Rank: 39.0*	Rank: 44.0	Rank: 30.0 (Same as Morocco)	Rank: 39.0 (Same as Tanzania and Tunisia)
	Score: 65.6**	Score: 66.3	Score: 69.4	Score: 61.3
World Average	Score: 66.4	Score: 68.9	Score: 67.7	Score: 62.6

Source: EIU [26]

**Rank 1 = top economy with most favourable conditions.*

***Normalized scores 0 to 100, where 100 = most favourable conditions*

5.1.7 Mexico's Secretariat of Agriculture and Rural Development

The Secretariat of Agriculture and Rural Development (SADER), previously named the Secretariat of Agriculture Livestock, Rural Development, Fisheries and Food (SAGARPA), manages the administration of Mexico's agricultural sector. SADER is a federal executive branch that seeks to support policies in leveraging the member economy's agricultural sector, enabling better production and stimulating collaboration with farmers while focusing on achieving food self-sufficiency in line with Mexico's National Development Plan.

SADER's goals include the following:

- To raise the standards of living in rural and coastal areas.
- To supply the domestic market with quality, healthy, and accessible food from the economy's fields and seas.
- To improve farmer's income by increasing Mexico's presence in global markets, promoting value-adding processes and energy production.
- To reverse the deterioration of ecosystems through water, soil, and biodiversity preservation.
- To lead the harmonious development of the rural environment through concerted actions, making agreements with all actors in rural society.

At the economic level, SADER's structure comprises 33 representations (one per federal entity, along with the delegations of Mexico City and the Lagunera Region). At the municipal level, there are 192 rural development districts and 713 rural development support centres. The wide range of representation across all levels enables SADER to better coordinate farmers, supply chain stakeholders, and government actors.

Mexico's current presidential administration highlighted the importance of policy initiatives that would benefit small and medium-scale farmers. This came with a reallocation of resources dedicated to such policies and related activities. In 2019, SADER was allocated a budget of

65.4 billion Mexican Peso (MXN) (around USD 3.4 billion) (Figure A5 in Appendix). About 66.0% of the budget was dedicated to six main programmes [57]:

1. The **Production for Wellbeing Programme** channels direct payments to farmers of corn, dry beans, bread wheat, rice, and other grains.
2. The **Rural Development Programme** aims to improve the productivity of farmer groups and associations in communities with high levels of marginalisation. The programme carries out extension services, investment projects, and technology applications.
3. The **Sustainable and Social Agricultural Markets Programme** incorporates several incentives for selected crops. This includes incentives for marketing, renovations of grain collection centres and equipment, and incentives to ensure a target income per metric.
4. **Guaranteed Prices for Basic Food Products** re-establishes guaranteed prices for white corn, dry beans, rice, bread, wheat, and milk but limited availability to small and medium-scale farmers.
5. The **Livestock Credit Programme** is a microcredit programme created to support small and medium livestock farmers.
6. The **Fertiliser Programme** aims to promote economy-wide food security by providing 450 kilograms of fertiliser per hectare for as many as three hectares for each qualifying farmer in marginalised municipalities.

Another way to evaluate the extent of the Mexican Government's investment in agriculture is by looking through the agricultural support estimates calculated by the OECD. In 2018, the Total Support Estimate (TSE) amounted to USD 56.2 billion. The TSE represents a percentage of an economy's GDP accounted for agriculture public support, where Mexico's TSE score was 0.5% [36]. This will be elaborated further in Section 5.4.

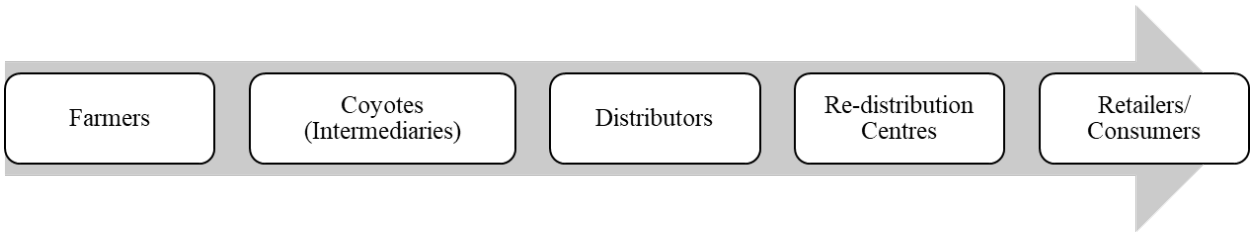
5.2 Section 2: Horticulture Supply Chain

This section sets out to elaborate on the Mexican horticulture supply chain. Specifically, this section aims to understand 1) the export and domestic market structures from the respondents' eyes and 2) the perceived challenges associated with the current structure. This section also provides insights into the impact of the COVID-19 pandemic on the horticulture supply chain.

5.2.1 Domestic Supply Chain

During the interviews with stakeholders, there were mentions of several different supply chains for the domestic market in Mexico. The most common supply chain has multiple intermediaries, including an intermediary referred to as a 'coyote' (*Figure 5.1*). In this supply chain, the farmers engage with an intermediary or a coyote to sell their produce. This, in turn, is transported to a distributor before it arrives at a re-distribution centre and finally to retailers/ consumer markets. A coyote transacts in bureaucratic procedures, and the work usually involves an official to carry out operations. One respondent shared that the need for coyotes is most likely due to stakeholders not having the necessary contacts or network to distribute or sell efficiently (e.g., a farmer does not have the means to transport fruits from the farm to the market). The coyotes purchase from farmers at lower or wholesale prices, enabling them to make substantial profit margins. Also, there could be multiple coyotes that the produce is sold to before it reaches consumers. For example, a coyote purchases the produce directly from a farmer and distributes it to another coyote that sells the produce to retailers. A farmer stated that there could be up to six coyotes in a supply chain.

Figure 5.1 Most Common Supply Chain in Mexico for Domestic Market



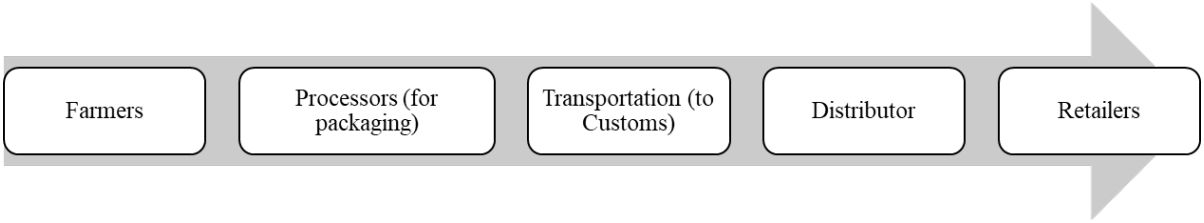
Source: Spire conducted interviews, 2020

Note: For illustration purposes, the above diagram has been created. However, the coyote (intermediary) can act at any stage in the process, both upstream (e.g., farmers) and downstream (consumers). The coyote does not necessarily come solely between farmers and distributors.

5.2.2 Export Supply Chain

Compared to the domestic supply chain, the export supply chain is more controlled and fixed in nature. For example, produce is transported to customs, where paperwork is submitted as evidence of permission to cross the border (USA). This paperwork includes a licence from the Department of Economy to prevent the dumping of produce. Consent is also required from the National Service for Agri-Food Health, Safety and Quality (SENASICA). Sometimes, the produce needs to be registered with the Food and Drug Administration (FDA). After clearing customs, the produce is sent to a distributor or a wholesaler, who then sells the produce (Figure 5.2).

Figure 5.2. Most Common Supply Chain in Mexico for Export Market



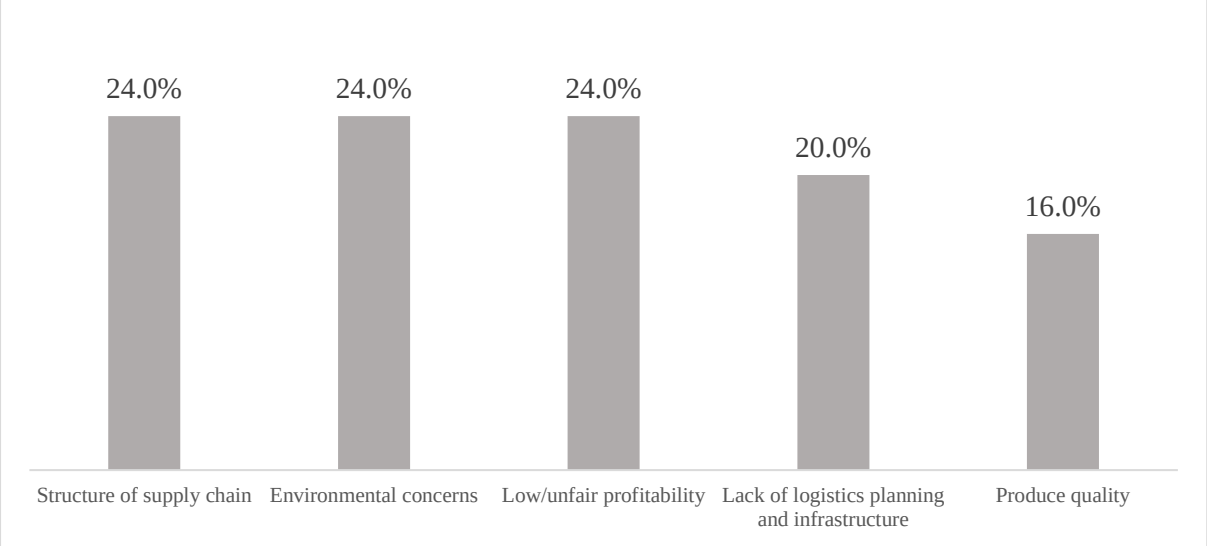
Source: Spire conducted interviews, 2020

5.2.3 Fundamental Supply Chain Issues

5.2.3.1 Horticultural Supply Chain Issues Perceived by Farmers, Food Processors, and Distributors

There were various challenges farmers, food processors, and distributors experienced when dealing with and operating within the supply chain. Through the interviews, the top four challenges discussed by the respondents were: (1) structure of supply chain, (2) environmental concerns, (3) low/unfair probability, and (4) logistics management (Figure 5.3).

Figure 5.3. Horticulture Supply Chain Issues Perceived by Farmers, Food Processors, Distributors, Government Officials, and Trade Associations in Mexico (n=25*)*



Source: Spire Conducted Interviews, 2020

Note. Irrelevant or non-applicable responses excluded (n=3). Other challenges include concerns about supplies (12.0%), Fraudulence (by intermediaries/ collectors/ distributors; 8.0%), price volatility (8.0%), certification issues (8.0%), lack of knowledge, skills or experience (8.0%), supply-demand mismatch (4.0%) and concerns about competition (4.0%). The remaining responses were categorised under 'others' (16.0%). Graph percentages may not add up to 100% because verbatims were multi-coded.

Structure of supply chain (24.0%): The respondents shared that the supply chain structure involved multiple intermediaries (e.g., coyotes). As the supply chain and its associated processes become lengthy and time-consuming, this is a challenge and often acts against many stakeholders, especially farmers who see reduced profit margins. The lengthy supply chain also risks the quality of the produce. More time is spent on transportation, and the high number of poor-quality roads may lead to damaged goods and eventually food wastage. As a remedy, one farmer said he sold unripe tomatoes to intermediaries so they would reach consumers in a ripe

state. However, as the tomatoes are passed between multiple intermediaries before reaching their end destination, the quality deteriorates.

Environmental concerns (24.0%): Environmental concerns such as climate change, pests, plagues, and crop diseases were the next most mentioned challenge, as these can directly impact a harvest. Smallholder farmers who tend to use traditional methods may often face difficulties addressing such issues. This leaves farmers at the mercy of unprecedented natural events. For instance, too much or too little rain can destroy crops, leaving the farmers with almost no harvest and a considerable loss of income.

There are solutions to deal with numerous environmental issues; farmers often lack the awareness/knowledge to implement solutions or cannot afford to do so. To elaborate, a lack of financial literacy amongst farmers reveals a possible absence of understanding of how crop insurance could benefit them. Without crop insurance, farmers continue to be vulnerable to weather changes. Furthermore, solutions such as greenhouses, albeit less affordable, are one way of overcoming poor weather conditions to optimise crop growth.

Low/unfair profitability (24.0%): The respondents revealed that profitability for farmers could be improved. As previously stated, farmers are quite reliant on intermediaries to utilise their connections and resources to ensure timely delivery and distribution of perishable produce. The intermediaries, in turn, purchase from the farmers at wholesale (usually lower) prices and enjoy larger profit margins when selling onto other intermediaries or consumers. Farmers end up earning less than expected, as intermediaries can influence the farmers to sell at their desired price. The respondents argued that this enabled intermediaries to profit around three to four times higher than standard profit margins.

Another challenge discussed was the volatility of crop prices, which directly and, most of the time, negatively impacted farmers' income. Some farmers attributed this to the lack of contracts between the farmers and the buyers. Contracts are written agreements between a farmer and an intermediary which stipulate the expected production quantity of fruits and vegetables, harvest schedules, and fixed buying prices. The lack of a contract means that there is often no agreed rate (of selling or buying), and a farmer is at an intermediary's discretion. Thus, farmers may at times receive lower and fluctuating incomes.

Lack of logistics planning and infrastructure (20.0%): One-fifth of respondents cited concerns with the lack of logistics planning (e.g., using proper packaging and cold storage) and infrastructure (e.g., efficient road networks) to safely and efficiently transport the produce through lengthy supply chains. This would require the coordination of numerous stakeholders and intermediaries, and delays could mean the produce is closer to spoiling at any one stage. Furthermore, with the produce spending, a significant amount of time on the road, and the lack of adequate cold storage facilities or packaging, high temperatures, and other conditions can speed up decomposition or spoilage.

Additionally, there is a lack of an efficient road network that facilitates the efficient transport of horticulture produce. To measure the comprehensiveness of Mexico's logistics infrastructure (both international and domestic), the World Bank's Logistics Performance Index (LPI) is used as a global indicator. Mexico has an LPI score of 3.0 [29]. This is slightly higher than the Latin APEC economies' average of 2.9. A maximum score of five on the LPI indicates that the economy has a comprehensive list of critical logistical infrastructures. In contrast, a score of zero means that the economy lacks a substantial number of key logistical infrastructures. Mexico ranked 16th out of 21 APEC economies, where a lower rank indicates a better logistical environment. Although Mexico's logistics and distribution infrastructure are better than most Latin APEC economies, there is still room for improvement. See Figure A2 in the Appendix or Table A7 for a detailed breakdown.

5.2.3.2 Export Supply Chain Issues Perceived by Farmers, Food Processors, and Distributors

The respondents shared that farmers were motivated to enter the export market as the earnings were higher than those achieved through selling to the local market. However, becoming an exporter was considered a challenge compared to catering to the domestic market. The latter, especially for traditional markets, does not require certifications nor strict adherence to high-quality standards. This leads to high-quality produce being prioritised for the international export market. In contrast, lower-quality produce is sold to the domestic market. Below is a list of the difficulties the respondents faced:

Lack of technical knowledge or capabilities to improve farming operations to the required standard for exporting. Many smallholder farmers practise traditional farming methods, which occasionally yield inconsistent or low-quality crops. Furthermore, most smallholder farmers have been unable to capitalise their businesses sufficiently to enter the export market given the current domestic supply chain set-up where they have difficulties earning their fair share of profits. Thus, they lack the capital to invest in research, machinery, and other forms of technology that could facilitate their daily operations. Without such investments, farmers find it challenging to meet the export market standards, including getting certified. More often than not, acquiring the required certifications can be expensive and time-consuming. It is also possible that specific certifications need to be renewed regularly (e.g., monthly), requiring even more investments from farmers. One example of certification is the PrimusGFS certification, which needs to be re-verified monthly. It is awarded to farmers who use water free of *Escherichia coli* and *Salmonella*.

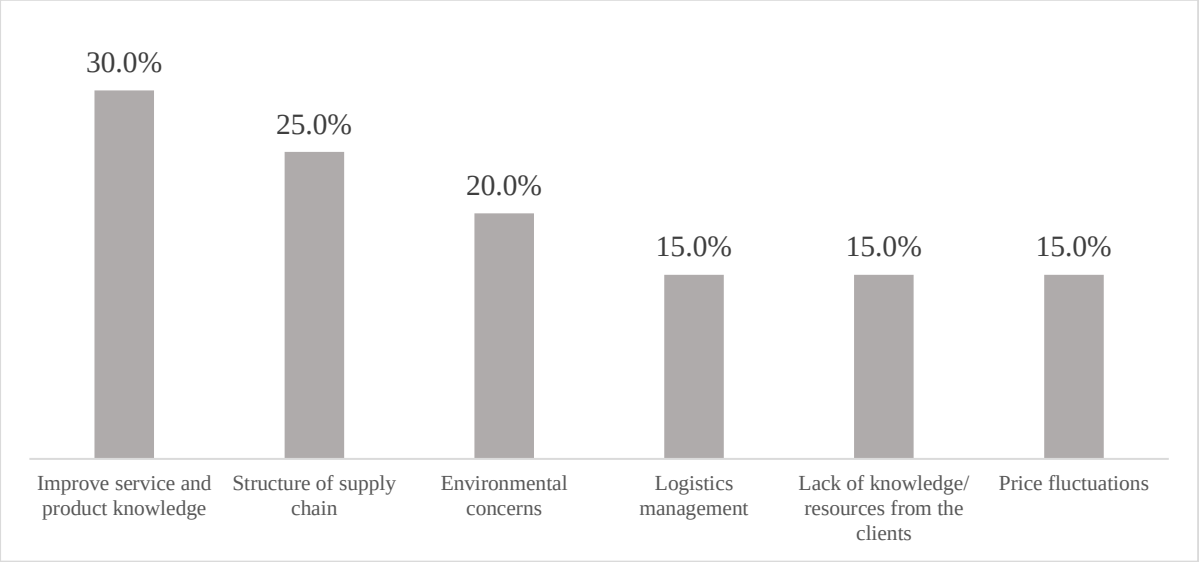
Tedious paperwork and administrative processes. The respondents said that preparing the necessary paperwork and liaising with third-party vendors (e.g., service providers for transportation and storage) requires experience. On the former, paperwork can be a lengthy procedure as it needs to be signed by an accountant or attorney authorised with limited administration power. Based on the accounts from many respondents, customs brokers are strict, and often reject paperwork that contains minor errors such as misplaced commas or full stops, even missing letterheads. Any delay due to missing approvals (paperwork) may increase the risk of compromising the quality of produce, which may then fail to meet required export standards.

Lack of network or business connections. As the export processes can be quite complicated, it is essential to have established connections to manage the whole process successfully. For example, a stakeholder must connect with an experienced customs agent, and a certified transporter to ensure the process goes smoothly. Without receiving assistance from such connections, these farmers face great difficulty selling to export markets; or scaling up their business.

5.2.3.3 Horticultural Supply Chain Issues Perceived by Service Providers

Among the issues experienced by service providers in dealing and operating within the supply chain, respondents found that the top three areas of concern were (1) improving products or services knowledge, (2) the structure of the supply chain (where multiple intermediaries are prevalent) and (3) environmental concerns (Figure 5.4).

Figure 5.4. Horticulture Supply Chain Challenges perceived by Service Providers in Mexico (n=20)



Source: Spire Conducted Interviews, 2020

Note. Other challenges include limited or inefficient use of technology (10.0%), keeping up with high demand (10.0%), poor infrastructure (5.0%) and lack of certification (5.0%). The remaining responses were categorised under 'others' (15.0%). Graph percentages may not add up to 100.0% because verbatims were multi-coded.

Improve services and product knowledge (30.0%): Service providers believed that there knowledge or awareness around services and products needs to be improved. The lack of knowledge in farmers, coupled with stakeholders (most of whom are intermediaries), some of whom may prioritise monetary benefits over providing the proper education or advice, can cause harm to the business of farmers and negatively impact the supply chain. It is possible that the intermediaries also lacked the appropriate knowledge themselves. For instance, farmers were unaware that a possible cause of poor harvest or soil damage was the use of incorrect agrochemicals. The agrochemical seller (usually a secondary seller) prioritised increasing sales over the education of using agrochemicals effectively (e.g., such as the specific amounts of chemicals to use in fighting plagues in different seasonal conditions). Therefore, farmers use more agrochemicals than necessary for their specific crops, which may cause environmental

harm (e.g., chemical runoff). The knowledge gap regarding the use of sustainable practices can lead to a compromise in the quality of their produce.

Structure of supply chain (25.0%): Like the sentiment emerging from supply chain players, the lengthy supply chain most likely leads to high (usually inflated) prices of produce. Overall, some intermediaries earn significantly larger profit margins compared to farmers.

> *"One of the main challenges of the supply chain will always be to eliminate intermediaries that may exist between any of the links because this will allow the farmer and the packer to sell at better prices and the consumer to buy at better offers. I do not think it is a problem that has arisen recently, but it is a business problem in which someone sees an opportunity and has the necessary contacts and enters the chain. Intermediaries, or coyotes (as they have always been known), have always existed, the biggest problem is that the farmer or the packer does not have contact with the supermarket directly or with the final consumer, so there are people in the middle who have contacts with that final consumer, and these are used to enter the chain, they come in contact with farmers and packers, to offer their services, they buy the merchandise and resell it in the United States."*
> – ***Transport and Storage Service provider***

Environmental concerns (20.0%): Service providers had similar opinions as stakeholders regarding environmental concerns. Changes in climate and other environmental problems can damage crops, impairing the harvest for that year. The inability to mitigate or manage pests and plagues due to a lack of knowledge can lead to damaged crops that are not fit for sale. On top of this, most smallholder farmers do not have crop insurance coverage, meaning they are not covered if they suffer a loss of crops, leaving them without food and income.

5.2.3.4 Horticulture Supply Chain and the COVID-19 Pandemic

The COVID-19 pandemic brought economy-wide disruptions in Mexico, which affected nearly all sectors, including those food-related. Stakeholders in the current food supply chain who are reliant on other companies to carry out their services, could not continue functioning. For example, one distributor had to source alternative papaya farmers as their previous partner had a lack of manpower able to work on the farm. According to the World Bank [31], an increase in the economy's unemployment rate from 3.5% in 2019 to 4.7% in 2020 was observed.

