

# Assessing the Impact of the COVID-19 Pandemic on Agricultural Production in Southeast Asia: Toward Transformative Change in Agricultural Food Systems

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## ABSTRACT

How will the COVID-19 pandemic affect the agriculture sector in Southeast Asia? Clearly, any disruptions in the agricultural food systems would create supply and demand shocks that would impact on the agriculture sector's immediate and long-term economic performance and food security contribution. Overall, the COVID-19 pandemic during the first quarter of year 2020 is estimated to result in 3.11 percent or 17.03 million tons reduction in aggregate volume of agricultural production in Southeast Asia due to decline in agricultural farm labor affecting 100.77 million individuals. This crisis could translate to 1.4 percent decrease in GDP of the Southeast Asian region, which is equivalent to USD 3.76 billion. Ensuring a systemic transformation of the agricultural systems into resilient, sustainable, productive, and inclusive food systems would be crucial for the future of Southeast Asia.

**Keywords:** COVID-19, agriculture food systems, Southeast Asia, transformative change, impact assessment

**JEL Classification:** O13, Q01, Q18

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## INTRODUCTION

### Overview of the Agriculture Sector in Southeast Asia

Agriculture remains a major engine of growth among Southeast Asian countries, particularly for poverty reduction and food security. Overall, the growth in agricultural production, particularly in terms of yield and area, has continued to increase in the region. Though the contribution of the agriculture sector to total output in many of these countries has generally been decreasing, the average share of agricultural labor to the total population remains significant. As of 2019, about 31 percent of the combined population in Southeast Asia (SEA) is employed in agriculture. Except for Singapore, Malaysia, and Brunei, at least 23 percent of total labor force of each of Southeast Asian countries has agriculture as its main source of livelihood; it is as high as 62 percent in the case of Lao PDR.

For 2015–2019, 36 million people in SEA live below the international poverty line (USD 1.9 /day). With an average nominal GDP per capita of USD 4,755 in 2019, the agriculture sector is in a strategic position to further close the gap in the seemingly increasing income inequality in SEA, averaging at a high Gini coefficient of 77.23. While generally, the agriculture sector's contribution to GDP of these countries has been declining, its socioeconomic importance remains undeniable.

The limited capacity of Southeast Asian countries to maximize the contribution of agriculture in terms of yield and income has been due to a myriad of factors spanning relatively small farm holdings; problematic land and tenurial systems; limited availability of high quality seeds; pests and diseases; constrained access to farm inputs, irrigation, and recommended agricultural practices; weather and climatic hazards; environmental degradation; absence of sufficient safety nets and financial support; and lack of strong market institutions, among others.

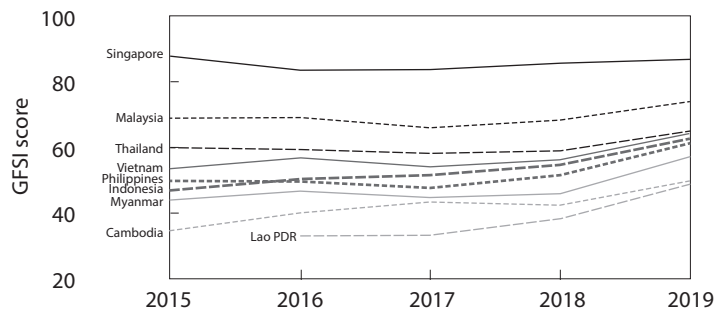
### Food Security Conditions in Southeast Asia

The United Nations defines food security as availability of and adequate access to sufficient, safe, and nutritious food at all times to maintain a healthy and active life (FAO 2003). Food security is measured in terms of its three pillars, namely, food availability, access, and utilization. Additionally, food stability has been added as a fourth pillar especially in consideration of the inherent exposure of SEA to weather and climate change-related hazards. While food availability refers to sufficient quantities of food on a consistent basis, either in terms of stock and production in a given area or the capacity to bring in food from elsewhere through trade or aid; food access refers to how people must be able to regularly acquire adequate quantities of food through purchase, home production, etc. On the other hand, food utilization presupposes that the consumed food has a positive nutritional impact on people.

Based on the Global Food Security Index (GFSI) ([The Economist Intelligence Unit 2020](#)), the widely accepted metric in measuring food security, countries comprising SEA vary greatly in their food security levels for the past years. Overall, SEA has a combined GFSI score of 63.3 in 2019 out of the highest possible score of 100, which shows a marked increase from 53.6 to 55.7 in years 2015 to 2018 (Figure 1). Comparisons among countries in SEA show Singapore and Malaysia in the lead with 87.4 and 73.8, respectively. In fact, the recent GFSI 2019 Report ranks Singapore as among the most food secure in the world. However, the rest of the Southeast Asian countries have GFSI scores of 49.1 (Lao People's Democratic Republic) to 65.1 (Thailand). For 2015–2019, most of these countries show no significant improvement in the GFSI except with a considerable upswing at the onset of 2019 due to overall favorable conditions on food availability and affordability. However, these initial gains would need to be sustained in 2020 onwards to be considered a success story in SEA.