Economy-wide measures such as social distancing and establishment closures led to a decreased demand for produce from specific channels such as restaurants and hotels. In contrast, there was an increase in demand from supermarkets and modern retail channels. Supermarkets, which saw their opening hours extended, became the leading retail channel. Other informal channels such as traditional markets or street vendors were forced to close or operate within reduced periods.

Given the temporary closure of the main supply centre due to social distancing measures, a shorter and more direct supply chain emerged. Farmers found ways to adapt by selling direct to consumers using e-commerce or digital platforms. Classed as an essential business and therefore still able to operate under government-imposed restrictions, farmers found new ways

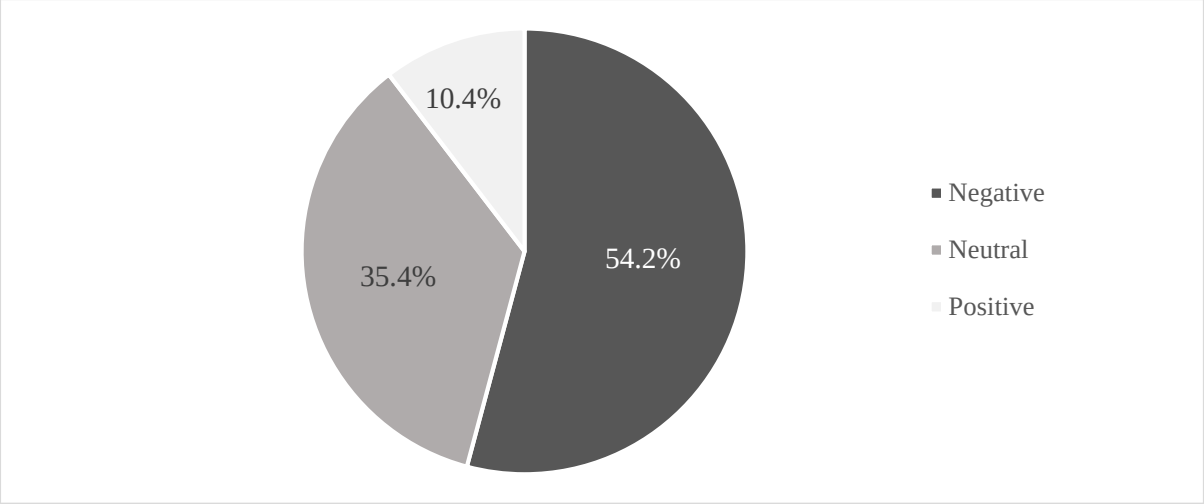
to reach customers. For example, some drove their trucks around neighbourhoods, selling their produce directly to consumers.

For the export market, regulations became stricter and higher standards were required due to safety and hygiene protocols. The respondents (who were exporting) had to attend training sessions on the new exportation rules and obtain new certificates to ensure compliance.

5.2.3.5 Perceived Impact of the COVID-19 Pandemic on the Supply Chain

Stakeholders and food service providers gave insight into the COVID-19 pandemic's impact and implications on the horticulture supply chain. The majority of respondents (54.2%) viewed the impact to be negative, while 35.4% of respondents remained neutral. A minority (10.4%) viewed the impact to be optimistic (Figure 5.5).

Figure 5.5. *Perceived Impact of the COVID-19 Pandemic on the Supply Chain in Mexico (n=48)*



Source: Spire Conducted Interviews, 2020

Note. Respondents categorised as 'Positive' could also provide negative comments and vice versa.

Positive (10.4%): A minority of respondents shared the COVID-19 pandemic's positive impacts on the supply chain, despite the disruptions. This is primarily due to the following factors:

- *Increased direct sales (an improved and more efficient supply chain).* The number of direct sales by farmers increased during the COVID-19 pandemic. Farmers had an opportunity to provide home delivery services to consumers located nearby. The convenient and direct delivery service to consumers' homes benefitted farmers by providing them with an alternative (new) sales channel. Moreover, it skipped the need to engage intermediaries who can pass on their costs to farmers.
- *Change in consumption patterns.* The Mexican media's emphasis on eating healthier to improve immune systems to better cope with the COVID-19 pandemic also had a

positive impact on sales. In particular, the sale of fruits associated with Vitamin C (e.g., citrus fruits) saw a considerable increase in demand.

Negative (54.2%): However, more than half of respondents had negative views towards the impact of the COVID-19 pandemic on the supply chain. The explanations included:

- The decrease in labour productivity as a result of preventing the spread of the COVID-19 pandemic led to disruptions across the entire supply chain. For example, factory operations that manufactured packaging (e.g., cardboard boxes) intended for transporting horticulture produce were halted, meaning the produce could not be adequately packed to prevent damage during transportation. In another example, laboratories that were used to produce seeds were also closed.
- Some stakeholders with limited networks struggled to find new alternative retail channels. Many stakeholders were forced to dispose of the unsold produce that had spoilt.

5.2.3.6 Perceived Resilience of the Supply Chain to the COVID-19 Pandemic's Impact

In contrast to the respondents' negative views, the majority of respondents considered Mexico's supply chain to be resilient (see Figure A6 in the Appendix).

Supply chain is resilient (74.0%): Almost three-quarters of respondents felt that the supply chain is and will continue to be resilient. The most common factor contributing to resiliency was the continuous demand for food. Another factor positively impacting demand is the emphasis on healthier eating that emerged during the health-related crisis. Farmers could sustain their operations by catering to this new consumer preference and by marketing their produce as offering a healthy food alternative.

The respondents also mentioned that businesses adapted to the new normal, incorporating personal protective equipment (PPE) using sanitising mats and requiring workers to regularly wash their hands to ensure the environment was clean for both employees and consumers.

Supply chain is not resilient (26.0%): Over a quarter of respondents felt that the supply chain was not resilient due to the heavy reliance on Central de Abasto in Mexico City, which is the economy's main market of horticultural goods. The onset of the COVID-19 pandemic prohibited the distribution or transport of horticultural goods into Mexico City from other states. One respondent said that 70.0% of Central de Abasto was closed. This meant that fewer or no business opportunities were available at the beginning of the COVID-19 pandemic. With the COVID-19 pandemic approaching Central de Abasto, many farmers believed the supply chain was not resilient.

5.3 Section 3: Services Engaged in the Horticulture Supply Chain

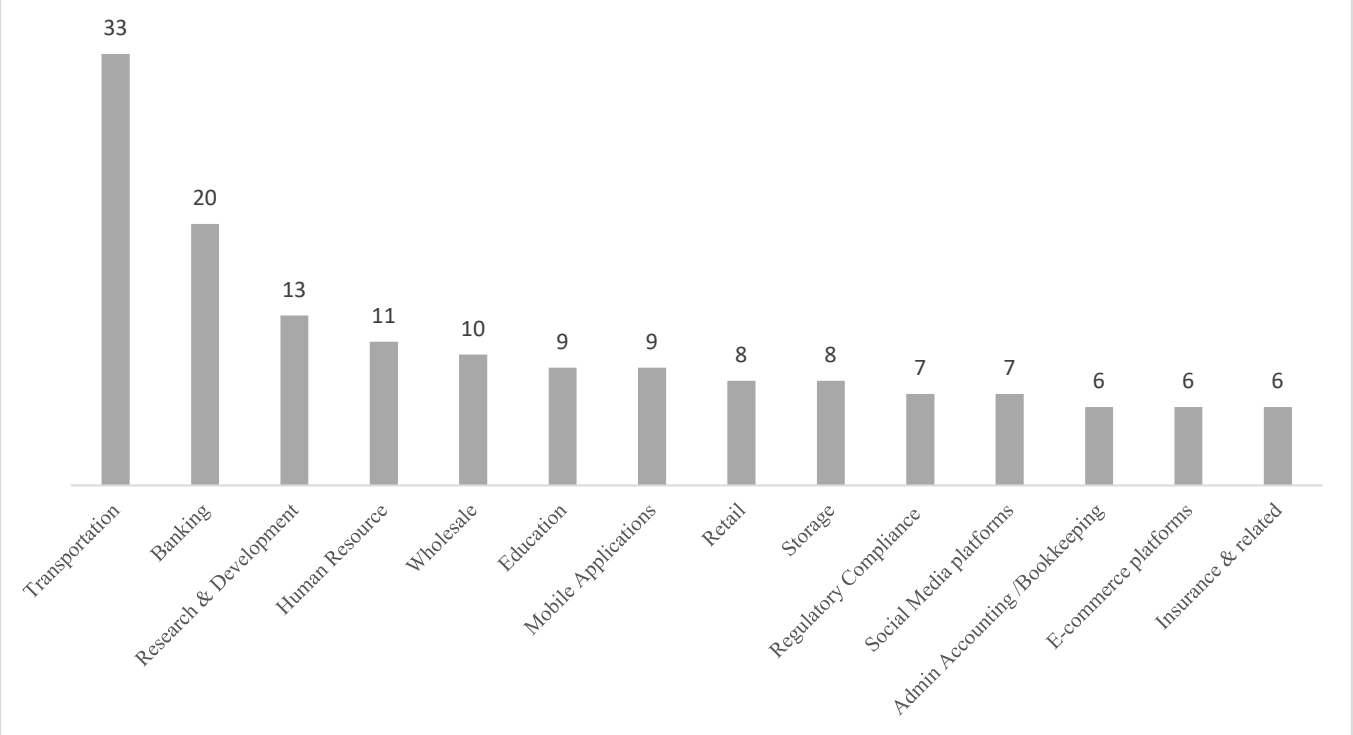
This section explores the interactions of food service providers and the supply chain (and supply chain players such as farmers, processors, and distributors), uncovering the impact of services on food security.

5.3.1 Perceived Importance of Various Services to Food Security

Services play an essential role in ensuring the continuity of the food supply chain. Across different economies, the impact of services on the supply chain is likely to vary. Some services may bring little added value to the resiliency of the supply chain due to structural restraints such as culture or the regulatory environment. However, these issues could change in times of unprecedented events, such as the COVID-19 pandemic. The horticulture sector shares key traits across economies that make specific services highly important. For example, storage services are essential to preserving the quality of fresh produce as fruits and vegetables have a fixed shelf life.

During the interviews, the respondents ranked their top three services for ensuring food security in the horticulture sector. To ensure the rankings accurately represented all of the respondents' scores, services ranked first were given a score of three, second a score of two, and third a score of one. The top three services identified were transportation, banking, and research and development (Figure 5.6).

Figure 5.6. Services Importance Scoring (Calculated)



Source: Spire conducted interviews, 2020

Note: Legal and Govt' (Score: 5), Financial (Score:4), Marketing and Branding (Score:4), Coordination and Inventory Management (Score:2). Other services not in the graph did not appear in any of the respondents' top three most important services. The maximum score possible for any service could be 72, while the lowest score could be 0.

5.3.1.1 Top three services and reasons for their importance

Transportation Services. The movement of produce is vital to the supply chain. Transportation ensures that produce reaches its intended destination in a manner that prevents damage and spoilage. Stakeholders can invest a considerable amount of money on transport services as almost all fresh produce is delivered to the main supply centre, Central de Abasto, before being further distributed to other smaller retail markets. Transport with refrigeration facilities is critical to ensure the fruits and vegetables maintain their quality.

According to the World Bank's LPI [29], as mentioned in Section 5.2.3, Mexico ranked 16th out of the 21 APEC economies (rank 1 indicates the best logistical environment). Based on Mexico's ranking amongst the APEC economies, there is a need to improve the standards in logistic infrastructure.

Banking Services. Credit can provide agricultural farmers with financial liquidity (economic stability) to purchase supplies and other resources (e.g., machinery, land rental, fertilisers). Formal and recognised financial institutions that usually offer subsidised rates can provide such credit. Furthermore, obtaining credit allows farmers to invest in their businesses to commercialise, upscale, and adopt better processes. However, currently, around 90.0% of the Mexican population still uses cash for their financial transactions [58]. See Table A15 in the Appendix for an example of a Mexican financial institution.

According to the World Bank's data on account ownership at a financial institution or mobile money service provider [32], Mexico is ranked 15th out of the 17 APEC economies (there was no data for Brunei Darussalam; Republic of Korea; Papua New Guinea; and Chinese Taipei). Rank 1 indicates that the highest percentage of the population (above 15 years old) owns a bank account, whereas Rank 17 indicates the lowest. Mexico has a relatively lower rate of banking penetration compared to other APEC economies.

Research and Development (R&D) Services. R&D is important to help respondents gain insight on how to improve the quality and stability of horticulture produce. It allows developments towards the latest agriculture technologies, offers solutions for crop diseases, and can increase yields. Awareness of the current developments in the sector (e.g., the use of clean energy) helps contribute to the long-term sustainability of farming businesses. The respondents felt that their clients viewed them more positively if they invested in R&D (e.g., the use of clean energy).

5.3.1.2 Services Perceived Essential during the COVID-19 Pandemic

The majority of respondents were pessimistic about the supply chain's future after the COVID-19 pandemic. (Figure 5.5). Aside from social distancing measures, (which included the temporary closure of traditional markets, supply centres, restaurants, and hotels), many local people were also reportedly wary of entering cities in fear of contracting the infectious disease. Businesses were forced to change the way they usually operate beyond just incorporating stricter hygiene measures. Services performed an integral role in ensuring the resilience of the horticulture sector despite the challenges brought about by the COVID-19 pandemic. Below is

a list of services that the respondents mentioned were useful in helping them deal with the COVID-19 pandemic:

Technology Services. With the closure of traditional markets such as La Central de Abasto to prevent the gathering of large crowds, businesses with access to the internet sought out online retail channels to keep their businesses afloat. The respondents argued that the utilisation of e-commerce platforms allowed them to continue sales and develop new customer bases, including consumers who preferred to remain at home. It is possible that the adoption of e-commerce improved the efficiency of the lengthy supply chain for some businesses.

Furthermore, all respondents spoke of a drastic increase in their reliance on online or remote communication, such as video conferencing and sending text messages or photos to update clients. Some respondents also used social media platforms to manage their business marketing.

Human Resource Services. To avoid the spread of COVID-19, business operations that required many workers needed to adhere to safe distancing measures. While operations continued, some businesses could no longer function at full capacity as fewer employees could work in the same (limited) space. Businesses implemented internal or skeletal workforce arrangements and extended logistical timelines to work around the restrictions and still meet their targets. For example, the packing of 1,000 boxes of oranges previously took two days to pack. With the COVID-19 pandemic, this increased to four days, compromising the quality of the produce.

Transportation Services. Stakeholders delivering fresh produce stopped or reduced their deliveries to cities temporarily when the COVID-19 pandemic hit. Since most fruits and vegetables come from rural areas, this eventually led to a reduced supply of produce in the cities. Stakeholders then shifted their deliveries to nearby markets or communities. Increased usage and availability of online communication channels with potential customers complemented home delivery services.

However, not all stakeholders accessed online solutions nor were able to tap into new markets. One respondent resorted to more informal means of selling by stationing themselves by the roadside to vend. It is possible that given the short distance travelled, this allowed for produce to be transported and sold without the use of cold storage facilities. See Table A16 in the Appendix for an example of a Mexican transport and logistics company.

5.3.1.3 Reported Service Expenditure by Supply Chain Players

On average, the respondents reported spending 33.0% of overall expenditure on in-house and outsourced services. The services that respondents spent most on are ranked in Table 5.2.

Table 5.2. Top Services Based on Expenditure

Rank	Service Type	% of total service expenditure (average)
1	Transportation	17.1
2	Wholesale	14.3
3	Human Resource	8.9
4	Banking	7.8
5	Retail	7.0
6	Storage	6.5
7	Legal and Gov't Compliance	5.8
8	Administrative Accounting / Bookkeeping	5.0
9	Others (Combined)	27.8

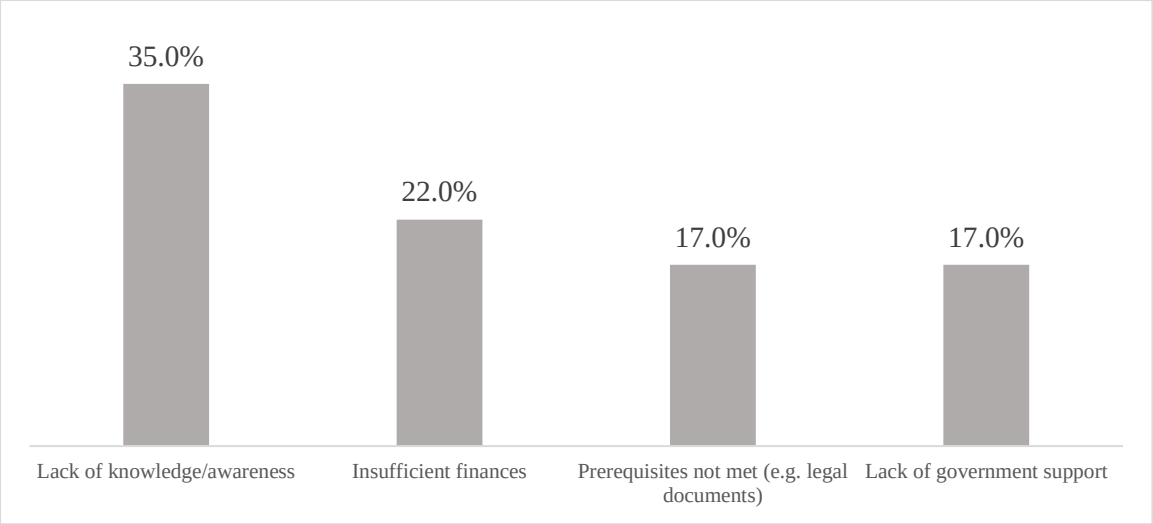
Source: Spire conducted interviews, 2020

Based on the data, the horticultural stakeholders spent the most on transportation (17.1%) and wholesale services (14.3%). Transportation, which had the highest reported expenditure, was also perceived by the respondents as the most important service. Within the current structure of the supply chain, stakeholders would send their produce to the main supply market in Central de Abasto. The cost of transportation (especially with cold storage facilities) is higher, possibly due to farmers being located far from the city or lacking connectivity (e.g., small roads).

5.3.2 Main Challenges in the Uptake of Services

Stakeholders within the supply chain described several challenges that they faced when it came to engaging services. The issues focus on the themes of accessibility, a lack of awareness and knowledge of services, a lack of financing, difficulty in meeting prerequisites, and a need for more government support (Figure 5.7).

Figure 5.7. Barriers to Engagement of Services for Farmers, Food Processors, Distributors, Government Officials, and Trade Associations in Mexico (n=23)



Source: Spire Conducted Interviews, 2020

Note. Irrelevant or non-applicable responses were excluded (n=5). Other barriers include insufficient manpower/connections (9.0%), lack of security (9.0%), others (9.0%), tedious/ long process of application (4%). Graph percentages may not add up to 100.0% because verbatims were multi-coded.

Lack of knowledge or awareness (35.0%). The most mentioned barrier by the respondents was the lack of awareness and knowledge on services, especially amongst elderly smallholder farmers. Farmers located in remote parts of Mexico employ very basic farming methods (e.g., using animals to plough land as they do not own any machinery), leading to lower quality, productivity, and even crop loss. Farmers tend to favour more traditional methods, and lack the knowledge to shift to modern farming practices.

Also, government communications struggle to reach these farmers as they live in remote areas with limited access to technology. Therefore, farmers remain disconnected and unaware of any government support for the engagement of services. The respondents said there was little knowledge and awareness of the following services:

- *Financial services.* Service providers said that horticulture farmers struggled with multiple aspects related to financing. Firstly, the current awareness of the availability of financial aid was low. Most stakeholders were more aware of the support available in previous years than what is currently available.

  Secondly, many Mexicans (including some farmers) do not have a bank account and still prefer to transact in cash. In comparison, some stakeholders could not provide the necessary documents in availing of financial services, possibly due to low levels of financial literacy. It was discussed that perhaps this lack of understanding led some farmers to develop a sense of distrust in financial institutions.

- *Educational Services.* As a result of only employing traditional farming methods, farmers cannot farm higher quality fruits and vegetables. They lack knowledge in

various areas, such as adopting farming technology and studying key market trends and transparency over how much consumers were paying for their produce. As important as it is to minimise the number of intermediaries, it is equally essential to make farmers aware of their actual market value. Thus, there is a strong need to improve awareness and encourage participation in training.

- *Technology services.* Incorporating technology solutions can benefit smallholder farmers who practise traditional farming methods. Though technology may not be readily available to all stakeholders, possibly due to lack of digital infrastructure and cost, some service providers found ways to make it more accessible (e.g., farmers can rent technology tools instead of purchasing the equipment). On the latter, technology service providers felt the responsibility to generate more awareness of the benefits of their services.

  It is useful to note that even if a service provider successfully gets the farmers or stakeholders to adopt a new process, the benefits typically take some time to acquire. As such, farmers can prematurely terminate the use of the service and go back to their traditional methods (service discontinuation). To avoid discontinuation, it is crucial to provide education and support (e.g., hotlines) during the beginning and for troubleshooting, and establish a sense of trust with farmers.

Insufficient Finance (22.0%). As mentioned in the previous section, the current domestic supply chain structure hinders some farmers (especially smallholders) from earning their fair share of the profit margin. As a result, farmers may earn just enough to sustain their operations but not enough to capitalise on their business. Using any services beyond the necessities (e.g., transportation, wholesale, and retail) is a 'luxury' smallholder farmer cannot afford. As shown in Table 5.2, essential services such as transportation and wholesale account for a large portion of a farmer's expenditure, possibly implying that these services can be costly and unaffordable for smallholder farmers.

The service providers had similar opinions as stakeholders, arguing that the main barriers to the uptake of services were the lack of knowledge and insufficient finances.

> "*Information about these topics is lacking and also accessibility to these services.*" – **Technology Service Provider**

Prerequisites not met (17.0%). On top of low financial literacy, stakeholders find it difficult to meet the conditions when applying for financial services. For example, farmers have to produce quality fruits and vegetables that meet the required market standards and implement mandated processes to control plant diseases (e.g., avoid using chemicals on the crops). Others struggle to provide guarantees or endorsements. It is usually the smallholder farmers who require financing the most.