While Asia, as a whole, has an estimated 81.7 million undernourished people in 2019—many of whom are women and people living in marginal areas who are most vulnerable to food insecurity—

**Figure 1. Global Food Security Index in Southeast Asia, 2015–2019**



Source: The Economist Intelligence Unit (2020)

about 57.9 million malnourished individuals are from the Southeast Asian region (UNICEF, WHO, and World Bank 2019). The number of undernourished people in SEA for the years 2010 to 2017 ranges from 59.2 to 73.7 million or about 9.3–12.3 percent of the total population of the region. Using 2017 data, highest prevalence of undernourishment in terms of percentage of the total population of a country was observed in Lao PDR (16.5%) and Cambodia (16.4%); the lowest are in Singapore (0%) and Malaysia (2.5%). Clearly, agriculture must not just aim to increase food production but also improve the nutritional status of the population.

### Objectives of the Study

On top of the systemic challenges besetting the agriculture sector, the onset of the COVID-19 pandemic in the first quarter of year 2020 is seen to have further threatened overall capacity of the sector to achieve productivity and income targets, as well as ensure sustained contribution to food security. The imposition of mobility restrictions and community quarantine lockdowns as a direct response to the COVID-19 pandemic resulted to disruptions in the agricultural food systems, creating supply and demand shocks. In turn, this would impact on the agriculture sector's immediate and long-term economic performance and food security contribution. This paper aimed to assess the impact of COVID-19 pandemic on agricultural production in SEA. It also puts out several lessons for the promotion

of a transformative change in agricultural food systems relevant for the countries comprising the Southeast Asian region.

### METHODS

The constraint caused by COVID-19 has impacted on labor supplies, hence, affecting the total agricultural output and the sector's performance. As applied in this study, these measures were analyzed through estimation of percent change in agricultural output and sectoral GDP share. Within such predicted global slowdown, Vos, Martin, and Laborde (2020) estimated that the reduced labor mobility would lead to a 1.4 percent reduction in labor supply using the approach developed by the International Food Policy Research Institute (IFPRI). Using this estimate, this study computed the agricultural labor force (ALF) in 2020 with a 1.4 percent drop from the ALF in 2019.

Secondary data from World Bank and FAOSTAT (FAO 2019b) were used in the analysis covering the most recent 5-year statistics (2015–2019) in agricultural performance of Southeast Asian countries. Specifically, the data collected and used in the analyses included (a) agricultural labor force, (b) volume of agricultural production primarily crops and livestock (in tons) and, (c) agriculture, forestry, and fishery share and percent share in total GDP (in USD).

The change in volume of production was estimated through projected volume for 2020 with the calculation of labor productivity using 2018 production volumes<sup>1</sup> and estimated agricultural labor force in 2020 (base year 2018). The annual agricultural production per worker, which is the ratio of the volume of agricultural production to the total number of employed persons in the agriculture sector, was used to estimate the volume of agricultural production for 2020. As applied in this study, the reduction in the volume of agricultural production from 2019 to 2020 due to 1.4 percent decrease in agricultural labor force was quantified and valued in terms of its GDP equivalent.

On the other hand, the change in GDP share was obtained through projected GDP with the calculation of labor productivity using data on GDP share in 2019 and estimated agricultural labor force in 2020, using the equations:

$$Y = [(L_1 * P) - Y_o] / Y_o \quad (1)$$

where

$Y$  = Change in volume of production due to agricultural labor force (in percent)

$L_1$  = Labor productivity (tons per labor capita)

$P$  = Estimated agricultural labor force in 2020

$Y_o$  = Volume of agricultural production in 2018 (MT)

$$GDP = [(L_2 * P) - GDP_o] / GDP_o \quad (2)$$

where

$GDP$  = Change in GDP share due to agricultural labor force

$L_2$  = Labor productivity (USD per labor capita)

$P$  = Estimated agricultural labor force in 2020

$GDP_o$  = GDP share of agriculture, forestry, and fishery in 2019 (USD)

It should be noted that the full effects of the COVID-19 pandemic on the agriculture sector in SEA will be determined once it has peaked and finally stopped. However, the estimates provided in this study indicate the extent of the impact of the COVID-19 pandemic, highlighting the importance of supporting programmatic interventions for the agriculture sector both during the pandemic as well as for a long-term post-COVID scenario in the Southeast Asian region.