Many smallholder farmers are not familiar with handling administrative processes with ease. Applications for financing require farmers to submit numerous documents indicating the flow of working capital and fixed assets, which are documents many farmers do not have.

Lack of government support (17.0%). Stakeholders living in the remote parts of Mexico were the least likely to receive information on government support for the services engagement. Other than the awareness of available government support being a mentioned barrier, the respondents felt that there is room for improvement on the depth and the scope of the support (for more information, see Section 5.4).

> *"I think that within the supply chain, the one who has the hardest time accessing these three services, unfortunately, is the farmer and even more so the smaller farmers. Because I consider that they are lagging in every way, and sometimes there are many requisites that prevent them from having access, regardless of the programmes that already exist. As for the programmes that already exist, they are very focused on small-scale production, which allows them to feed themselves at a family level, but if they want to take it to a larger level, they do not allow them."*
> – ***Retail and Wholesale Service provider***

5.3.2.1 Main Challenges in the Uptake of Services during the COVID-19 Pandemic

The COVID-19 pandemic brought about numerous aforementioned challenges, associated with the accessibility of services.

Increased cost due to lack of manpower. The respondents saw transportation services with refrigeration capabilities to be costly but necessary to prevent food wastage. As the service requires capital, refrigerated transportation is not accessible to all stakeholders.

Furthermore, the cost inflated during the onset of the COVID-19 pandemic as businesses had to comply with healthcare and hygiene protocols (e.g., swab tests, temperature taking). Based on the accounts of many respondents, some people feared contracting COVID-19 and stopped reporting to work. As a result, companies involved in distribution were unable to operate at their full capacity. Due to the limited number of distribution services available, based on the account of interviewed stakeholders, some companies increased their charges during the initial stages of the COVID-19 pandemic. Farmers had no choice but to pay premium prices to distribute their products.

Temporary closure of offices. The temporary closure of government offices with no alternative online solutions delayed the operations of some businesses and disrupted the supply chain. For example, transportation companies require a government-approved licence for each vehicle to operate. Operating a vehicle without government approval can lead to a fine or penalty.

Additionally, warehouses that were closed or overstocked resulted in little space to adequately store incoming produce. Though stakeholders tried to sell off as much produce as possible, higher amounts of unsold produce resulted in significant losses to stakeholders.

5.4 Section 4: Government Support for Horticulture and Agriculture

In 2019, the Government of Mexico published the National Development Plan (NDP) to cover 2019 to 2024. The plan specified economy-wide objectives, strategies, and priorities in pursuit of Mexico's inclusive and sustainable development. One of the objectives was to address food dependency by undertaking government-initiated programmes. As stated in Section 5.1 (Mexico Agriculture Secretariat), the roster of programmes include; (1) Production for Wellbeing Programme, (2) Rural Development Programme, (3) Sustainable and Social Agricultural Markets Programme, (4) Guaranteed Prices for Basic Food Products, (5) Livestock Credit Programme and (6) the Fertiliser Programme [59].

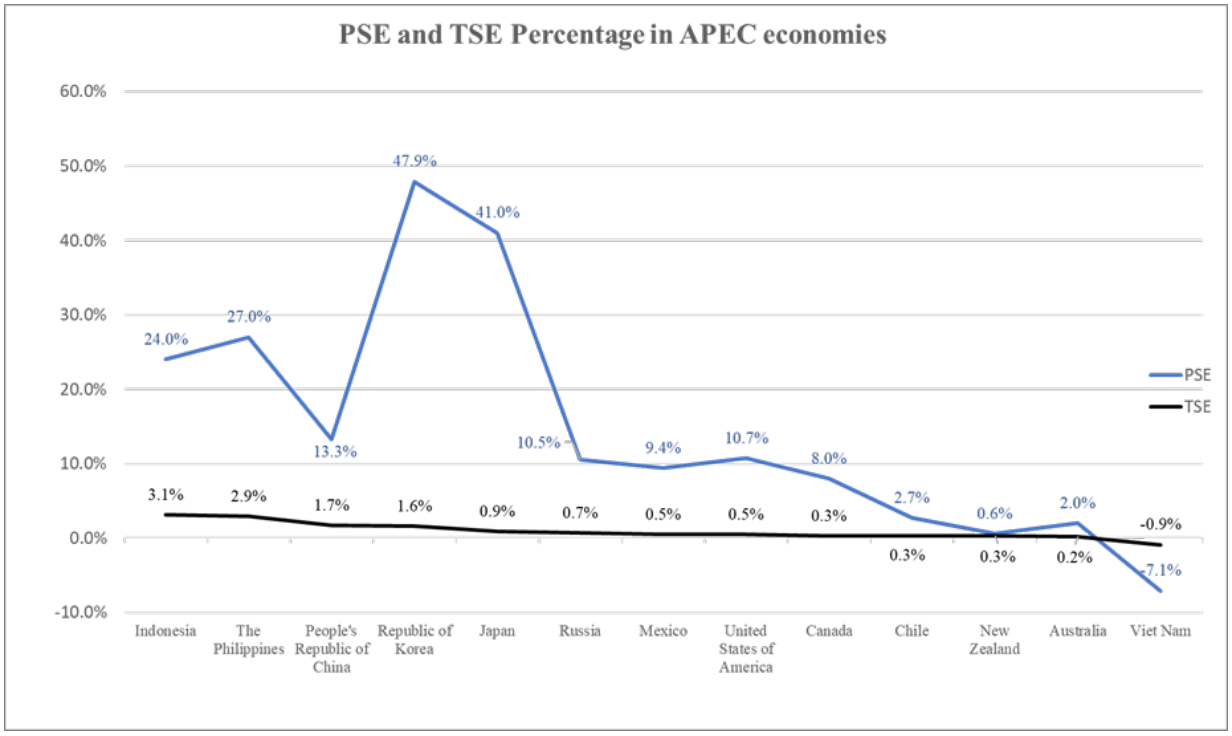
Aside from the list above, there were additional forms of support according to the Ministry of Interior:

- The **support programme for coffee and sugarcane growers** in Mexico, where 250,000 coffee and 170,000 sugar cane farmers benefit from monetary assistance. The grant aims to promote the revival of coffee plantations, the implementation of sustainable practices, product and biodiversity diversification or conservation, as well as the use of better genetic material, soil, and water.
- The **creation of the Mexican Food Safety Organization (SEGALMEX)**. SEGALMEX aims to centralise the purchase and distribution of commodities to make food and basic goods accessible to marginalised communities through the participation of DICONSA and LICONSA (stores across Mexico supported by a network of warehouses in both rural and urban areas).

Mexico's Total Support Estimate (TSE) evaluates the size of the government's support for agriculture. According to the OECD, Mexico's TSE amounted to USD 56.2 billion in 2018 [36]. The TSE has three main categories of support – the PSE, GSSE, and CSE, mentioned earlier in Indonesia Report Section 4.

The TSE can also be represented as a percentage of an economy's GDP accounting for agriculture public support, where Mexico's TSE score is 0.5% (see Figure 5.8).

Figure 5.8. PSE and TSE Percentages in APEC economies



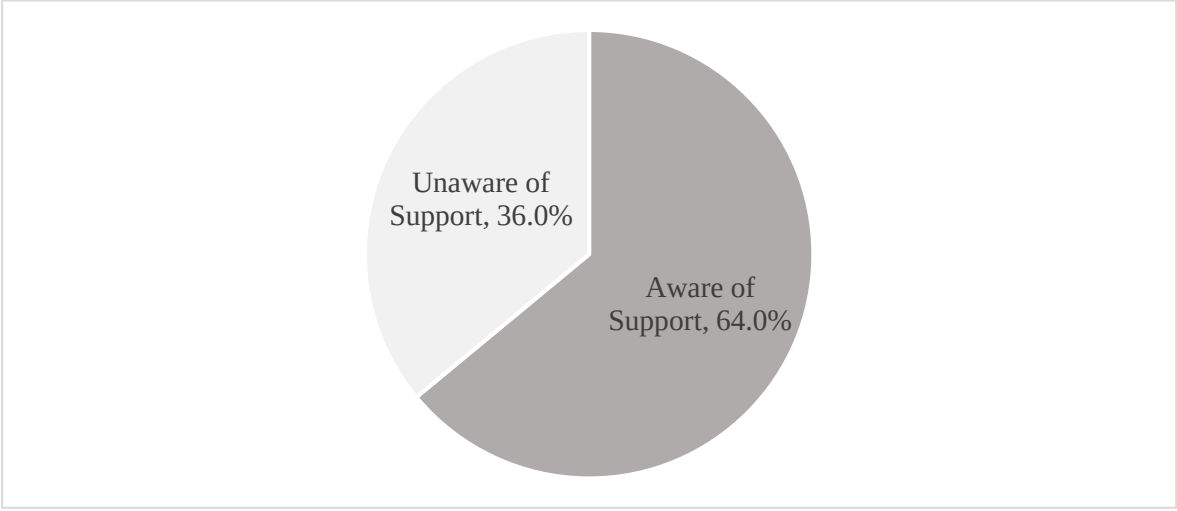
Source: OECD [36]

Note: Data not available for seven APEC economies: Brunei Darussalam; Hong Kong, China; Papua New Guinea; Peru; Singapore; Chinese Taipei; and Thailand.

5.4.1 Views on Government Support

The majority of respondents (64.0%) were aware of at least one form of horticultural government support (Figure 5.9). The respondents who were aware identified financial (e.g., microloans) as well as training and education as the most common forms of support (Figure 5.10).

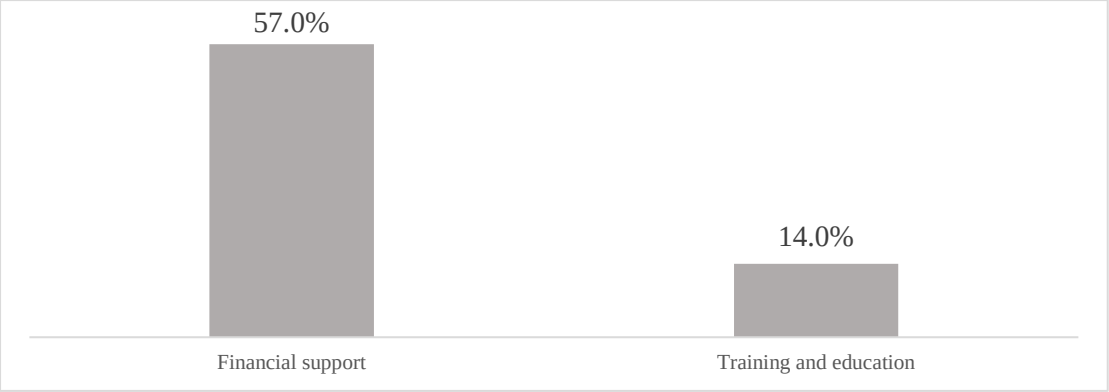
Figure 5.9. Awareness of Government Support for Horticulture Supply Chain in Mexico *(n=25)*



Source: Spire Conducted Interviews, 2020

Note. Irrelevant or non-applicable responses have been excluded (n=3).

Figure 5.10. Known Types of Government Support for Horticulture Supply Chain in Mexico (n=14)



Source: Spire Conducted Interviews, 2020

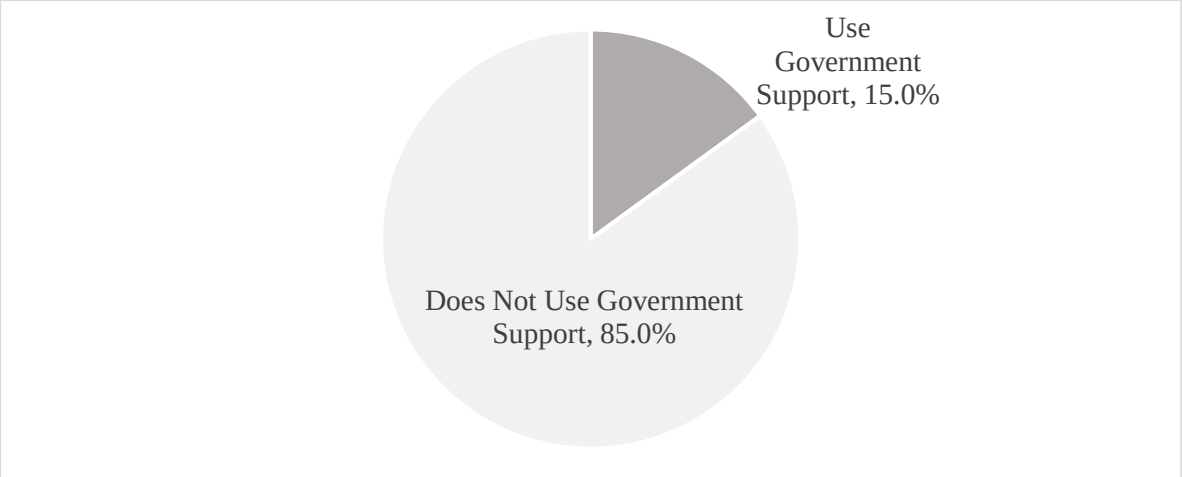
Note. Irrelevant responses where respondents lacked knowledge or did not respond were excluded (n=14). Other types of support include resources support (7.0%), public management of parts of the supply chain (7.0%), legal and administrative support (7.0%), marketing and advertisement (7.0%) and risk management for farmers (7.0%). The remaining responses were categorised under 'others' (43.0%). Graph percentages may not add up to 100.0% because verbatims were multi-coded.

The respondents said that government support usually targeted farmers, especially smallholders, more than other players in the supply chain. Some of the financial programmes mentioned included monetary grants to aid the income of farmers (e.g., Procampo Productivo) and those which help smallholder farmers increase their productivity by strengthening their assets (e.g., International Fund for Agricultural Development (IFAD)). Some respondents mentioned apprenticeship programmes to prepare the next generation of (young) workers for the agricultural sector for training and education.

Albeit aware of government support, only 15.0% of respondents said that they had used any (Figure 5.11). Some smallholders struggled to meet the set requirements to qualify for support due to limited means. Some 19.0% of respondents attributed prohibitive application processes as a hindrance, possibly contributing to the respondents' overall lack of interest in availing and learning about available government support. This lack of interest may also reflect a disconnect between the available programmes and programmes needed on the ground.

In addition, qualifiers for government support programmes were amended to be more targeted, mainly focusing on small-scale farmers living in impoverished areas [28]. Some programmes (e.g., PROCAMPO, PROAGRO, and Production for Wellbeing) were modified to target farmers with 1) less than 20 hectares of farmland, 2) living in highly marginalised indigenous communities, and 3) based in the south-eastern states. A handful of stakeholders interviewed said they no longer qualified for the support that they had previously (Figure 5.12).

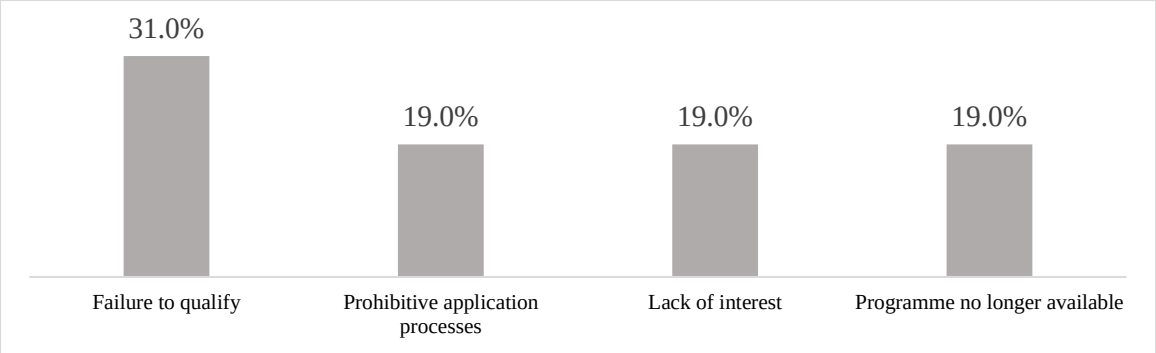
Figure 5.11. Use of Government Support by Farmers, Food Processors, and Distributors in Mexico (n=26)



Source: Spire Conducted Interviews, 2020

Note. Irrelevant or non-applicable responses have been excluded (n=2). Reasons for using government support include sizeable financial, administrative, or other benefits (50.0%, n=4) and new opportunities (25.0%; n=4).

Figure 5.12. Reasons for Not Using Government Support for Farmers, Food Processors, and Distributors in Mexico (n=16)



Source: Spire Conducted Interviews, 2020

Note. Irrelevant or non-applicable responses have been excluded (n=8). For the category of 'Programme no longer available', respondents reflected that previously used government support programmes were withdrawn or had revised requirements and level of support to the extent that the respondents are no longer using them. The remaining responses were categorised under 'others' (16.0%). Graph percentages may not add up to 100.0% because verbatims were multi-coded.

5.4.2 COVID-19 Pandemic Government Support and Measures

As the COVID-19 pandemic disrupted all segments of the food supply chain [60], SADER led support policies to aid the agriculture sector and the agro-food supply chain. SADER collaborates with supply chain players and members to ensure food supply, inventories, and distribution despite disruptions. SADER's priorities have gravitated towards key productive chains such as horticulture, grains, poultry, beef, fisheries, and aquaculture.

Agriculture-linked policies:

- In collaboration with the National Water Commission, SADER has maintained programmes related to the conservation and restoration of water infrastructure in the agricultural sector during the COVID-19 pandemic.
- One of the government's social schemes, the Sowing Life programme (Sembrando Vida), included 200,000 more farmers in 2020, on top of 200,000 jobs in 2019. Sembrando Vida distributes plants (mahogany, cedar, cacao, rubber, cinnamon, and soursop) and farming inputs for agroforestry projects to farmers living below the poverty line.

Supply chain-linked policies:

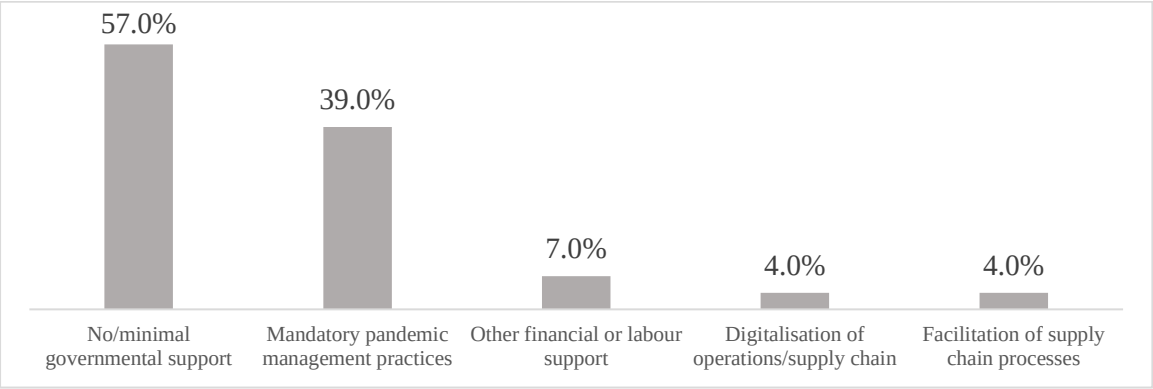
- Processes involving food imports were fast-tracked through digital services. The Centre for Documentation and Judgement (CDD) of the National Service for Health, Safety, and Agrifood Quality (SENASICA) remotely administers up to 60.0% of import processes.
- Reinforced hygiene inspection systems in food production, handling, and preparing. Also, the ministries of Colombia, Chile, Peru, Bolivia, and Ecuador held meetings to

share sanitary protocols and experiences to minimise the impact of the COVID-19 pandemic on the sector.

- The agricultural ministries of Honduras, El Salvador, Costa Rica, Guatemala, Mexico, Nicaragua, Panama, the Dominican Republic, as well as members of the Inter-American Institute for Cooperation in Agriculture (IICA), offered to create an inventory of export-ready products and food transportation protocols to ensure food distribution where it is lacking.
- Agricultural ministries of 25 Latin American economies signed a ministerial declaration committed to execute and encompass the following:
    - provide financial and technical assistance to farmers
    - ensure wholesale markets operate properly
    - implement emergency programmes to facilitate food banks and mitigate food waste
    - monitor domestic and inter-economy logistics chains
    - encourage the use of e-commerce
    - guarantee that fiscal and trade policies in place do not disrupt trade flows
    - real-time monitoring of markets

While policies were in place, most respondents (57.0%) considered the government's COVID-19 pandemic regulatory efforts lacking or minimal (Figure 5.13). According to the respondents, government offices closed and were unable to address stakeholders' concerns remotely. Many companies shouldered the costs incurred in adhering to government-mandated sanitation measures, and there was no horticulture-specific government support. On the latter, while some respondents approached the government for advice on managing their business through the COVID-19 pandemic better, other respondents also did not expect the government to provide such information without any prompting. This highlighted an unmet need for advisory support on the ground. Finally, respondents perceived that there was more support for the export-related supply chain players than for those serving local markets.

Figure 5.13. COVID-19 Government Measures identified by Farmers, Food Processors, Distributors, Government Officials, and Trade Associations in Mexico (n=28)



Source: Spire Conducted Interviews, 2020

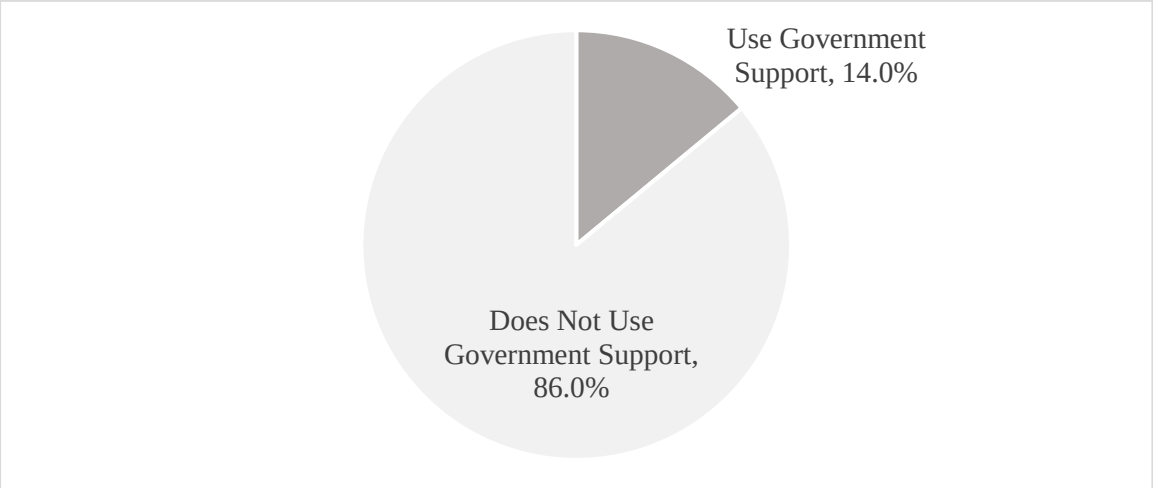
Note. The remaining responses were categorised under 'others' (14.0%). Graph percentages may not add up to 100.0% because verbatims were multi-coded.