## RESULTS AND DISCUSSION

### Decreased Agricultural Labor Supply and Production

The COVID-19 pandemic creates supply and demand shocks affecting all the relevant economic sectors, particularly, agriculture. The extent of the effects of COVID-19 could be better appreciated across the value chain, which shows how food flows from the farmer-producers through the processors, distributors, retailers, and finally reaching the plates of the consumers. Overall, the food supply chain shows the linkage between supply and demand in an agricultural food system.

The mobility restrictions as a result of the imposition of community lockdowns result in quantity reduction in farm labor that would translate to overall reduction in agricultural output. Reduced agricultural production is also caused by farmers' limited access to farm inputs and to markets to sell produce, which may result in profit losses and wastage of farm produce. In the long run, the loss of income and the economic slowdown would also result in decrease in demand, particularly among the farmers and farming families without safety nets. Among Southeast Asian countries, agriculture remains to be a major source of direct employment, such as in the case of Lao PDR (62%), Myanmar (49%), Timor-Leste (44%), and Vietnam (37%).

The restrictions caused by COVID-19 during the first quarter of year 2020 translate to 1.4 percent drop in farm labor supply as estimated by Vos, Martin, and Laborde (2020). This has caused

<sup>1</sup> Agricultural production volume data across the Southeast Asian region for 2019 were still unavailable as of this writing, hence, latest available data for this is for 2018.

an overall decrease in the volume of aggregate agricultural production amounting to 17.034 million tons (or 3.11% drop in production) for the whole of SEA (Table 1). Among the countries most affected by the decline in agricultural labor supply are Vietnam, Cambodia, and Indonesia, which showed an estimated reduction in volume of aggregate agricultural production of 3.82, 3.63, and 3.28 percent, respectively. For SEA, whose population is heavily based on the agriculture sector, the disruption caused by the COVID-19 pandemic poses the risks of unemployment, which, if unabated sooner, will eventually result to widespread reduction in living standards due to limited capacity and access to basic necessities.

### Impact on GDP via Reduced Agricultural Output

The spread of COVID-19 has significant economic impact on SEA especially that the percent GDP shares of agriculture, forestry, and fishery in the total GDP of the Southeast Asian countries are relatively high, particularly for countries like Cambodia (20%), Lao PDR (15%), Timor-Leste (13%), and Indonesia (13%). The decrease in agricultural labor force due to COVID-19 could translate to the reduction of agriculture's share in total GDP among Southeast Asian countries. Overall, an estimated 1.4 percent drop in GDP (USD 3.76 billion) could be felt by the whole of SEA (Table 2). Almost all SEA countries, except Brunei, could manifest more than one percent decline in the share of agriculture to total GDP.

**Table 1. Estimated reduction in the volume of agricultural production due to decrease in agricultural labor force in Southeast Asia**

Country	Volume of Agricultural Production* (Million Tons)	Labor Productivity (Tons/Worker)**	With COVID Scenario			
			Estimated ALF in 2020 Due to COVID (Million)***	Estimated Volume of Agricultural Production (Million Tons)****	% Change in Volume of Agricultural Production Due to Decrease in ALF	Reduction in Volume of Agricultural Production (Million Tons)
			2020	2020		2020
Brunei	0.16	15.793	0.01	0.156	-1.40%	-0.002
Cambodia	4.88	1.580	2.98	4.705	-3.63%	-0.177
Indonesia	0.05	0.001	38.05	0.045	-3.28%	-0.002
Lao PDR	12.30	5.211	2.35	12.230	-0.56%	-0.069
Malaysia	132.73	80.932	1.60	129.274	-2.60%	-3.454
Myanmar	64.47	5.302	11.90	63.096	-2.13%	-1.373
Philippines	99.98	9.379	10.34	97.011	-2.97%	-2.972
Singapore	0.18	6.163	0.0296	0.182	-1.40%	-0.003
Thailand	112.53	9.002	12.16	109.442	-2.74%	-3.084
Timor-Leste	0.38	1.595	0.24	0.377	-1.40%	-0.005
Vietnam	120.67	5.492	21.13	116.056	-3.82%	-4.614
Souteast Asia	548.33	5.272	100.77	531.295	-3.11%	-17.034

\* Computed using crops and livestock production

\*\* Computed using the agricultural production in 2018 as base year

\*\*\* Computed assuming 1.4 percent reduction in agricultural labor force (Vos, Martin, and Laborde 2020)