Some 39.0% of respondents were aware that the government had implemented general measures to prevent the spread of COVID-19. The respondents said that these measures encompassed sanitation protocols (e.g., social distancing, temperature screening, mask-wearing) prioritising the health and wellness of the workforce (e.g., keeping vulnerable workers away from operations). Measures also included continuous collaboration with the private sector to monitor the COVID-19 pandemic's impact within the supply chain. A modest number of respondents also identified financial or labour support (7.0%), digitalisation (4.0%), and facilitation of supply chain processes (4.0%) as top-of-mind COVID-19 government measures.

5.4.3 Views on Government Support for Engaging Food Service Providers

With most respondents (64.0%) being aware of at least one form of agricultural government support (Figure 5.9), only a subset (14.0%) said they were currently using at least one type of government support to engage in food services (Figure 5.14). What encouraged them to avail the government's programmes were the sizeable benefits (e.g., access to capital) which provided new opportunities for them to improve their operations and productivity. On the other hand, smallholder respondents (more so for farmers) did not use any government support due to the policy priorities (e.g., addressing the COVID-19 pandemic) and the lack of information made available to them.

Figure 5.14. Use of Government Support to Engage Horticulture-Related Services in Mexico (n=14)



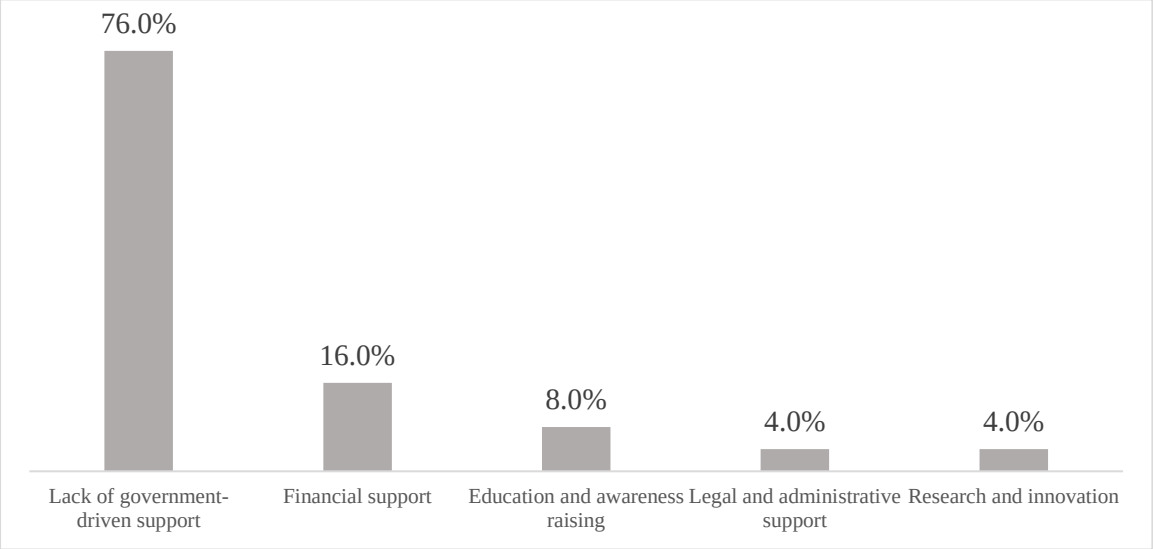
Source: Spire Conducted Interviews, 2020

Note. Irrelevant or non-applicable responses have been excluded (n=14).

In contrast, most respondents (86.0%) did not use any government support despite being aware of at least one government programme (Figure 5.14). These respondents reiterated that the coverage of support programmes was not enough for all players within the supply chain, considering that the government's primary focus was on smallholder farmers. The respondents believed there used to be more government support available, but with the recent changes to refine the list of benefactors, some stakeholders no longer qualified. As an echo to the barriers in engaging services, the respondents did not use government support due to a failure to qualify and a lack of interest, coupled with prohibitive and time-consuming application processes.

Out of the 64.0% of respondents who knew of generic government support (See Figure 5.9), only around half knew of any government support to engage services. On the latter, a higher number of respondents knew of support for financial services, followed by education and legal services (See Figure 5.15). The large majority, however, were not aware of any government support to engage services.

Figure 5.15. Awareness of Types of Government Support for Engagement of Services by Farmers, Food Processors, Distributors, Government Officials, and Trade Associations in Mexico (n=25)



Source: Spire Conducted Interviews, 2020

Note. Irrelevant or non-applicable responses have been excluded (n=3). The remaining responses were categorised under 'others' (4.0%). Graph percentages may not add up to 100.0% because verbatims were multi-coded.

5.4.4 Public and Private Initiatives Identified by the Respondents

In addition to determining the awareness of government support, the respondents also named specific programmes they were aware of. These programmes were initiated by government agencies, private companies, or institutions to support agriculture and horticulture in Mexico. Table 5.3 contains a list of respondent-identified programmes, sorted according to the overall service importance (based on reported expenditure).

There are two additional lists of programmes; (1) where the respondents could not recall the programme name but described it enough for identification (indirect), and (2) a list that includes programmes obtained through secondary research. These three programmes list (direct, indirect, and desk research) have been collated and can be found in Table A17. These lists are not intended to be a comprehensive review of all programmes or initiatives present in Mexico.

Table 5.3. Programmes Mentioned Sorted by Service Importance

Ranked Services by Expenditure (sorted by highest to lowest)	Number of Programmes per Service	Programme Names
Transportation Services	1	Fiscal Stimulus for Diesel Credit (*Estimulo Fiscal para Crédito de Diesel*)
Wholesale Service	1	Food Security Mexico (*Seguridad Alimentaria Mexicana* or SEGALMEX)
Human Resource Service	2	Pymexport Centers (*Centros Pyme Exporta*)*
		Sowing Life Programme *(Sembrando Vidas*)
Banking Services	5	Microcredit Financial Programme: Fund for Social Development (FONDESO)
		Nacional Financiera (NAFIN)
		National Foreign Trade Bank services (Banco Nacional de Comercio Exterior, BANCOMEXT)
		Altepetl: Wellness for the Field
		Established Trusts in Relation to Agriculture (*Fideicomisos Instituidos en Relación con la Agricultura* or FIRA)
Retail Services	0	*No identified programme under this service.*
Storage Services	1	Siacomex*
Legal and Government Compliance	0	*No identified programme under this service.*
Administrative Accounting/ Bookkeeping Services	0	*No identified programme under this service.*

* *Directly mentioned programmes that overlap multiple services.*

Overall, the respondents were most aware of the support programmes available for banking and human resources. However, based on Table 5.3, there is a possible gap in either the availability or awareness of support in some categories. For example, even though retail, administrative-accounting/bookkeeping, and legal and government compliance are all important services, respondents were unable to name any programmes in these categories.

The possible gaps could suggest challenges in information dissemination and outreach. It would be advantageous to improve the awareness campaigns of such programmes to aid stakeholders in need.

6 Main Findings and Recommendation

The FAO defined Food Security as "when people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life". Food-related services play a pivotal role in ensuring the continuity of the food supply chain as well as improving an economy's food security.

The current study set out three objectives: 1) to identify barriers and opportunities faced when engaging food-related services, 2) to develop policy setting and capacity building recommendations to improve access to food-related services, and 3) to provide insight into how the COVID-19 pandemic has affected food security. To illustrate these objectives, the horticulture sector (fruits and vegetables) was chosen to maximise the applicability to all APEC economies. In addition, Indonesia and Mexico were chosen as two APEC economies to base the study on.

Based on the insights derived from reviewing Indonesia's and Mexico's horticulture sector and from relevant food supply chain stakeholders' interviews, three main opportunities for food policy setting and capacity building were identified (in no particular order): 1) to improve the efficiency of the lengthy supply chain, 2) to upgrade transportation/logistical management, connectivity, and capacity; and 3) to improve the awareness, knowledge building and technical know-how of farmers. Each of these opportunities is described in detail below. Following this, we present two additional challenges (and potential solutions) the COVID-19 pandemic has highlighted: 1) the shrinking workforce and an overreliance on manpower and 2) a lack of sufficient financial reserves. Each suggested policy recommendation includes case studies to showcase solutions adopted by other economies faced with similar challenges (see Appendix B). While these case studies may not apply to every economy, the case studies are selected based on the positive outcomes of their methodologies.

Detailed elaborations on the two economies can be found in the Indonesia and Mexico profiles. Policy case studies of how other APEC economies have addressed the opportunities and barriers described below can be found in Appendix B.

Opportunity 1: To Improve the Efficiency of Supply Chain(s)

Throughout this research, the presence of lengthy supply chains was cited as a challenge, with fruits and vegetables changing hands multiple times and an excessive number of intermediaries separating farmers from downstream markets. Nearly a third of horticulture stakeholders indicated that the supply chain structure was the main challenge to them. For example, a Mexican stakeholder said there could be up to six different intermediaries involved.

With the social distancing restrictions imposed during the COVID-19 pandemic, farmers could not rely on intermediaries as before and were pushed to seek new markets (due to the closure of primary markets such as physical marketplaces, hotels, restaurants, and cafés) or consider new sales channels.

A lengthy supply chain results in the following:

i. **Disproportionate profit margins** – 42% of Indonesian stakeholders interviewed mentioned price fraudulence. Some intermediaries pressure farmers to sell at lower wholesale prices, increasing their profit at the farmers' expense. In other cases, intermediaries can earn three to four times more profit than a farmer from selling produce,

constraining farmers to a subsistence farming, 'the practice of growing crops and raising livestock sufficient only for one's use, without any surplus for trade' hence not having the means to invest or innovate in the product, services, or processes.

ii. **Increased risk of food wastage**– Food wastage is not only the disposal of produce that is unsuitable for consumption but also encompasses the loss of quality, such as lowering moisture or weight [61]. Firstly, efficient and effective communication is vital for supply chain players. Fragmented information sharing and a lack of communication can result in disruption and inefficiencies and, eventually, the wastage of fruits and vegetables. Secondly, produce spends more time in transit than at downstream markets, potentially shortening its shelf life. The lack of adequate storage and warehousing standards further contributes to an increased risk of food wastage. Though cold storage would be the better investment, this is not affordable for all farmers. Thus, a good-enough storage facility would be a better-suited solution.

iii. **Lack of transparency and traceability –** Paper tracking and manual inspections can be slow and prone to human error [62], reducing transparency along the supply chain and making it challenging to enter new markets such as export. A more efficient supply chain can allow for standardisation and early identification of wastage and food safety. At the same time, proper track and trace systems may help farmers tap into new export markets. Based on an interviewed expert's opinion, traceability has double benefits that enable the agribusiness community to identify which farmers caused an issue (e.g., introduced a contaminant) and signal farmers that they can be tracked, pushing them to adopt higher operational standards.

Policy Recommendations:

To solve these issues, based on the research, we recommend the following:

a. **Facilitate better access to new markets through the uptake and technical development of agricultural e-commerce platforms.** An e-commerce platform with a user-friendly application (i.e., easy to use, mobile and desktop compatible, etc.) could help close the gap between farmers and downstream markets, reducing farmers' reliance on intermediaries. Governments may bridge the gap between farmers and new (and wider) markets by optimising partnerships with existing e-commerce platforms (e.g., Tokopedia in Indonesia or Mercado Libre in Mexico) to facilitate the creation of more efficient sales channels. Technology often adds value to existing processes, making businesses more profitable, efficient, safer, and environmentally friendlier.

- **Implementation Mechanism:**
    i. Governments may spearhead the horticulture e-commerce initiative in collaboration with the private sector, leveraging on existing platforms. These platforms should integrate information relevant (and more valuable than existing solutions) to both consumers and stakeholders and serve as logistic solutions that allow disintermediation and shortening of the supply chain.
    ii. Feature(s) of interest could include a list of transportation or cold storage service providers or the use of freelance delivery vendors, for example.
    iii. Over time these platforms need to be commercially sustainable without government intervention.

- **Pros:** Evidence for the benefits of adopting an online channel can be seen from the unintended consequences of the COVID-19 pandemic that pushed farmers to look for new markets, enabling them to connect directly with consumers. In addition to an efficient supply chain and increased food security, the platform could reduce farmers' reliance on intermediaries, regulate pricing, and increase transparency. It may attract young people to join the farming industry, which has a rapidly ageing population. Also, such platforms help connect smaller farmers with large agribusinesses to enable the latter to buy from them – lowering transaction costs and offering the prospects of higher farmer prices or lower consumer prices.
- **Cons:** Rural or less technology-savvy farmers may be unable to access an online platform. Thus, governments may need to improve rural infrastructure, specifically internet-related ones, and communicate, promote, and provide training for using such a platform. It could also take time to develop and implement, especially if governments do not collaborate with existing e-commerce platforms.

Opportunity 2: To Upgrade Transportation/Logistical Management, Connectivity, and Capacity

Nearly one-fifth of stakeholders' expenditure was spent on transportation services. Transportation is viewed as an essential service that consumes one of the largest proportions of stakeholder expenditure. Poor connectivity to rural areas, a lack of cold storage facilities, and a reliance on traditional transportation (e.g., open-air trucks) make it difficult for farmers to access their markets. The impact of having less comprehensive logistics and transport infrastructure results in:

i. **High cost of transportation services –** Based on an interviewed expert's sharing, the first-mile transport companies in rural areas are dominated by small local truck companies with low levels of technological capabilities, with little to no involvement of major logistics companies. This, coupled with the long travel distances and fewer direct routes, increase transportation costs for farmers and consumers. The amount of money farmers can invest elsewhere, such as in innovation to improve current processes, is therefore reduced. Improvements to logistic infrastructures could benefit both farmers and consumers.
ii. **Increased risk of fruits and vegetables getting damaged or spoilt during transit** – The current improvements in last-mile logistics have not been mirrored in first-mile logistics, resulting in nearly 50.0% of food wastage and the loss of quality of fruits and vegetables when not stored in proper conditions [63].
iii. **Reduced access to markets –** Distribution can be challenging in economies with dispersed populations and challenging landscapes (such as Indonesia). Especially for smallholder farmers, situated across numerous far-flung areas, it becomes uneconomical for transporters to collect small volumes of produce from these farms. These farmers also lack adequate infrastructure to consolidate produce for collection or be stored at a controlled temperature with conditions that help preserve quality [63]. Improving logistics infrastructure can lead to investments to develop rural-based supply chains, leading to higher rural employment levels and economic development beyond the horticulture industry.

Policy Recommendations:

To solve these issues, based on the research, we recommend the following:

a. **Improve transit infrastructure**

Creating and enhancing strategically located road infrastructure can facilitate efficient and effective transportation networks and benefit stakeholders throughout the supply chain.

- **Implementation Mechanism:**
  I. Identify zones of significant supply and demand under-served by roads or alternative transit routes like rivers and waterways.
  II. Alternatively, upgrade previously disadvantaged production zones. Upgrading plans can be prepared based on projections of future produce traffic.
  III. These plans may include developing new roads, widening existing roads, and enhanced maintenance regimes for existing roads.
- **Pros:** Improve rural accessibility and facilitate efficient transportation, which is important for perishables like horticulture. Farmers will have easier access to intermediaries and export markets, consumers will be offered a more comprehensive range of produce, and logistics companies will see reduced transport and maintenance costs.
- **Cons:** Building basic infrastructure like roads is extremely costly and requires significant planning and effort to develop.

b. **Develop integrated logistics parks**

Logistics parks refer to industrial areas for activities related to transport, logistics, and distribution of goods [1]. Over the long term, such parks can improve connectivity and ensure the safe and timely delivery of produce, serving as a one-stop service centre for wholesale, transportation, and storage management. This is especially important to rural-based farmers. Rural logistic centres can connect village-level roads to economy-wide and regional roads.

- **Implementation Mechanism:**
  i. Governments may spearhead the initiative and collaborate with the private sector to launch such logistics parks. Ideally, several decentralised parks would be developed at strategic locations to maximise accessibility.
  ii. The logistic parks should provide services for agricultural produce circulation, processing, transport, distribution, and storage, and interconnect with existing logistic parks, agricultural production bases, wholesale markets, and distribution centres.
  iii. Rural markets, agricultural production collection points, and agricultural-input distribution centres could all be relocated to these logistic parks.
  iv. Office facilities could be provided to facilitate government officials and consultants interacting with farmers to develop education and consultancy.
  v. Governments may also consider partnering with private sector entities to drive the development of other related tools such as logistic information platforms or/and mobile applications, to work in conjunction with the logistic parks' operations, and effectively connect all the different stakeholders across the supply chain. Both sellers and buyers could utilise such information platforms. The government's involvement could be during the set-up stage till development, promoting the programme's uptake. The selection of the participants could be made through a tender process.
  vi. Logistic parks should be built in alignment with other developmental planning areas, e.g., city-rural logistic planning.

- **Pros:** Improved food security, creation of jobs, more efficient supply chains, centralised agriculture area, and increased efficiency for exporters. Additionally, such a hub could support the operational requirements (e.g., stores, packing houses, electricity for lights to work in the evening/dark) needed to facilitate/support the e-commerce market development.
- **Cons:** Dependent on the prior completion of specific requirements, such as connecting road infrastructure. At the start of the project, the development will require significant investments of time, funding, and coordination efforts with the different parties involved.

  This solution, compared to others, will take a longer period of time to plan and execute. It may not be feasible for economies that cannot bring onboard major logistic companies to anchor such projects. If the latter is the case, it could be a viable option to first establish ties with private organisations to develop warehousing to address the challenges with first-mile transportation.

Opportunity 3: To Improve Awareness, Knowledge-building, and Technical Know-how of Farmers

Smallholder farms make up nearly half of the population of farmers in Indonesia and Mexico. Most have low literacy rates, partake in subsistence farming, and apply very basic farming practices. The two main barriers to the uptake of services are information dissemination (being aware of the existence and the benefits of services or skills) and a lack of knowledge on topics crucial to the horticultural sector's development, which were mentioned by an average of 23.0% of interviewed service providers.

The most common problem areas are 1) technology, 2) financing, and 3) modern farming techniques. Despite most stakeholders being aware of government support and efforts to promote collectives (such as in Indonesia), farmers' uptake for such support remains low, with only one-third of farmers becoming involved. This could result in:

i. **Lower quality produce** – Local produce quality standards for the local market are lower than international/ export standards, reducing their competitiveness against imported produce. Farmers often have little capital to improve their processes to enter the export market. Higher quality produce could lead to increased demand and sales (e.g., export opportunities), reduce the need for costly intermediaries, facilitate increased earnings for farmers, and allow for more investment in other forms of innovation.
ii. **Inefficient processes/non-scalable businesses** – A lack of innovation leads to less efficient, laborious farming methods. Also, some traditional farming methods can be detrimental to the environment (such as inadequate levels of fertiliser use). Some farmers' crops are also vulnerable to unfavourable weather conditions worsened by global warming's evolving effects.
iii. **Low uptake of other services to improve processes –** Other than on essential services (e.g., transportation, storage), stakeholders are less willing to spend on technology, business, or marketing services. This could be further exacerbated by stakeholders wanting to receive the immediate benefits from their investments rather than waiting an undeterminable (but extended) amount of time.

iv. **Under/Non-utilisation of government support/ membership in farmer groups for process improvement –** Most stakeholders focus on essential services and do not utilise government support for engaging other 'non-essential' services (e.g., technology, business). Many administrative processes required to access government support are challenging for less-educated farmers, deterring many potential beneficiaries from applying for support.

Policy recommendations:

To solve these issues, based on the research, we recommend the following:

a. **Offer extension and training services to farmers.**
   - **Implementation Mechanism:**
     i. Governments may spearhead education initiatives, identifying the type of curriculum that is most beneficial for farmers.
     ii. Governments could engage influential farmer groups, associations, and private organisations to identify, develop, and conduct the most beneficial education programmes. Having their endorsement is crucial to ensure uptake [64].
     iii. Governments may consider deploying consultants to encourage and train farmers to use support programmes in the initial months of the roll-out. This depends on the cultural preferences of different modes of communication that can be utilised. For example, Indonesian farmers are accustomed to using chatroom platforms, especially during the COVID-19 pandemic. Thus, the extension officers will be able to share technical and market knowledge with hundreds of farmers in the chatroom.
     iv. Though not a topic that surfaced during the current research, according to the World Bank [65], women farmers have significantly less access to agriculture extension services, highlighting the need to identify suitable channels of engagement that would be apt for all genders (e.g., online workshops).
   - **Pros:** Improving the education of farmers on agriculture knowledge and technical know-how can help improve food security (increased efficiencies can lead to increased yield), improved produce quality, and earnings. In addition, promoting awareness and sustainable farming practices may mitigate environmental issues and better prepare stakeholders for the global warming challenges ahead.
   - **Cons:** It could be challenging to implement a large-scale education campaign. Firstly, sending educators out to rural villages to teach farmers who do not have access to the internet (e.g., online resources) would be very time-consuming and labour intensive. Even having central locations for classes could be challenging to encourage farmers' attendance. Secondly, prior research needs to be done to identify the regionally specific curricula (e.g., which crops to prioritise or grow based on the environment, and implement sustainable agricultural methods). An economy-wide programme may not be practical nor economically feasible.

b. **Promote agriculture mechanisation tool sharing amongst stakeholders through equipment-lending networks, low-cost rental services, or equipment-sharing clubs.**

   - **Implementation Mechanism:**
     i. Equipment-sharing initiatives can be led both by large-scale farmers (private) or by the government.

ii. In equipment sharing clubs, a third-party group is responsible for leasing and maintaining the equipment for the farmers. Larger cooperatives or governments can purchase equipment cheaper through wholesale channels.
iii. Farmers, especially those more senior and less tech-savvy, will need support, such as training on how to utilise new equipment or tools. Thus, it would be important to invest in offering such agriculture extension services.

- **Pros**: To provide farmers with accessibility to previously unaffordable equipment. Furthermore, trial and observation of innovative equipment use could decrease the associated adoption barriers, and encourage equipment adoption.
- **Cons**: Owning and maintaining equipment requires upfront investments. Farmers may still shoulder some form of financial participation to use the equipment, e.g., through seasonally leasing rather than buying the equipment.

COVID-19 Learnings Points

The COVID-19 pandemic exacerbated ongoing challenges faced by the Horticulture industry, particularly in the areas of a shrinking workforce and financial access.

For more details: see Indonesia and Mexico in Sections 2, 3 and 4: segments on Horticulture Supply Chain and the COVID-19 Pandemic, Services Perceived Essential during COVID-19 Pandemic, and COVID-19 Pandemic Government Support and Measures.

Challenge 1: Shrinking Workforce and Overreliance on Manpower

Before the COVID-19 pandemic, labour supply was an ongoing challenge for the horticulture industry, where stakeholders were faced with a decreasing labour supply (including an ageing workforce). One known reason is due to a lack of youth interest in farming, leaving an ageing workforce. Furthermore, most farmers often rely on labour-intensive and traditional methods of operation. When the COVID-19 pandemic occurred, this disrupted the supply chain's status quo and underlined the need to adapt. Businesses had to adhere to large-scale social distancing measures and work around the reliance on the larger number of workers and manual procedures for processing and distribution. Eventually, there were also increases in unemployment rates as the COVID-19 pandemic dragged on and forced businesses to fold or let employees go. This led to decreased productivity, delivery delays, and even the closure of some establishments or factories. For example, a Mexican factory that manufactured packaging (e.g., cardboard boxes) halted operations, meaning produce could not be adequately packed to prevent damage during transportation.

To make up for the lack of a horticulture workforce, smart farming (including the adoption of automation and provision of technology) in general offers one permanent solution. Given the nature of horticulture production, the complete technological replacement of labour-intensive work may not be feasible. Yet, with recent technological advancements (improved mechanisation), automation has proven to be suitable for activities such as packing and sorting, reducing the physical demands on workers and the requirement for their physical presence at the workplace. This approach, driven by smart farming through digital technology, suggests that farmers can act as managers of their crops rather than labourers, to avoid repetitive, physically-demanding, and tedious tasks in the field [66].

Policy recommendations:

a. **Develop programmes to encourage uptake of technological tools and automation practices.**
    - **Implementation Mechanism:**
        i. Policymakers may stimulate the adoption of technologies that can improve horticulture sustainability by 1) ensuring coherence in existing technology-related policies, especially in the areas of agriculture, trade, environment and R&D; 2) identifying the most suitable technologies for stakeholders; 3) analysing which are the most effective and efficient ways to disseminate information and encourage adoption and incorporation of technologies.
        ii. The communications plan can be developed by utilising the most suitable channels for interaction and information dissemination, serving as a platform to educate farmers on how the programme may benefit them in the long run.
        iii. To maximise the advantages of adopting advanced horticulture practices, training and education programmes should be rolled out to supplement communication outreach efforts. Agriculture extension officers should be available to provide support (e.g., technical assistance) to stakeholders.

    - **Pros:** Opportunities in smart farming for horticulture or agriculture in general are growing, offering promising solutions in handling labour shortages and declining productivity or profitability. Innovations reduce farm operating costs, in the long run, boost efficiency, and reduce reliance on manual labour in completing field tasks. Furthermore, the incorporation of smart farming may attract young people to join the farming industry, as they are often more eager to learn and apply modern agriculture technology.
    - **Cons:** Like most innovations, there are limitations in the early stages of technology adoption. Most smallholder farmers do not have enough resources or capital to acquire certain technologies, while traditional farming is still the preferred approach. Without sufficient identification and planning of automated practices, fast adoption may leave stakeholders vulnerable to a wide skills gap where workers are not competently trained to handle technological tools.

b. **Enable industry dialogues and collaborations to foster automation in food production and distribution.**
    - **Implementation Mechanism**:
        i. Facilitate a wider participatory dialogue involving private-public task forces or expert working groups amongst industry leaders or stakeholders, farmers, automation service providers, non-government organisations on sustainable farming, and researchers to drive the conversation on how best to adopt automation in food production and distribution. The following areas of discussion may be explored:
            a. Forms of support/incentives for automation service providers.
            b. Roadmap for businesses in adopting automation in the workplace.

c. Possible collaborations among research and development institutions.
d. Prepare for potential labour displacement through the development of government employment relief schemes that enable companies to minimise staff retrenchment, including employee engagement and staff reskilling activities.
e. Learnings from stakeholders, e.g., upstream and downstream sectors or service providers, may influence farmers' technology adoption. However, they can also learn from farmers, so such technologies take into account the implications on the farming sector.
f. The key role of off-road equipment manufacturers should agricultural robots be considered as the next generation of farming machines.

- **Pros:** Policymakers benefit from industry dialogue, as it can reflect a broader range of issues and perspectives. Participating working groups or task forces collaborate to provide remedies to issues in an engaging space.
- **Cons:** Effective industry dialogues require long-term objectives supported by intensive yet instructive research to identify which technology best practices should be adopted at different supply chain points. Without proper follow-throughs, such as the development of criteria to track adoption progress, industry dialogue objectives can be short-lived. Thorough ex-post assessments could raise accountability and ensure new issues are addressed before investments are further made.

c. **Encourage adoption of seasonal work arrangements**

- **Implementation Mechanism:**
  i. Develop seasonal worker programmes to accommodate planting and harvest peaks to assist rural farmers when local labour supply falls faster than demand (e.g., movement of city-dwellers to the rural farmlands). Individuals approved for the programme may be given goods or monetary incentives for their relocation during peak seasons. Governments may scope down their targets by prioritising the unemployed, homeless, or those living in disaster-prone areas for example.
  ii. Available jobs must also match potential workers' skillsets and the needs of the provinces or farms they return to. Alternatively, skillsets could be taught too.
- **Pros:** Encouraging the movement of workers in the city to the rural farmlands to remedy the shrinking workforce may address population growth, urban migration, and the interrupted flow of migrant farmers as the COVID-19 measures called for restricted movements across borders.
- **Cons:** There is a risk that the programme benefits may be short-term until the economy recovers from the crisis. Boosting sustainable employment in the provinces will be crucial.

Challenge 2: Lack of Sufficient Financial Reserves

As supply chain stakeholders allocate their financial resources based on short-term market signals, less attention gets paid to building sufficient and sustainable financial reserves for emergency use. The COVID-19 pandemic highlighted businesses' need to be financially prepared for long-term (years-long) and not just short-term (months-long) emergencies. In addition, the sharp economic downturn reduced purchasing power, and fluctuating product prices during the crisis left stakeholders and farmers with fewer financial resources, especially with the restricted access to traditional markets.

Aside from having less cash flow to continue daily operations and to survive until the next crop cycle, respondents from both economies ranked inadequate financial know-how as the main deterrent for the uptake of financial services (further elaboration can be seen in the previous section *Opportunity 3*).

Policy recommendations:

a. **Immediate provision of financial relief programmes**
   - **Implementation Mechanism:**
     i. Financial relief in the form of temporary interest-free plans or payment deferments can be rolled out quickly and efficiently to serve as a safety net for disaster-affected households. Ideally, this is accompanied by simplifying banking requirements (e.g., fewer administrative processes). However, recovery should focus on facilitating long-term resilience. It is important to prevent developing reliance on interest-free loans, as these are temporary solutions (short term).
     ii. Governments will be required to effectively communicate their programmes to less educated and less financially adept stakeholders/farmers or beneficiaries through economy-wide communication, education, and promotional campaigns.
     iii. Better financial access can also be provided to women in farming. From research by the World Bank [65], female farmers have significantly less access to farming finance, despite making up nearly 49.0% of rural farmers (for low-income economies). Women earn nearly 40.0% lower than male farmers in rural areas [67].
   - **Pros:** Better access to credit can stabilise a company's financial position, allowing it to operate even in times of long-term crises. Access to credit may also help cover operational costs and increase businesses' working capital.
   - **Cons:** As previously alluded to, the possibility of creating a dependency on the temporary relief is quite likely, and long-term planning is required. Possibly, stakeholders should explore opportunities to develop roadmaps in consultation with government agricultural officers.

b. **Collaborate or provide Fintech companies with avenues to promote their services as an alternative to traditional lending.**
   - **Implementation Mechanism**:

     Government regulations must cover the protection and encouragement of start-up innovation without compromising the development of traditional banking institutions, services, and products. Active public-private collaboration and

engagement (e.g., formal feedback mechanisms such as advisory committees) are required to identify opportunities to manage the adoption of Fintech solutions best while benefiting and safeguarding the interests of all stakeholders (e.g., farmers and lenders).

- **Pros**: Fintech widens the reach of financial services to the un/under-insured and un/under-banked by providing wider access to basic financial services. Adopting Fintech solutions can aid governments to ensure and improve efficiency and stimulate competition in the economies' financial systems.
- **Cons:** Government regulations must cover the protection and encouragement of start-up innovation without compromising the development of traditional banking institutions, services, and products.

According to the IMF (International Monetary Fund) [68], Fintech presents a challenge to the existing institutional arrangements in addressing three areas: 1) having effective coordination (because it is cross-boundary), 2) ensuring flexibility (respond quickly to changes and new developments), and 3) having clear mandates. Not addressing the aforementioned areas could lead to financial instability. See example: Indonesia currently does not have adequate Fintech laws, compromising on consumer protection, reporting 2,018 illegal Peer-to-Peer (P2P) lending, 472 illegal investment companies, and 69 illegal pawnbrokers.

7 Suggestions for Future Research

The present paper focused on the Mexican and Indonesian horticulture sector. Further research in other APEC economies or beyond the horticulture sector could lead to diverging results. Therefore, future research in other economies could pave a more nuanced path for the development of public policies to improve horticultural and economic capacity and inclusion. In some examples, within both economies, there was no observed difference between the various stakeholders' opinions towards the barriers in uptake of services. This finding may be representative of Indonesia and Mexico and less representative of other APEC economies due to factors such as culture, economic features, or other differing characteristics.

Furthermore, there are differences between the economies' expenditure on food-related services, with Mexico spending more on wholesale and Indonesia spending on banking. This further supports the potential for differences between other economies. Suppose there is interest to uncover insights unique to various types of stakeholders or food service providers. In that case, it could be relevant for future research to replicate the current study within different APEC economies and possibly to other sectors beyond horticulture.

Finally, the paper has refrained from providing specifications and details on the potential engagement models that could be adopted and other related details (e.g., how to split the profit, facilitate joint collaboration, etc.) about public-private partnerships. Depending on the objectives and preferences of individual economies', these details may vary greatly and may necessitate different paths for collaborating with private companies. Thus, it is strongly advised to identify the engagement model that best aligns with the objectives and work out a plan to maximise the potential of the collaboration.

8 Appendix

8.1 Appendix A. List of Interviewed Respondents

Respondents interviewed for Mexico (Sample Size = 48 respondents)

CAT 1	**Ministry and Trade Association**				
#	**Respondent**	**Small/ Large Scale Company**	**Position**	**Type of Horticulture Product**	**Export, Domestic or Both Markets**
1	Ministry 1	NIL	General Director	NIL	NIL
2	Ministry 2	NIL	Sub- secretary	NIL	NIL
3	Trade Association 1	NIL	President and General Director	Green leaf lettuce, cucumber, squash, eggplant, bell peppers, and beans.	Export
4	Trade Association 2	NIL	President	Avocado, berries, and lemon.	Both
CAT 2	**Farmers**				
#	**Respondent**	**Small/ Large Scale Company**	**Position**	**Type of Horticulture Product**	**Export, Domestic or Both Markets**
1	Farmer 1	Small	Owner	Lettuce and tomatoes.	Domestic
2	Farmer 2	Small	Area Coordinator	Vegetables, peppers, and tomatoes.	Both
3	Farmer 3	Small	Society Secretary and Coordinator	Tomatoes and lettuce.	Domestic
4	Farmer 4	Small	Manager	Tomato, corn, chilli, and shell tomato.	Domestic
5	Farmer 5	Large	Director	Coriander, radish chard lettuce, chives, prickly pear chayote, parsley, beets, and squash.	Domestic
6	Farmer 6	Large	General Manager	Fresh vegetables,	Both

				broccoli, celery and carrot.	
7	Farmer 7	Large	Vice President	Watermelons, melons, bananas, jackfruit, starfruit, and papayas.	Both
8	Farmer 8	Large	Director	Dried chilli peppers, aubergines, coriander, jalapeño peppers, bean tomato, and rolled oats.	Both
9	Farmer 9	Small	General Manager	Berries	Both
10	Farmer 10	Small	Manager	Cucumber and tomato.	Both
11	Farmer 11	Small	Owner	Chilli serrano	Local
CAT 3	**Processors**				
	Respondent	**Small/ Large Scale Company**	**Position**	**Type of Horticulture Product**	**Export, Domestic or Both Markets**
1	Processor 1	Small	Partner Director	Carrot, cabbage, squash, spinach, mushrooms, garlic, onion, parsley, coriander, corn, tomato, and dried pepper.	Both
2	Processor 2	Large	Manager	All vegetables and fruits.	Both
3	Processor 3	Large	General Manager	Wing lettuce, Italian lettuce, celery, broccoli, purple cabbage, white cabbage, carrot, and garlic.	Domestic
4	Processor 4	Large	Manager	Avocados	Both
5	Processor 5	Small	Manufacturing Director	Chillies, spices, condiments, seasonings, herbs, and tenderisers.	Domestic

CAT 4	Distributors				
	Respondent	**Small/ Large Scale Company**	**Position**	**Type of Horticulture Product**	**Export, Domestic or Both Markets**
1	Distributor 1	Small	Director	Papayas	Domestic
2	Distributor 2	Small	Owner	Oranges, grapefruits, and lemons.	Domestic
3	Distributor 3	Small	Owner	Italian lettuce, sangria lettuce, endive heart, fennel bulb, arugula normal lettuce, baby spinach, normal spinach, and radicchios.	Domestic
4	Distributor 4	Small	General Manager	Carrots and vegetables.	Domestic
5	Distributor 5	Small	General Manager	Orange, grapefruit, lemons and tangerines.	Domestic
6	Distributor 6	Large	Director	Cauliflower, brussels sprouts, zucchini, mangoes, cantaloupe, papayas, and organic broccoli.	Export
7	Distributor 7	Large	General Manager	Romaine lettuce, avocado chayote, habanero, wax chilli, and tomato.	Domestic
8	Distributor 8	Large	Manager	Strawberry, mango and blackberry.	Both
CAT 5	**Food Service Providers**				
	Respondent	**Small/ Large Scale Company**	**Position**	**Type of Horticulture Product**	**Export, Domestic or Both Markets**
1	Business Service 1	Small	Director	Corn, cereal, oats, broccoli, onion, chilli, and gladiolas.	Domestic

#	**Respondent**	**Small/ Large Scale Company**	**Position**	**Type of Horticulture Product**	**Export, Domestic or Both Markets**
2	Business Service 2	Large	Consulting and Coordination	Tomato and chilli.	Both
3	Business Service 3	Small	Legal Advisor and Representative	Chilacayote, chilli, avocado, and tomato.	Domestic
4	Business Service 4	Large	Manager	Berries, tomatoes, and potatoes.	Domestic
5	Financial Service 1	Small	Head of Agricultural Industry Credits.	Berry, sugar cane, vegetables, corn and beans.	Both
6	Financial Service 2	Large	General Manager	Financial credits for rural and business support, among others.	Domestic
7	Financial Service 3	Large	Patrimonial Manager	Financial credits for rural and business support, among others.	Both
8	Financial Service 4	Large	Manager	Financial credits for rural and business support, among others.	Both
9	Tech Service 1	Small	Technology Director	All types of fruits and vegetables.	Domestic
10	Tech Service 2	Large	General Director	Grains, vegetables, cauliflower, watermelon, onion, and melon.	Both
11	Tech Service 3	Small	Director	Software control of agricultural production, multicultural, fruit horticultural, and administrative management of production of	Domestic

				farming companies.	
#	**Respondent**	**Small/ Large Scale Company**	**Position**	**Type of Horticulture Product**	**Export, Domestic or Both Markets**
12	Tech Service 4	Large	Director	Systems and technologies for agriculture.	Domestic
13	Transport and Storage Service 1	Large	Owner	Transport: chilled meat, perishable foods, fruits, and vegetables.	Domestic
14	Transport and Storage Service 2	Small	Administrator	Chilli, tomato, greenhouse cucumber fruits: apples, grapes, asparagus, kiwi, and pears.	Both
15	Transport and Storage Service 3	Small	Logistics and Perishables Manager	Fruits, avocado, tomato, bell pepper, banana, cauliflower, broccoli, mango, and perishable vegetables.	Export
16	Transport and Storage Service 4	Large	Quality Manager	Food grains, lettuces, carrots, potatoes, tomato, and pine.	Domestic
17	Wholesale and Retail Service 1	Large	Director	All type of fruits and vegetables.	Both
18	Wholesale and Retail Service 2	Large	Quality Manager	All kinds of vegetables, fruits, and fine dried chilli seeds.	Both
19	Wholesale and Retail Service 3	Small	Owner	Chilli, tomato and onion.	Domestic
20	Wholesale and Retail Service 4	Small	Owner Manager	Tangerines, oranges, and grapefruits.	Domestic

Respondents interviewed for Indonesia (Sample Size = 48 respondents)

CAT 1	**Ministry and Trade Association**

#	**Respondent**	**Small/ Large Scale Company**	**Position**	**Type of Horticulture Product**	**Export, Domestic or Both Markets**
1	Ministry 1	NIL	Director of Fruits and Floriculture	NIL	NIL
2	Ministry 2	NIL	Director of Marketing and Processing of Horticultural Products	NIL	NIL
3	Trade Association 1	NIL	Chairman	Fruits and vegetables.	Both
4	Trade Association 2	NIL	Chairman	Chilli	Both
CAT 2	**Farmers**				
#	**Respondent**	**Small/ Large Scale Company**	**Position**	**Type of Horticulture Product**	**Export, Domestic or Both Markets**
1	Farmer 1	Large	Head of Supply Chain	Pineapple, bananas, kiwis, and guava.	Both
2	Farmer 2	Large	Co-Founder	Fruits (mangosteen, salak, coconut, and kaffir lime)	Export
3	Farmer 3	Large	Owner	Fresh fruits and vegetables.	Both
4	Farmer 4	Small	Operational Manager	Red dragon fruit	Both
5	Farmer 5	Large	General Manager	Paprika, tomato, zucchini, kabocha, and chayote.	Both
6	Farmer 6	Small	NIL	Paprika, rosemary, freeze (for salads), zucchini, thyme, basil, curry, pakcoy, coriander, and red cabbage.	Domestic
7	Farmer 7	Small	Director /Leader	Carrots, beans, baby beans, cherry tomatoes, lettuce, watercress,	Domestic

				Japanese cucumber, and broccoli.	
8	Farmer 8	Small	Owner	Oranges, watermelons, melons, pineapples, papayas, rambutan, and dragon fruit.	Domestic
9	Farmer 9	Small	Plant Head	Mango	Domestic
10	Farmer 10	Small	Owner	Dragon fruit and guava.	Domestic
CAT 3	**Processors**				
	Respondent	**Small/ Large Scale Company**	**Position**	**Type of Horticulture Product**	**Export, Domestic or Both Markets**
1	Processor 1	Large	Director	Tomato, vegetables, nuts, biopharmaca (spices) such as red chilli, onion, garlic, and other fresh herbs such as turmeric and ginger.	Both
2	Processor 2	Large	Supply Chain Manager	Fruits, tomato, nuts, red chilli, onion, garlic, and other fresh herbs such as turmeric and ginger.	Both
3	Processor 3	Large	Operational Manager	Tomato, spices such as red chilli, onion, garlic, and other fresh herbs such as turmeric and ginger.	Domestic
4	Processor 4	Large	Plants Operation Manager	Fruits, nuts, and coconuts.	Both
5	Processor 5	Small	Director	Fruits	Domestic
6	Processor 6	Small	Owner	Strawberry, blueberry, and ficus carica.	Domestic

CAT 4	Distributor				
	Respondent	**Small/ Large Scale Company**	**Position**	**Type of Horticulture Product**	**Export, Domestic or Both Markets**
1	Distributor 1	Large	Owner	Fruits and vegetables.	Both
2	Distributor 2	Large	Management of Information System and Personal Assistant	Fruits and vegetables.	Both
3	Distributor 3	Large	General Manager	Fruits	Domestic
4	Distributor 4	Small	Operational Head	Fruits and vegetables.	Domestic
5	Distributor 5	Large	Operational Head	Corn, soybean, rice, and cashews.	Both
6	Distributor 6	Large	Operations and Marketing Head	Chilli, onion, garlic, tomato, vegetables, fruits, and herbs.	Both
7	Distributor 7	Small	Director	Chilli and onion.	Domestic
8	Distributor 8	Small	Founder	Lemon, potato, lettuce, broccoli, red potatoes, and carrot.	Domestic
CAT 5	**Food Service Providers**				
	Respondent	**Small/ Large Scale Company**	**Position**	**Type of Horticulture Product**	**Export, Domestic or Both Markets**
1	Business Service 1	Large	Procurement Business Partner	Rice, corn, chilli, tomato, onions, potatoes, mango, soybean, etc.	Both
2	Business Service 2	Small	Business Manager	Chilli, ginger, black pepper, black cumin, and cardamom.	Domestic
3	Business Service 3	Large	Director	Nuts, vegetables, and fruits	Domestic
4	Business Service 4	Small	Marketing Manager	Corn, chilli, cassava, lemon, aloe vera, melon, eggplant, and cucumber.	Domestic

5	Financial Service 1	Small	Operation Manager	Fruits, vegetables, and herbs.	Domestic
6	Financial Service 2	Small	CEO	Fruits, vegetables, and herbs.	Domestic
7	Financial Service 3	Large	Commissioner	Fruits, vegetables, and herbs.	Domestic
8	Financial Service 4	Large	Operation Manager	Fruits, vegetables, and herbs.	Domestic
9	Tech Service 1	Small	Co-Founder	Chilli and tomato.	Domestic
10	Tech Service 2	Small	Co-Founder /CEO	Onions, chilli, and vegetables.	Domestic
11	Tech Service 3	Large	Head of Business Development and International Operations	Rice and corn.	Both
12	Tech Service 4	Large	Co-Founder	Fruits, vegetables, and herbs.	Both
13	Transport and Storage Service 1	Small	Owner	Fruits, vegetables, and herbs.	Domestic
14	Transport and Storage Service 2	Small	Marketing Head	Fruits, vegetables, and herbs.	Domestic
15	Transport and Storage Service 3	Large	General Manager	Fruits, vegetables, and herbs.	Domestic
16	Transport and Storage Service 4	Large	General Manager Halal Logistic and Cold Storage	Fruits, vegetables, and herbs.	Both
17	Wholesale and Retail Service 1	Large	Director of Marketing Communications	Fruits, vegetables, and seasoning.	Domestic
18	Wholesale and Retail Service 2	Large	General Manager	Fruits, vegetables, and seasoning.	Domestic
19	Wholesale and Retail Service 3	Small	Purchasing Manager	Fruits, vegetables, and herbs.	Domestic
20	Wholesale and Retail Service 4	Small	Owner	Fruits, vegetables, and herbs.	Domestic

8.2 Appendix B: Sample Policy Case Studies

Opportunity 1. Improve the Efficiency of the Supply Chain: ***Government-driven (or backed) e-commerce platform***

Malaysia's Ourfarm Platform (B2B) https://www.ourfarm.asia/ [69]

i. Purpose: To boost the income of local farmers by removing the costs of intermediaries and providing logistic support that will allow farmers to conduct direct sales. It also helps to lower the prices paid by consumers.

ii. Method: The partnership between AirAsia and the Malaysian Ministry of Agriculture and Food Industries helps support over a thousand government contracts and farmers. The platform offers farmers training on digitalising their business through a third-party provider.

Thailand [70]

i. Purpose: The Ministry of Agriculture's campaign "Turning Farmers into Professional Online Merchants" in cooperation with the economy's leading e-commerce platform (Lazada Thailand) was initiated to encourage farmers to promote Thailand's agricultural products and increase the current reach to a wider market.

ii. Method: The government partnered with Lazada to provide Thailand's farmers with e-commerce business training and a platform to sell their produce free of charge. The first phase of training targeted farmers from the large agricultural land plot programme, farmers in 86,000 community enterprises and 3,000 agricultural cooperatives, and 11,000 participants from the "Young Smart Farmer" project. There were 6,000 large agricultural land plots that covered 350,000 farmers.

iii. Outcome: 113 new online agricultural shops opened on Lazada in two months (April to May 2020). The ministry expanded programme's scope to include more online platforms (e.g., Shopee) to increase sales channels and cover larger markets. Online selling has also helped farmers rely less on traditional intermediaries while achieving higher profit margins, as online platforms enable price regulation. Lastly, online selling offers farmers insight into market demand, which guides farmers on the types of crops to be cultivated.

Opportunity 2. Upgrade Transportation/Logistical Management, Connectivity, and Capacity: ***Develop integrated logistic parks & improve transit infrastructure***

United States [71]

i. Purpose: An integrated system that provides end-to-end logistic solutions that ensure coordinated cargo transportation through every stage of the supply chain, from farmer to end user.

ii. Method: Planning was implemented through private-public and provider-user coordination. The project was funded through loans, equity, government subsidies, and sales of securitised instruments.

People's Republic of China [71]

i. Purpose: To ensure the smooth transportation of agricultural produce through the Green Channel Policy.

ii. Method: China's government created a list of more than 100 kinds of fresh agricultural products (including vegetables, fruit, live poultry, meat, eggs, and milk) that have been exempted from tolls on roads, bridges, and tunnels since 2010. Transport vehicles can only be exempted if at least 80% of their total volume is agricultural (fresh) produce; vehicles should not be loaded with any non-agricultural products.

iii. Outcome: Despite the initial costs incurred, the initiative lowered circulation costs of agriculture, helped to facilitate the swift and timely delivery of fresh produce to urban areas, and boosted trade in fresh produce.

People's Republic of China [71]

i. Purpose: Developing rural logistic infrastructure to achieve food security, specifically to increase rural roads' coverage and safety to improve the circulation of agricultural products and farming inputs.
ii. Method: Measures included rural road network development, transport hubs, freight stations, network nodes, transportation equipment, postal enterprises, freight forwarding enterprises, and the creation of other such facilities.
iii. Outcome: The project brought accessibility to 99.98% of townships and 99.82% of the administrative villages. The increased connectivity allowed for the efficient and safe transportation of fresh produce and other goods.

Opportunity 3. to Improve Awareness, Knowledge-building and Technical know-how of Farmers: ***Offer extension and training services to farmers & Promote equipment sharing amongst stakeholders through equipment-lending networks, low-cost rental services or equipment-sharing clubs***

Viet Nam [72]
i. Purpose: CropLife International partnered with the government of Viet Nam and the German International development organisation (GIZ) to train rice farmers on sustainable rice farming at Viet Nam's Mekong Delta. The goal was to equip small-scale rice farmers in Viet Nam with the knowledge to handle pest outbreaks that wipe-out (rice) yields and threaten food security.
ii. Method: The three-year project educated farmers from 15,000 rice farms. Farmers were taught integrated pest management strategies to protect their crops. Through the project, at least 300 pesticide retailers were also trained to help farmers identify the correct crop protection products and their proper usage.

Canada [73]
i. Purpose: Improve accessibility to equipment through the Coopérative d'Utilisation de Matériel Agricole (CUMA).
ii. Method: Organised by farmers, the cooperative members pay a fee to finance a portion of the equipment, insurance, maintenance, storage, and repair fees. Members are entitled to use the equipment for a certain amount of time or acres per year.

United States [73]
Purpose: Rent out agricultural equipment at reduced fees through the Southern Maryland Agricultural Development Commission (SMADC).
Methodology: The SMADC is a collaboration between government agencies and the regional farming communities. The project involved the successful launch of a tool-sharing initiative in five economies to provide low-cost equipment rental. Equipment purchases were funded through grants.

COVID-19 Takeaways

Challenge 1. Shrinking Workforce and Overreliance on Manpower: ***Develop programmes to encourage uptake of technological tools and automation practices & Government-led industry collaborations***

Thailand [74]
i. Purpose: Thailand's government introduced tax perks to provide SMEs with wider access to technological tools and services to provide an easier transition to automation in work processes.
ii. Method: Thailand's Digital Economic Promotion Agency (DEPA) offered a 200% tax deduction to purchase digital software, hardware, and services by SMEs. Hardware included smart devices, 3D printers, robotics, drones, wearable, and IoT devices. Digital services also covered cloud-based services, digital architect design services, consultations, and Fintech.

Granting better access to technology tools and services as a step to adopting automation lessens back-office and customer-facing processes, making workflow faster and more efficient.

People's Republic of China [75]

i. Purpose: Automation is designed to mitigate the ageing rural workforce in the farming sector. This project aims to develop fully automated machinery capable of planting, fertilising, and harvesting each of China's staple crops (rice, wheat, and corn) between 2019 and 2025.

ii. Method: The government pushes firms such as automated driving system developers and tractor manufacturers to develop autonomous agriculture technology (e.g., driverless tractors). The government supports local technology trials through the Telematics Industry Application Alliance (TIAA) industry group.

Challenge 2. Lack of Sufficient Financial Reserves: ***Provide better access to microcredit or financial services***

Indonesia [76] [77] [78]

i. Purpose: Kredit Usaha Rakyat (KUR) was created to provide long-term loans to SMEs via banks or other financial institutions. KUR provides affordable interest rates and capital of up to IDR 500 million (33,900 USD).

ii. Method: Relaxation of administrative requirements such as business permits and other collateral documents to increase accessibility to long-term loans at affordable interest rates. In the KUR Super Micro scheme, loans with 0% interest were offered until December 31, 2020, while KUR for micro small and medium enterprises (UMKM) were given a subsidy of 6% until 31 Dec 2020. KUR increased SMEs' credit flow while existing loans got a six-month delay on interest and debt repayment.

iii. Outcome: KUR's implementation was affected by the COVID-19 crisis, as disbursements fell from IDR 18.99 trillion in March 2020 to IDR 4.76 trillion in May the same year. However, the disbursements increased significantly to IDR 17.72 trillion in October 2020 as more stakeholders were granted better access due to the adjustments made. The implementation of KUR between January and October 2020 reached IDR.148.38 trillion (78.09% of the 2020 target of IDR 190 trillion) and has been utilized by 4.5 million debtors.

Japan [79] [80]

i. Purpose: In response to the COVID-19 crisis, special measures were built into the Employment Adjustment Subsidy (EAS) scheme, such as coverage expansion, ease of eligibility criteria or administrative procedures for better accessibility, adjustments in production, employment benefit levels, and benefit duration, as well as the waiting period in subsequent claims.

ii. Method: Due to the COVID-19 pandemic, access to the EAS that previously required a 10% reduction in production for three months has been reduced to 5% over one month. Japan increased the subsidy rates for hours not worked to a maximum of 100% for SMEs and 80% for larger firms. Non-regular workers without insurance, and regular workers employed by SMEs who did not apply for the subsidy, were also covered. After a crisis, the government often readjusts the parameters so that the insurance fund can accumulate reserves for crises in the future.

iii. Outcome: SMEs and workers can apply directly or access the new scheme while having approximately 80% of their usual earnings covered.

8.3 Appendix C: Tables and Figures

8.3.1 Table A1. Prevalence of Undernourishment in APEC Economies

APEC Economies	Prevalence of undernourishment (% of the population)			Change from 2017 to 2018
	2016	2017	2018	
Australia	2.5	2.5	2.5	Maintained
Brunei Darussalam	2.5	2.5	2.5	Maintained
Canada	2.5	2.5	2.5	Maintained
Chile	3.2	3.3	3.5	Dropped
People's Republic of China	2.5	2.5	2.5	Maintained
Hong Kong, China	2.5	2.5	2.5	Maintained
Indonesia	9.2	8.9	9	Dropped
Japan	2.5	2.5	2.5	Maintained
Republic of Korea	2.5	2.5	2.5	Maintained
Malaysia	3.4	3.2	3	Improved
Mexico	6.4	6.7	7.1	Dropped
New Zealand	2.5	2.5	2.5	Maintained
Peru	6.9	7	6.7	Improved
The Philippines	15.2	14.9	14.5	Improved
Russia	2.5	2.5	2.5	Maintained
Thailand	8.6	8.9	9.3	Dropped
United States	2.5	2.5	2.5	Maintained
Viet Nam	7.6	6.9	6.4	Improved

Source: [81]

Note: Data for Singapore; Papua New Guinea; and Chinese Taipei was not available.

8.3.2 Table A2. Prevalence of Severe and Moderate Food Insecurity in APEC Economies

% of the Total Population	Prevalence of severe food insecurity in the total population		Change from the previous wave	Prevalence of moderate food insecurity in the total population		Change from the previous wave
	2014 to 2016	2017 to 2019		2014 to 2016	2017 to 2019	
Australia	2.8	3.9	Dropped	10.8	13.5	Dropped
Canada	0.6	No data available	Unable to determine	5	No data available	Unable to determine
Chile	2.7	3.8	Dropped	10.2	15.6	Dropped
Indonesia	1	0.8	Improved	7.6	7	Improved
Japan	<0.5	0.7	Dropped	2.6	3.1	Dropped
Republic of Korea	<0.5	<0.5	Unable to determine	4.8	5.1	Dropped
Malaysia	7.8	6.7	Improved	17.4	15.1	Improved
Mexico	8	11.5	Dropped	27.4	34.9	Dropped
New Zealand	2.8	4.5	Dropped	10	14	Dropped
Peru	9	No data available	Unable to determine	29.9	No data available	Unable to determine
The Philippines	12.2	17.6	Dropped	44	55.3	Dropped
Russia	0.7	0.8	Dropped	8.2	8.4	Dropped
Singapore	1	1.4	Dropped	2.8	4.7	Dropped
United States	1.1	0.8	Improved	10.5	8.5	Improved
Viet Nam	No data available	<0.5	Unable to determine	No data available	6.2	Unable to determine

Source: [3]
Note: Data for Brunei Darussalam; People's Republic of China; Hong Kong, China; Papua New Guinea; Chinese Taipei; and Thailand was not available.

8.3.3 Table 2.2. Summary of Criteria used for the Analysis of Economy Case Study Selection

Criteria	Remarks	Data Evaluated
Size of Sector	Economies with a large horticulture sector are more attractive as a case study because there is access to a larger pool of industry experts and market players. These economies are also more critical and representative case studies as they contribute more significantly to the global food industry.	Food and Agriculture Organisation of the United Nations (FAO) – Area under plantation in 2018 (latest data available) [13]
Productivity of Horticulture Sector	The case study should focus on economies where the horticulture sector is a large part of the economy and is reasonably productive.	FAO – Per hectare yield in 2018 (latest available data) [13]
Importance of Agriculture to the Economy	It is also essential to pick economies where crop production significantly contributes to the host economy's Gross Domestic Product (GDP). Sectors that contribute more to the economy's GDP are more likely to receive a fair amount of attention (and thus investment) from government and even private entities.	World Bank – Agriculture, forestry, and fishing value added (percentage of GDP) [82]
Efficiency of Food Systems	The case study should be an economy where food systems are reasonably efficient and showcase both strengths and weaknesses. One way to assess this is by the Food Waste and Loss Index. The Economist Intelligence Unit's (EIU) "Food Sustainability Index 2018: Food Loss and Waste" is a weighted average of policy indicators to respond to food loss and waste.	EIU Food Sustainability Index 2018: Food Loss and Waste [26]
Sustainability (and sophistication) of Food Systems	The case study should be an economy that is sophisticated and forward-looking. Economies that are currently practising more sustainable practices offer better benchmarks. This can be assessed through the EIU's "Food Sustainability Index 2018: Sustainable Agriculture". The Sustainable Agriculture score is a weighted average of the indicators in the water, land, emissions, and land-users category. A higher score means that an economy is on the path to implementing a sustainable agriculture system. These indicators include water management impact, laws around land ownership and protection of smallholders, public support to research, development, rural banking penetration, farmer income, and access to financial aid. The index is composed of 30 indicators and 90 individual metrics.	EIU Food Sustainability Index 2018: Sustainable Agriculture [26]

Technology Adoption	Modern-day farmers' use of agriculture/ horticulture technology is essential for various reasons, such as improving crop productivity, efficiency, safety, and environmental concerns. As such, it is vital to assess the technological adoption of economies. The CISCO Digital Readiness Index 2019 is a measure of the economy's digital readiness. The index comprises seven different sub-factors, of which one constitutes technology adoption. Technology adoption further comprises internet usage, mobile cellular penetration, and cloud services.	CISCO Digital Readiness Index 2019 – Technology Adoption [83]

8.3.4 Table A3. Criteria in Choosing Two APEC Economies

APEC Economies	**Area Under Plantation** [13]		**Yield** [13]		**Agriculture Value Added** [82]		**Food Loss and Wastage** [26]		**Sustainable Agriculture Index** [26]		**Digital Readiness Index – Technology Adoption** [83]		**Average Rank**	**Final Rank**
	Hectare (Ha)	Rank	Tonnes per Ha	Rank	% of GDP	Rank	Score	Rank	Score	Rank	Score	Rank		
People's Republic of China	42,113,142	1	537,122	6	7.11	6	82.40	1	60.70	4	0.97	11	4.83	3
Indonesia	**2,014,906**	**4**	**718,65**	**2**	**12.72**	**2**	**61.40**	**4**	**61.10**	**3**	**0.97**	**10**	**4.17**	**1**
Malaysia	158,009	12	425,290	9	7.28	5	No Data	Unable to determine	No Data	Unable to determine	1.35	4	7.50	10
The Philippines	2,351,635	3	240,114	13	8.82	3	No Data	Unable to determine	No Data	Unable to determine	1.02	6	6.25	7
Singapore	1,426	15	213,702	14	0.03	14	No Data	Unable to determine	No Data	Unable to determine	1.96	1	11.00	13
Thailand	1,676,686	6	294,841	12	8.00	4	No Data	Unable to determine	No Data	Unable to determine	1.24	5	6.75	9
Viet Nam	1,944,544	5	366,921	10	13.96	1	No Data	Unable to determine	No Data	Unable to determine	0.98	8	6.00	5
Brunei Darussalam	8,223	13	130,194	15	0.99	12	No Data	Unable to determine	No Data	Unable to determine	No Data	-	13.33	15
Hong Kong, China	2,083	14	355,727	11	0.06	13	No Data	Unable to determine	No Data	Unable to determine	No Data	Unable to determine	12.67	14
Japan	613,866	8	614,836	4	1.24	11	71.60	2	73.40	1	1.69	2	4.67	2
Republic of Korea	553,600	9	865,027	1	1.69	10	No Data	Unable to determine	No Data	Unable to determine	No Data	Unable to determine	6.67	8
Chinese Taipei	307,167	11	587,815	5	No Data	Unable to determine	No Data	Unable to determine	No Data	Unable to determine	No Data	Unable to determine	8.00	12
Chile	497,393	10	652,622	3	3.54	8	No Data	Unable to determine	No Data	Unable to determine	1.37	3	6.00	6
Mexico	**2,783,664**	**2**	**524,551**	**7**	**3.47**	**9**	**66.30**	**3**	**69.40**	**2**	**0.99**	**7**	**5.00**	**4**
Peru	754,843	7	453,379	8	6.89	7	No Data	Unable to determine	No Data	Unable to determine	0.97	9	7.75	11

Tables and Figures for Indonesia case study

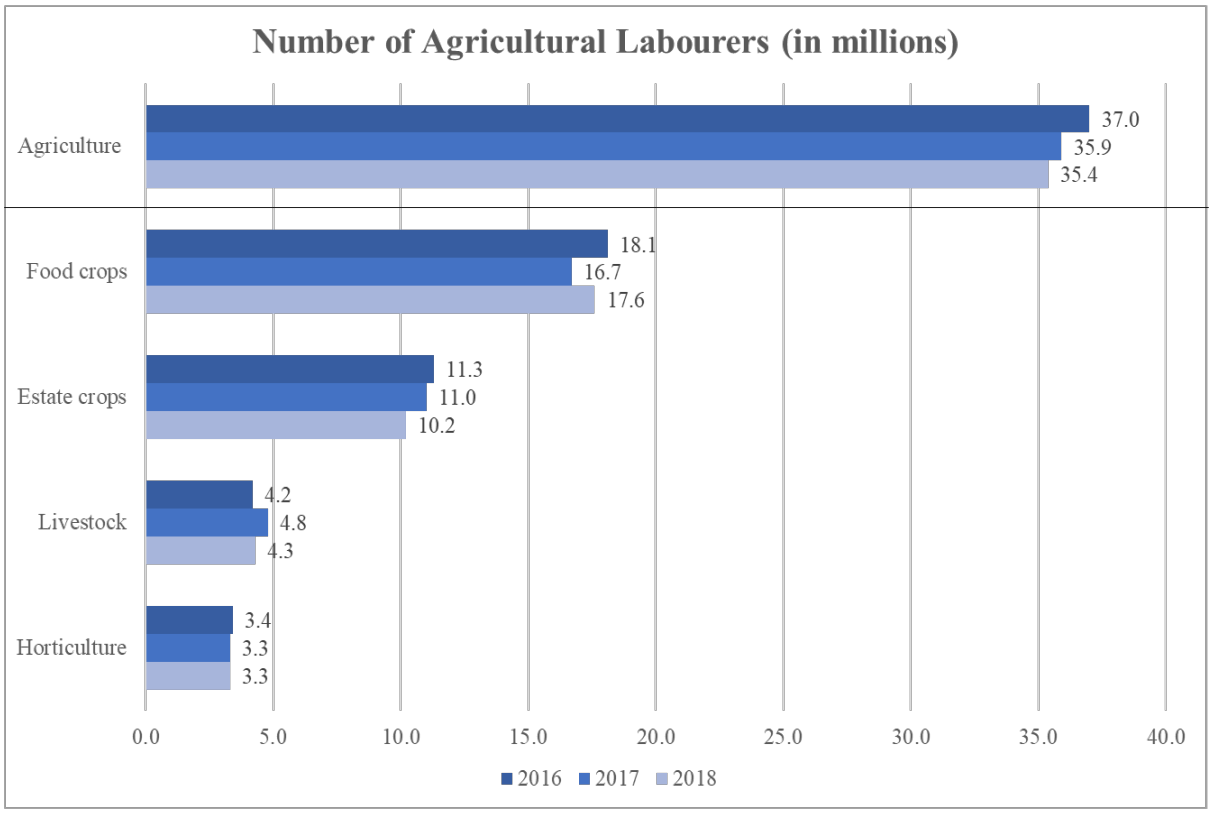
8.3.5 Table A4. Top 20 Commodities produced in Indonesia

Top 20 Commodities Produced in Indonesia 2018		
No.	**Item**	**Tonnes**
1	Oil palm fruit	115,267,491
2	Rice, paddy	83,037,000
3	Rice, paddy (rice milled equivalent)	55,385,679
4	Maise	30,253,938
5	Sugar cane	21,744,000
6	Coconuts	18,555,371
7	Cassava	16,119,020
8	Bananas	7,264,383
9	Rubber, natural	3,630,268
10	Mangoes, mangosteens, guavas	3,083,643
11	Meat, chicken	2,544,105
12	Chillies and peppers, green	2,542,358
13	Tropical fresh fruit*	2,533,498
14	Oranges	2,510,442
15	Sweet potatoes	1,806,389
16	Pineapples	1,805,506
17	Eggs, hen, in shell	1,644,460
18	Onions, dry	1,503,438
19	Cabbages and other brassicas	1,407,932
20	Fresh fruit*	1,340,787

Source: [51]

** Other fresh fruit that are not identified separately by FAO because of their minor relevance at the international level.*

8.3.6 *Figure A1. Number of Agricultural Labour by Sub-Sectors in Indonesia, 2016 to 2018*



Source: Food and Fertilizer Technology Center [19]

8.3.7 *Table A5. Indonesia Agricultural Labour Productivity by Revenue (IDR 1000)*

Sector	Sector's Annual Labour Productivity	Annual Full-time Adjusted Productivity	Productivity per Day	
			National Labour Force Survey	Full-Time
Agriculture:	23,041.80	29,685.20	88.60	114.20
Food crops	13,043.40	17,139.20	50.20	65.90
Horticulture	**43,357.50**	**54,158.90**	**166.80**	**208.30**
Estate crops	21,348.80	27,004.10	82.10	103.90
Livestock	26,211.80	41,050.80	100.80	157.90

Source: [19]

**The exchange rate of USD 1 = IDR 8,991 (2010)*

8.3.8 Table A6. Ministry of Agriculture Organisational Structure and Work Units of Indonesia

Ministry of Agriculture Organizational Structure		
1	Secretariat General	http://setjen.pertanian.go.id/site/
2	Inspectorate General	http://itjen.pertanian.go.id/
3	Directorate General of Food Plantation	http://tanamanpangan.pertanian.go.id/
4	Directorate General of Horticulture	http://hortikultura.pertanian.go.id/
5	Directorate General of Livestock and Animal Health	https://ditjenpkh.pertanian.go.id/index.html
6	Directorate General of Plantation	http://ditjenbun.pertanian.go.id/
7	Agricultural Research and Development Agency	http://www.litbang.pertanian.go.id/
8	Food Security Agency	http://bkp.pertanian.go.id/
9	Directorate General of Agricultural Infrastructure and Facilities	https://psp.pertanian.go.id/
10	Agricultural Quarantine Agency	https://karantina.pertanian.go.id/
11	Agricultural Human Resources Extension and Development Agency	http://bppsdmp.pertanian.go.id/id
Other Work Units		
13	Special Advisor to Minister of Agriculture on Bio-Industry Development	
14	Special Advisor to Minister of Agriculture on Trade and International Relations	
15	Special Advisor to Minister of Agriculture on Agricultural Investment	
16	Special Advisor to Minister of Agriculture on Agricultural Environment	
17	Special Advisor to Minister of Agriculture on Agricultural Infrastructure	

Source: [84]

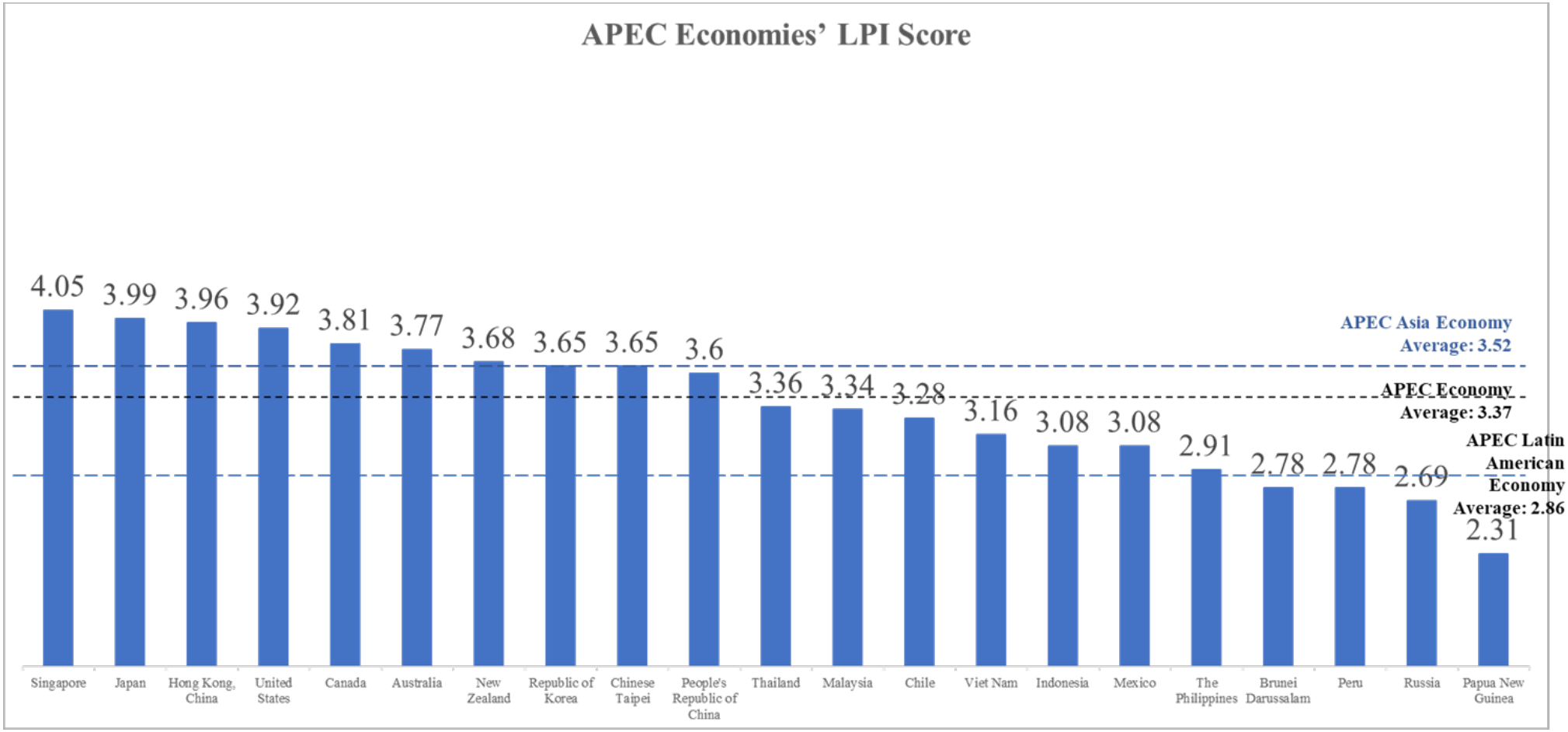
8.3.9 Table A7. APEC Economies' Logistics Performance Index Scores and Ranking

APEC Economies	**Aggregated LPI Score 2018*** *Note: Scores closer to five are indicative of an economy with comprehensive logistic infrastructure*	**Rank** *Note: A lower rank is indicative of an economy with comprehensive logistic infrastructure*	**Rank amongst APEC Economies** *Note: A lower rank is indicative of an economy with comprehensive logistic infrastructure*
Australia	3.8	19	6
Brunei Darussalam	2.8	73	18
Canada	3.8	17	5
Chile	3.3	40	13
People's Republic of China	3.6	27	10
Hong Kong, China	4.0	9	3
Indonesia	3.1	51	15
Japan	4.0	7	2
Republic of Korea	3.7	23	8
Malaysia	3.3	35	12
Mexico	3.1	53	16
New Zealand	3.7	22	7
Papua New Guinea	2.3	144	21
Peru	2.8	74	19
The Philippines	2.9	64	17
Russia	2.7	85	20
Singapore	4.1	5	1
Chinese Taipei	3.7	24	9
Thailand	3.4	34	11
United States	3.9	10	4
Viet Nam	3.2	45	14
Asian APEC Economies Average	**3.5**		
Latin American APEC Economies Average	**2.9**		

Source: [29]

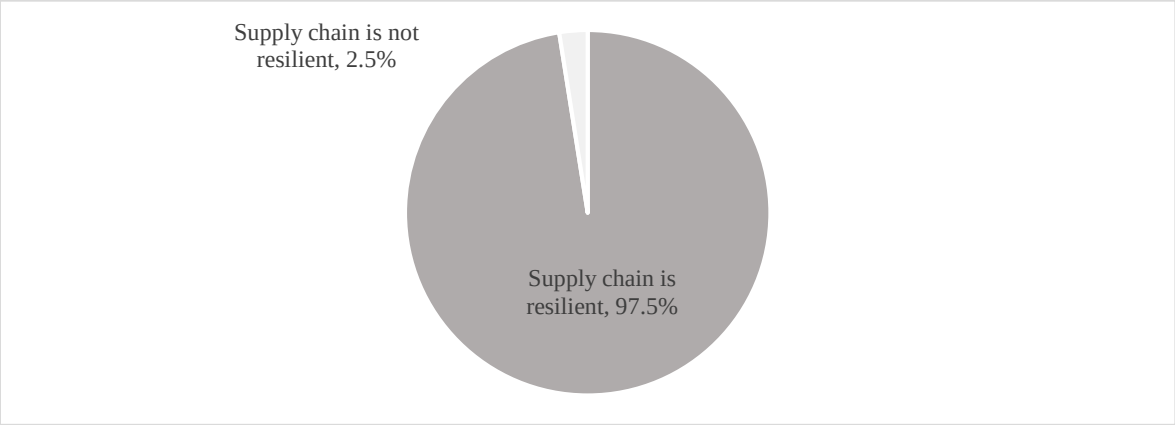
**The Aggregated LPI combines the four most recent LPI editions from 2012, 2014, 2016, and 2018 LPI surveys to generate a "big picture" to better indicate economies' logistics performance.*

8.3.10 Figure A2. APEC Economies' Logistic Performance Index Scores (2019)



Source: World Bank [29]

8.3.11 Figure A3. Perceived Resilience of Supply Chain to the COVID-19 Pandemic's Impact in Indonesia (n=40)



Source: Spire conducted interviews, 2020

Note. Irrelevant or non-applicable responses have been excluded (n=8).

8.3.12 Table A8. Sample Case Study #1 (Indonesia)

Indonesia's Transport and Storage Case Study: PT Multi Terminal

In 2019, road transportation contributed to 54% of the overall transportation subsector in Indonesia [85]. This reflected the growth of the Indonesian logistics sector by 10.5% from 2018. Despite this growth, there is still a lack of proper transportation and storage infrastructure. Local farmers' profits have been affected by traditional transport methods such as open-air trucks, which do little to prevent the damage caused during transport. Poor transportation and inadequate storage standards can lead to (food) quality degradation, resulting in considerable wastage and the loss of income for farmers [86].

PT Multi Terminal Indonesia (MTI), which is also known as IPC Logistic, provides services that mitigate produce damage during transportation. The company specialises in the logistics sector and provides services with regards to exports, customs clearance, cargo transportation, warehousing, and distribution, as well as halal logistics and cold storage. Their modern warehouse management system aims to support efficient and quality transportation at a reasonable cost. MTI's halal logistics and cold storage (HLC) system are comprised of dry warehouse areas, cold warehouse areas, and transportation trucks with refrigeration units. They focus on transporting horticultural products, beef and fish.

The loading and unloading process for perishables (e.g., fruits and vegetables) are done within one hour to prevent damage to the quality of the goods. Customers must notify the warehouse two days before the goods arrive so temperatures can be regulated for the incoming load. Goods can be kept in the warehouse for a maximum of three days. Once they are released, they have to be put into cold storage transportation and be immediately transported to the customer.

Like other transportation and storage companies, PT Multi Terminal ensures the continuity of the supply chain; by transporting and storing perishable produce adequately to reach the consumer eventually.

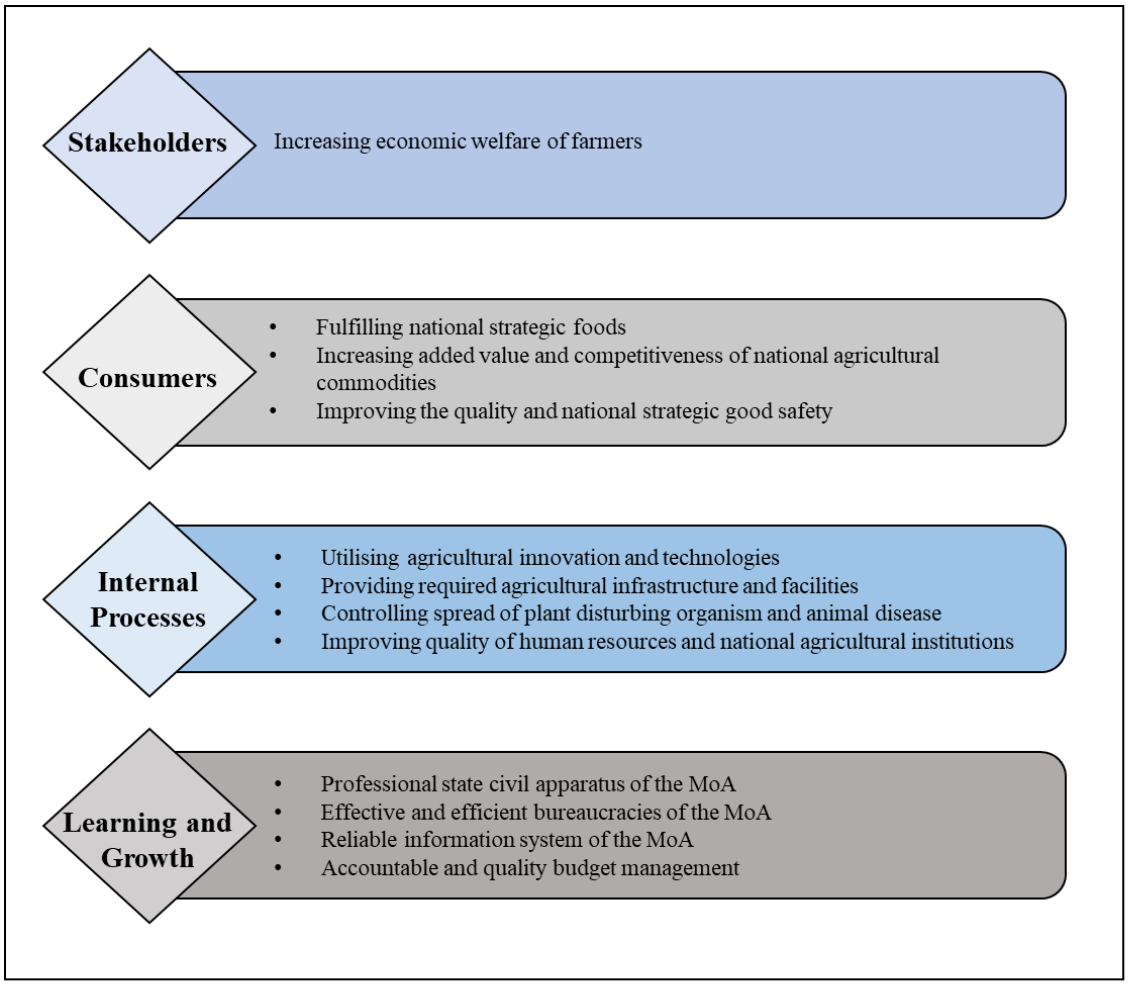
Source: [87]

8.3.13 Table A9. Sample Case Study #2 (Indonesia)

Indonesia's Fintech Case study: TaniFund (Tani Group) Fintech is an integral part of financial services, capable of improving and automating various processes through specialised algorithms and software [88]. Adopted across organisations, businesses, and consumers, it bridges the gap between society's demand for financing and the limited supply from traditional financial institutions by providing access to funding for those in low to middle-income brackets. Although agriculture constituted a significant 12.7% of Indonesia's GDP in 2019, many farmers did not qualify for financing from traditional financial institutions, such as banks [89]. This arises from the nature of the horticultural industry in Indonesia, comprising legions of smallholders with limited collateral and poor credit history. To combat this issue, Indonesian Agritech Start-up TaniHub founded TaniFund – a peer-to-peer (P2P) lending platform for Indonesian farmers. The platform allows members of the public to invest in a profit-sharing system that includes farmers and Tanifund. The share of profit is split in a 40:40:20 ratio across investors, farmers, and Tanifund, respectively. TaniFund minimises investment risks by only funding experienced farmers and closely monitoring their development. TaniFund has worked with over 855 agriculture farmers. One example of a project managed by Tanifund involved the Berastagi carrots farmed by the Radhea Putra Farmer Group in Margamukti Village, Bandung. TaniFund selected this particular farmer group because they had a good track record in carrots, potatoes, and tomatoes [90]. Investors can select the projects they want to invest in, most of which would involve horticultural produce. For each project, details such as the amount of capital required, estimation of returns, and calculations regarding the production and harvest costs are provided to investors. The funding provided is given to farmers in the form of fertilisers, seeds, farming equipment, and weekly allowances until completion. Upon harvest, the crops are sold and distributed through TaniHub's online marketplace. [91]

Source: [92]

8.3.14 *Figure A4. Diagram of Perspective and Target of the Indonesian Ministry of Agriculture for 2020 to 2024*



Source: MoA, 2019

8.3.15 Table A10. Initiatives and Support Programmes Sorted by Service Expenditure in Indonesia

Public and Private Horticulture-related Initiatives Identified by the Respondents

Service	Number of direct mentions (respondent specifically mentioned the programme)	Number of indirect mentions (respondent did not specifically mention the programme name but is familiar with it)	Desk Research (not mentioned by respondents, purely secondary data)
Transportation	No data	No data	1: AMMdes
Banking	2: KUR, UMI	3: Innovative Financing Scheme, PRISMA, National Economic Recovery Programme	No data
Storage	2: BULOG, NLE Portal	1: WRS	1: Community Food Granary
HR	No data	1: AgriProFocus	1: IJHOP4
Software	No data	1: Koltiva	1: OSS
Wholesale	No data	1: TaniSupply	No data
E-commerce	1: Toko Tani	1: LimaKilo	1: PUPM
Total Number of Services	5	8	5

Tables and Figures for Mexico case study

8.3.16 *Table A11. Age Distribution of Agriculture Workers in Mexico*

Age segment	Percentage in Agricultural Workforce
18 to 25 years old	0.9%
26 to 45 years old	22.6%
46 to 60 years old	37.8%
61 years old and above	38.7%

Source: [43]

8.3.17 Table A12: Top 20 Commodities Produced in Mexico 2018

Top 20 Commodities Produced in Mexico 2018		
No.	Item	1,000 Tonnes
1	Sugar cane	56,841,523
2	Maise	27,169,977
3	Milk, whole fresh cow	12,005,692
4	Oranges	4,737,990
5	Tomatoes	4,559,375
6	Sorghum	4,531,097
7	Chillies and peppers, green	3,379,289
8	Meat, chicken	3,338,372
9	Wheat	2,943,445
10	Eggs, hen, in shell	2,871,918
11	Lemons and limes	2,547,834
12	Bananas	2,354,479
13	Avocados	2,184,663
14	Mangoes, mangosteens, guavas	2,178,927
15	Meat, cattle	1,980,846
16	Potatoes	1,802,592
17	Onions, dry	1,572,608
18	Meat, pig	1,502,521
19	Watermelons	1,472,459
20	Beans, dry	1,196,156

Source: [51]

8.3.18 Table A13. Top 20 Commodities Produced in Mexico based on Export Value 2018

Commodities Produced in Mexico based on Export Value 2018		
No.	Item	Value (Unit Billion USD)
1	Beer of barley	4,491,048
2	Avocados	2,391,963
3	Tomatoes	2,260,996
4	Beverages, distilled alcoholic	1,723,436
5	Pastry	1,288,301
6	Chillies and peppers, green	1,157,979
7	Food, prepared	910,569
8	Meat, cattle, boneless (beef and veal)	849,653
9	Fruit, prepared	799,422
10	Sugar confectionery	732,434
11	Chocolate products	612,196
12	Walnuts, shelled	567,054
13	Lemons and limes	552,052
14	Meat, pork	530,835
15	Cucumbers and gherkins	521,352
16	Sugar Raw Centrifugal	482,176
17	Juice, orange, single strength	459,142
18	Vegetables, frozen	458,111
19	Beverages, non-alcoholic	448,554
20	Mangoes, mangosteens, guavas	444,669

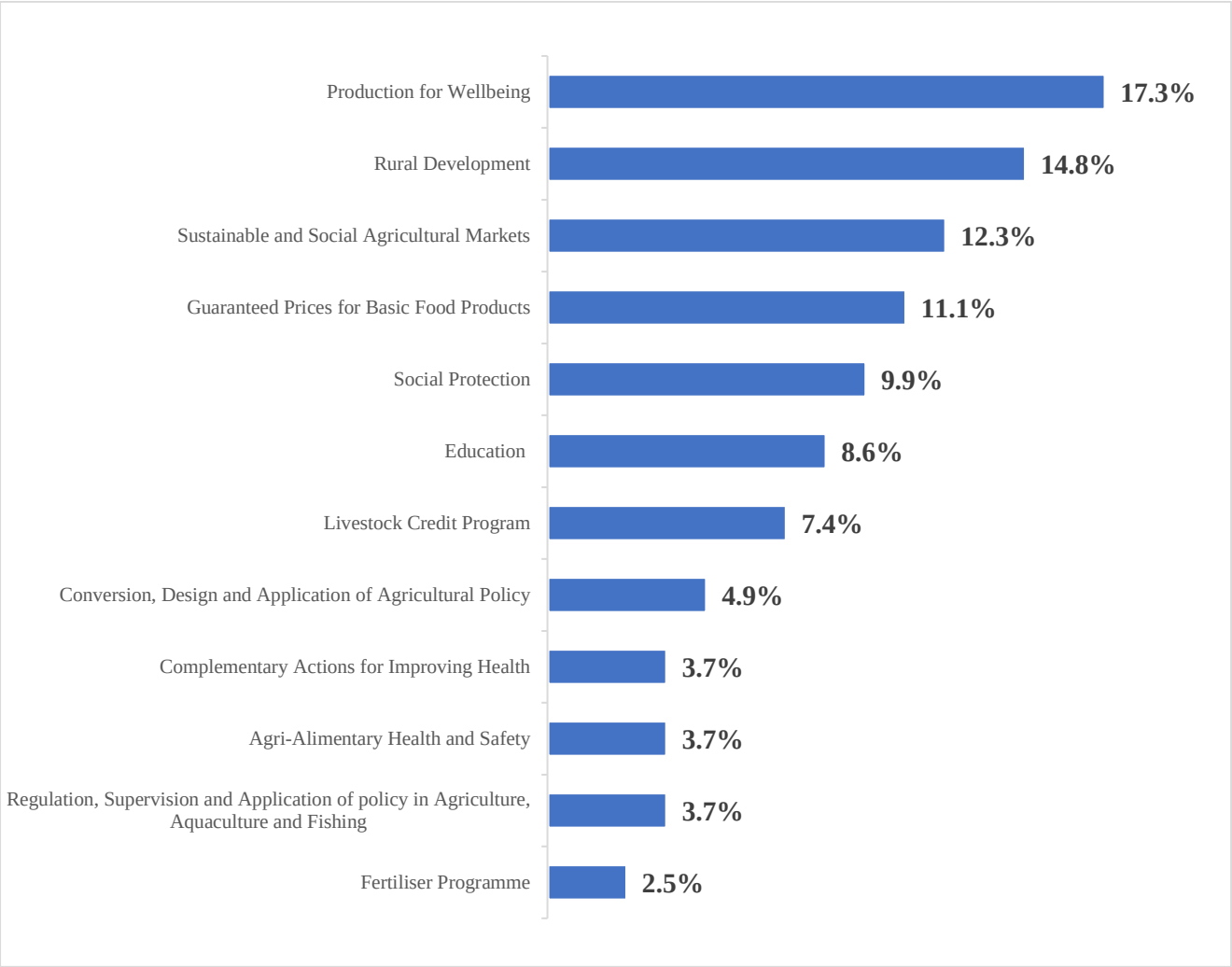
Source: [51]

8.3.19 *Table A14. Top 20 Trading Partners, Exports from Mexico (2018)*

Trading Partners, Exports from Mexico (2018)		
No.	Partner Economies	Value (Unit Billion USD)
1	United States	25,535,391
2	Japan	854,563
3	Venezuela (Bolivarian Republic of)	847,272
4	Canada	792,937
5	Guatemala	333,555
6	People's Republic of China	321,167
7	Netherlands	278,068
8	United Kingdom of Great Britain and Northern Ireland	228,403
9	Germany	227,203
10	Colombia	222,969
11	Spain	167,694
12	El Salvador	134,303
13	Chile	131,392
14	Peru	123,487
15	Honduras	120530
16	Costa Rica	115,753
17	Australia	115,329
18	Republic of Korea	111,524
19	Dominican Republic	106,591
20	Algeria	102,841

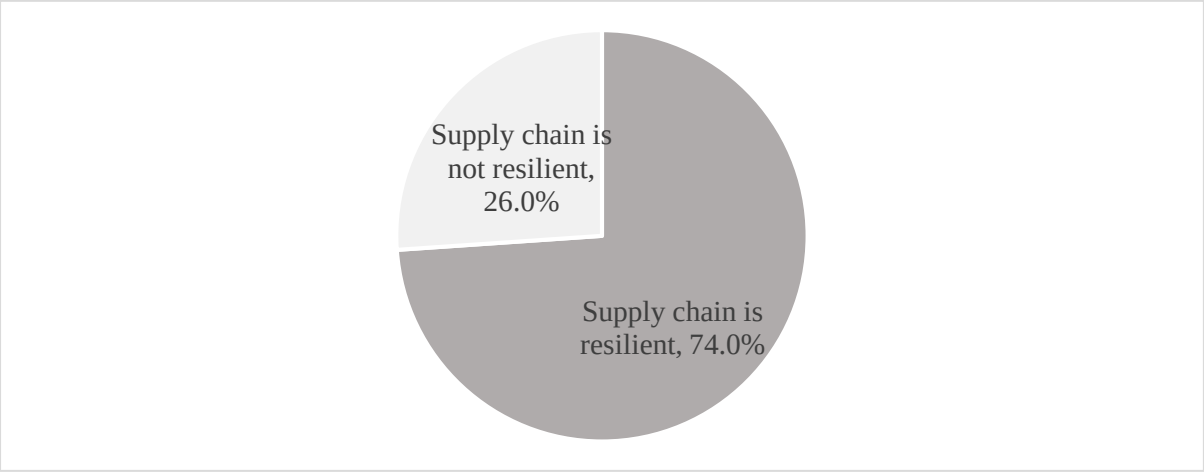
Source: [53]

8.3.20 *Figure A5. Agricultural Secretariat Budget Allocation 2019 of Mexico*



Source: USDA [57]

8.3.21 *Figure A6. Perceived Resilience of Supply Chain despite the COVID-19 Pandemic's Impact in Mexico (n=46)*



Source: Spire Conducted Interviews, 2020

Note. Irrelevant or non-applicable responses have been excluded (n=2).

8.3.22 Table A15. Sample Case Study #1 (Mexico)

Mexico's Banking Service Case Study: Caja Popular Tamazula

Banking operations constitute the largest share of system assets, and six development banks (DBs) account for 11% of assets in Mexico. Other Financial Intermediaries (OFIs), such as Savings and Loan Cooperative Societies (SOCAP), represent less than 2% of total assets in the financial sector.

One example of a Mexican SOCAP is Caja Popular Tamazula which offers savings, credit, and cooperative education services to its members, mostly low-income families located in Southern Jalisco. Credit services cover consumption expenses, personal expenses, and agricultural expenses.

Caja Popular has a CrediAgro programme providing loans ranging from 5,000 MXN (USD 240) to 2,000,000 MXN (USD 97,000). Horticultural produce eligible for loans are tomatoes and bell peppers grown in greenhouses and avocados. Loans must be used for specific purposes such as payrolls, acquisitions of inputs (e.g., seeds), leasing of equipment for production activities, and running production costs. In addition, this loan service offers loan interest rates as low as 12%. This is lower than the average interest rate for SMEs (in general) in Mexico, which was 17.7% in 2018.

Source: [93]

8.3.23 Table A16. Sample Case Study #2 (Mexico)

Mexico's Transportation Case study: Palos Garza

Palos Garza (PG), an international logistics company, provides transportation and distribution services and serves as a customs agency for the trade of goods. PG is the only customs agency in Port of Nuevo Laredo, one of the six transborder agglomerations along the US-Mexican border.

PG has an agro-logistics hub and a bonded warehouse authorised by SADER. The company offers cold storage services, which comprise of their sampling area for fruits and vegetables, a laboratory for product sampling, temperature-controlled docks, cold rooms, and a space to hold 300 transport vehicles. PG's warehouse is FDA registered, and pest control services are available through a third-party vendor to ensure that pests do not damage transported produce. To ensure the safety of the produce, there is a security system with cameras, anti-theft measures, and fire alarms.

Source: [94]

8.3.24 *Table A17. Initiatives and Support Programmes Sorted by Service Expenditure in Mexico*

Public and Private Horticulture-related Initiatives Identified by the Respondents

Service	Directly mentioned (respondent specifically mentioned the programme)	Indirectly mentioned (respondent didn't specifically mention the programme name but is familiar with it)	Desk Research (not mentioned by respondents, purely secondary data)
Transportation	1: Estimulo Fiscal para Crédito de Diesel	No data	No data
Wholesale	1: SEGALMEX	1: Forward Contract Programme	No data
HR	3: CONFENACAM, Sowing Life Programme, Pyme Exporta Centres	1: Jóvenes Construyendo	1: Production for Wellbeing
Banking	4: FONDESO, NAFIN, BANCOMEXT, Altepetl	2: Preferential loans (subsidised by the government) from the National Financial for Agricultural, Rural, Forestry and Fisheries Development and Production Subsidies from the Mexican Government	3: BANSEFI, Target Income Programme, FIRA
Retail	No data	1: DICONSA and LICONSA merger	No data
Storage	1: Customs Agency SIACOMEX	No data	No data
Total Number of Services	10	5	4

9 Reference List

1. Johan Visser, K.H., Karyn Welsh. *Introduction in the concept of logistics parks*. N.S; Available from: https://www.researchgate.net/profile/Johan-Visser/publication/274079841_introduction_into_the_concept_of_logistics_parks/links/551555490cf2d70ee270063f/introduction-into-the-concept-of-logistics-parks.pdf.
2. FAO, I., UNICEF, WFP and WHO, *The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets*. 2020.
3. FAO, I., UNICEF, *The State of Food Security and Nutrition in the World 2020: Transforming Food Systems for Affordable Healthy Diets.* Rome: FAO, IFAD, UNICEF, WFP and WHO, 2020.
4. FAO, *Sustainable Development Goals: Indicator 2.1.1 - Prevalence of undernourishment*. 2020.
5. World Food Summit, *Rome Declaration on World Food Security.* 1996.
6. FAO. *Hunger and food insecurity*. n.d.; Available from: http://www.fao.org/hunger/en/.
7. FAO, *An Introduction to the Basic Concepts of Food Security*. 2008.
8. APEC, *Insights On The Regulatory Environment Within APEC Economies And Its Impact On Trade In Services In Food Value Chains*. 2019.
9. Badan Pusat Statistik. *Badan Pusat Statistik,*. 2021; Available from: https://www.bps.go.id/.
10. World Bank. *The World Bank in Indonesia*. 2020; Available from: https://www.worldbank.org/en/country/indonesia/overview.
11. Statista. *Indonesia: Share of economic sectors in the gross domestic product (GDP) from 2009 to 2019.* 2021; Available from: https://www.statista.com/statistics/319236/share-of-economic-sectors-in-the-gdp-in-indonesia/#:~:text=In%202019%2C%20the%20share%20of,sector%20contributed%20about%2044.23%20percent.
12. World Bank, *Employment in agriculture (% of total employment) (modeled ILO estimate) - Indonesia*. 2020.
13. FAO. *Indonesia*. 2018; Available from: http://www.fao.org/faostat/en/#country/101.
14. WFP, *WFP Indonesia - Country Brief*. 2020.
15. WFP, *Strategic Review of Food Security and Nutrition in Indonesia*. 2020.
16. EU-Indonesia Business Network (EIBN), *EIBN Sector Reports - Agribusiness*. 2018.
17. Oxford Business Group, *New Areas for Growth in Indonesia's Agriculture Sector*. 2017.
18. FAO, *Small Family Farms Country Factsheet*. 2018.
19. Food and Fertilizer Technology Center. *Indonesian Agricultural Labor Policy*. 2020; Available from: https://ap.fftc.org.tw/article/2592
20. World Bank, *Employment in agriculture (% of total employment) (modelled ILO estimate)*. 2020.
21. Anthony Iswara, *A Land Without Farmers - Indonesia's agricultural conundrum*, in *The Jakarta Post*. 2020.
22. Indonesian Central Bureau of Statistics (BPS), *Percentage of Horticultural Plant Farmers by Gender and Plant Types in Indonesia (Percent)* 2018.
23. UNICEF. *Indonesia: Number of malnourished children could increase sharply due to COVID-19 unless swift action is taken*. 2020; Available from: https://www.unicef.org/indonesia/press-releases/number-of-malnourished-children-in-indonesia-could-increase-sharply-due-to-covid-19.

24. Capone, R., et al., *Food system sustainability and food security: connecting the dots.* Journal of Food Security, 2014. **2**(1): p. 13-22.
25. The Economist Intelligence Unit, B.C.f.F.N., *Food Sustainability Index*. 2018.
26. EIU, *Fixing Food 2018: Best Practices Towards the Sustainable Development Goals*. 2018.
27. Schreer, V. and M. Padmanabhan, *The many meanings of organic farming: framing food security and food sovereignty in Indonesia.* Organic Agriculture, 2019: p. 1-12.
28. OECD, *Agricultural Policy Monitoring and Evaluation*. 2020.
29. World Bank. *Logistics and performance index*. 2018; Available from: https://lpi.worldbank.org/.
30. The Jakarta Post, *What you need to know about large-scale social restrictions in Jakarta*. 2020.
31. World Bank. *Unemployment, total (% of total labor force) (modeled ILO estimate).* 2021; Available from: https://data.worldbank.org/indicator/SL.UEM.TOTL.ZS?end=2020andlocations=MX-IDandstart=2018.
32. World Bank, *Account Ownership At A Financial Institution Or With A Mobile-Money-Service Provider*. 2018.
33. The Jakarta Post, *Govt, Private Companies Push For Digital Transformation Of Msmes*. 2019.
34. Statista, *Smartphone penetration as share of population in Indonesia 2015-2025*. 2020.
35. Food and Fertilizer Technology Center. *The Law No.18/2012 Governing Food Security In Indonesia*. 2014; Available from: https://ap.fftc.org.tw/article/616
36. OECD. *Agricultural Support*. 2020; Available from: https://data.oecd.org/agrpolicy/agricultural-support.html
37. Bank, W., M.o.A. (Indonesia), and FAO. *Indonesia Agro-Value Chain Assessment: Issues and Options in Promoting Digital Agriculture* 2020; Available from: http://documents1.worldbank.org/curated/en/442511593422707873/Indonesia-Agro-Value-Chain-Assessment-Background-Paper-2-Issues-and-Options-in-Promoting-Digital-Agriculture.docx.
38. Republic of Indonesia Ministry of Finance, *IMi and KUR, Social Impact Investments that Promote Pojok Village, Banten*. 2019.
39. World Bank. *Mexico Overview*. 2020; Available from: https://www.worldbank.org/en/country/mexico/overview.
40. World Bank, *GDP (Current US$) - Mexico*. 2019.
41. Statista, *Mexico: Distribution of the gross domestic product (GDP) across economic sectors from 2009 to 2019*. 2019.
42. Investopedia. *Emerging Markets: Analyzing Mexico's GDP*. 2019; Available from: https://www.investopedia.com/articles/investing/090315/emerging-markets-analyzing-mexicos-gdp.asp.
43. Oxford Business Group. *Mexico supports small-scale farmers to strengthen its agriculture sector*. 2019; Available from: https://oxfordbusinessgroup.com/overview/fertile-ground-non-traditional-exports-and-agro-industry-drive-growth-government-looking-support.
44. FAO, *The economic lives of smallholder farmers*. 2015.
45. Statista, *Mexico: Distribution of the workforce across economic sectors from 2010 to 2020*. 2020.
46. Statista. *Mexico: number of agricultural employees 2016-2020, by gender*. 2021; Available from: https://www.statista.com/statistics/1014914/mexico-employees-agriculture-gender/.

47. United States Department of Agriculture (USDA), *Farm Labor Markets in the United States and Mexico Pose Challenges for U.S. Agriculture*. 2018.
48. FAO. *Mexico*. 2020; Available from: http://www.fao.org/faostat/en/#country/138.
49. FAO. *INFORMATION AS A VALUED FARM INPUT - A PILOT EXPERIENCE IN SONORA, MEXICO*. n.d.; Available from: http://www.fao.org/3/W3616E/w3616e09.htm.
50. USDA, *Global Trade Patterns in Fruit and Vegetables*. 2004.
51. FAO, *Commodities By Country*. 2018.
52. Statista, *Harvested area of avocado in Mexico from 2010 to 2019 (in 1,000 hectares)*. 2020.
53. FAO, *Major Export Partners*. 2018.
54. Transfer Latin Business Consultancy. *Opportunities for Dutch Businesses in the Mexican Protected Horticulture Sector*. 2020; Available from: https://www.rvo.nl/sites/default/files/2020/05/Opportunities-for-Dutch-Businesses-in-the-Mexican-Protected-Horticulture-Sector.pdf.
55. Ibarrola-Rivas, M. and L. Galicia, *Rethinking Food Security in Mexico: Discussing the Need for Sustainable Transversal Policies Linking Food Production and Food Consumption.* Investigaciones Geográficas, Boletín del Instituto de Geografía, 2017. **2017**(94): p. 106-121.
56. INEGI, *Nacional Agricultural Census of Mexico 2007, from INEGI*. 2007.
57. USDA. *Mexico Policy*. 2020; Available from: https://www.ers.usda.gov/topics/international-markets-us-trade/countries-regions/usmca-canada-mexico/mexico-policy/#:~:text=The%20PEC%20covers%20activities%20implemented,)%2C%20Mexico's%20counterpart%20to%20USDA.&text=For%202019%2C%20SADER%20was%20allocated,about%20%24US%203.4%20billion).
58. National Institute of Statistics and Geography (INEGI), N.B.a.S.C.C. *National Survey of Financial Inclusion (ENIF) 2018* 2018; Available from: http://en.www.inegi.org.mx/programas/enif/2018/.
59. National Law Review. *Mexico's 2019-2024 National Development Plan*. 2019; Available from: https://www.natlawreview.com/article/mexico-s-2019-2024-national-development-plan.
60. OECD, *Food Supply Chains and COVID-19: Impacts and Policy Lessons.* 2020.
61. FAO, *Food Loss and Food Waste.* 2011.
62. Jad Asaad. *Fixing the 5 big problems in the food supply chain*. 2018; Available from: https://supplychainbeyond.com/5-big-problems-in-the-food-supply-chain/.
63. InspiraFarm. *What's New: The first-mile distribution dilemma: what is needed to assure quality and safety of fresh produce from the point of production?* 2018; Available from: https://www.inspirafarms.com/whats-new_may2018/.
64. B. Calcinai, *Food safety compliance training for horticulture: collaborative course development by institutions and industry.* 2009.
65. World Bank. *Access to Finance for Women in Agricultural Dependent Households*. 2015; Available from: https://pubdocs.worldbank.org/en/239071450386092259/Session-4-Access-to-Finance-for-Women-in-Agriculture-Panos-Varangis.pdf.
66. Saiz-Rubio, R.-M., *From Smart Farming towards Agriculture 5.0: A Review on Crop Data Management.* Agronomy, 2020.
67. APEC. *APEC Compendium of Best Practices: Women in Agriculture and Fisheries*. 2020; Available from: https://www.apec.org/Publications/2020/06/APEC-Compendium-of-Best-Practices--Women-in-Agriculture-and-Fisheries.

68. International Monetary Fund. *Institutional Arrangements for Fintech Regulation and Supervision*. 2019; Available from: https://www.imf.org/~/media/Files/Publications/FTN063/2019/English/FTNEA2019002.ashx.
69. Liam O'Callaghan. *AirAsia enters e-commerce: Airline launches B2B e-commerce platform to connect farmers and customers and provide logistical support*. 2020; Available from: http://www.fruitnet.com/asiafruit/article/182094/airasia-enters-e-commerce.
70. Thailand Today. *Agriculture Ministry joins with Lazada to benefit farmers,*. 2019; Available from: https://www.thailandtoday.co/11/12/2019/agriculture-ministry-joins-with-lazada-to-benefit-farmers/.
71. Asian Development Bank, *Promoting Logistics Development in Rural Areas*. 2017.
72. CropLife. *Sustainable Rice Farming in Viet Nam*. 2019; Available from: https://croplife.org/trainingthroughlocalpartnerships/vietnam/
73. Faith Gilbert. *A guide to sharing farm equipment A tool-sharing toolkit for farmers, co-operators, and organizers of shared equipment pools*. 2018; Available from: https://static1.squarespace.com/static/53a4e2b0e4b044c4de439e15/t/5afa42a26d2a73b330e797f7/1526350506535/A+Guide+to+Sharing+Farm+Equipment_2018_WEB.pdf.
74. SUCHIT LEESA-NGUANSUK, *Tax perk aims to help SMEs join digital wave*, in *Bangkok Post,*. 2019.
75. Hallie Gu. *On the autofarm: China turns to driverless tractors, combines to overhaul agriculture*. 2019; Available from: https://www.reuters.com/article/us-china-farming-technology-idUSKCN1PA0DV.
76. World Food Programme (WFP). *INDONESIA COVID-19: Economic and Food Security Implications*. 2020; Available from: https://docs.wfp.org/api/documents/WFP-0000122120/download/.
77. Indonesia, C.S.o.T.R.o. *Gov't to Provide Super-Micro People's Business Credit for Laid-Off Workers, Productive Housewives*. 2020; Available from: https://setkab.go.id/en/govt-to-provide-super-micro-peoples-business-credit-for-laid-off-workers-productive-housewives/.
78. United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA), *Situation Update: Response to COVID-19 in Indonesia.* 2020.
79. OECD. *Job retention schemes during the COVID-19 lockdown and beyond*. 2020; Available from: https://www.oecd.org/coronavirus/policy-responses/job-retention-schemes-during-the-covid-19-lockdown-and-beyond-0853ba1d/.
80. International Labour Organization, *Policy design of the employment adjustment subsidy in Japan*. 2020.
81. World Bank, *Prevalence of Undernourishment (% of population)*. 2020.
82. World Bank, *Agriculture, Forestry, and Fishing, Value Added (% of GDP)*. 2019.
83. CISCO. *Digital Readiness Index*. 2019; Available from: https://www.cisco.com/c/m/en_us/about/corporate-social-responsibility/research-resources/digital-readiness-index.html#/.
84. Ministry Of Agriculture Republic Indonesia. *Ministry Of Agriculture Republic Indonesia*. 2020; Available from: https://www.pertanian.go.id/unit_en.php.
85. The Jakarta Post, *Railways, warehousing boost logistics sector as it grows by 10.5% in 2019*, in *The Jakarta Post*. 2020.
86. Iordachescu, *Postharvest Losses In Transportation And Storage For Fresh Fruits And Vegetables Sector.* . 2019.
87. IPC Logistic. *Company profile*. 2020; Available from: https://ipclogistic.co.id/tentang_kami/profil_perusahaan.html, .

88. Investopedia, *Financial Technology - Fintech.,*. 2020.
89. PricewaterhouseCoopers (PWC), *Indonesia's Fintech Lending: Driving Economic Growth Through Financial Inclusion.* 2019.
90. MIT Technology Review. *How fintech is disrupting agriculture in Indonesia* 2019; Available from: https://insights.techreview.com/how fintech - is -disrupting - agriculture - in – Indonesia/.
91. International Finance Corporation. *Digital Marketplace Keeps Indonesian Farmers in Business*. 2020; Available from: https://www.ifc.org/wps/wcm/connect/news_ext_content/ifc_external_corporate_site/news+and+events/news/impact-stories/tanihub-indonesia
92. Tanifund. *Tanifund*. 2020; Available from: https://tanifund.com/.
93. Caja Popular Tamazula. *CrediAgro*. 2020; Available from: https://www.cajapopulartamazula.com/crediagro-avio.
94. Palos Garza. *Palos Garza*. n.d; Available from: https://www.palosgarza.com/puerta-a-puerta/.