\*\*\*\* Estimated based on 2018 production and with 1.4 percent reduction in ALF

**Table 2. Estimated reduction in GDP due to decrease in agricultural labor force in Southeast Asia**

Country	With COVID Scenario				With COVID Scenario		
	Estimated ALF in 2020 Due to COVID (Million)*	Estimated GDP (Billion USD)**	Difference in GDP (Billion USD)	% Change in GDP	Total Population (Millions)	Percent Increase in Poverty Ratio Due to ALF Reduction***	Estimated Increase in the Number of Population Living Below USD 1.90 a Day (Millions)
	2020	2020	2000	2020	2020		
Brunei	0.01	0.14	0.000	0.00%	0.43		
Cambodia	2.978	4.70	-0.066	-1.39%	16.50		
Indonesia	38.05	142.50	-2.022	-1.40%	266.10	2.07	5.51
Laos	2.347	3.03	-0.043	-1.39%	6.70	2.97	0.20
Malaysia	1.597	27.90	-0.402	-1.42%	32.60		
Myanmar	11.901	17.16	-0.244	-1.40%	54.10	2.97	1.61
Philippines	10.343	30.26	-0.430	-1.40%	108.80	2.97	3.23
Singapore	0.0296	0.08	-0.001	-1.33%	5.71		
Thailand	12.157	38.06	-0.542	-1.40%	66.56	2.36	1.57
Timor-Leste	0.237	0.41	-0.005	-1.25%	1.30	1.63	0.02
Vietnam	21.13	34.51	-0.490	-1.40%	96.48	0.96	0.93
Southeast Asia	100.769	264.60	-3.758	-1.40%	655.28	2.24	14.68

\* Computed assuming 1.4 percent reduction in agricultural labor force (Vos, Martin, and Laborde 2020)

\*\* Computed using the estimated 2020 ALF and the computed labor productivity

\*\*\* Based on the estimates of IFPRI from 1.4 percent reduction in labor supply, except for Brunei, Cambodia, Malaysia, and Singapore, for which data are not available

Considerable growth in the economic and agricultural performance of the Southeast Asian region has been observed in the immediate past years. The recorded stable increase in real GDP of the region for 2017–2019, averaging at 5.2, was a remarkable increase as compared to the preceding years. Recent projections of the Organization for Economic Cooperation and Development (OECD) (2019) likewise provide that Southeast Asian countries would have maintained an average of 5.2 percent GDP per year in 2019–2023. Such trend is consistent with what is observed across Asia where recent economic growth is found to be remarkably higher than in all regions in recent decades. However, Atkeson (2020) posits that the ongoing public health crisis will weigh heavily on economic activity, employment, and inflation in the near term, and poses considerable risks to

the economic outlook over the medium term. As such, the OECD, on 2 March 2020, lowered its forecast of global economic growth by 0.5 percent for 2020 from 2.9 percent to 2.4 percent. On the other hand, the IMF (2020) projection shows that the ASEAN-5 (Indonesia, Malaysia, the Philippines, Thailand, and Vietnam) growth will be at -0.6 percent in 2020, significantly lower from its earlier forecast of +4.8 percent. Lastly, the analysis of ADB (2020) likewise provide that the Southeast Asian region will experience decelerated growth at +1 percent in year 2020.

This decrease in GDP could mean more families in SEA being pushed below the poverty line (Table 2). Except for Brunei, the estimates of this current study show that percent change in GDP across Southeast Asian countries due to decrease in agricultural labor force as induced by the

COVID-19 mobility restrictions range from 1.25 percent (Timor Leste) to 1.42 percent (Malaysia). In addition, the poverty impacts of an economic slowdown could range from 0.96 (Vietnam) to 2.97 percent rise in poverty ratio in Indonesia, Lao PDR, Myanmar, and the Philippines. Overall, poverty impacts in SEA could reach an additional 14.68 million families to live below the USD 1.90 a day threshold (Table 2). Clearly, the COVID-19 pandemic would push back the ability of some countries in SEA to further hit their poverty reduction targets as set in their commitments for the Sustainable Development Goals 2030.

### **Toward Transformed Agricultural Food Systems in Southeast Asia**

The experience with COVID-19 further highlights the importance of the agriculture sector in ensuring the achievement of food security especially during times of crisis. How food security is defined, which in turn becomes the basis of how agriculture programs and projects are designed to achieve it, now further raises an important aspect related to viewing agricultural systems as food systems.

Seeing food security as a coordination problem, both the government and private sectors could use this experience with COVID-19 to rethink how food production and consumption could be made more sustainable. Across the agricultural supply chain, the COVID-19 pandemic resulted in movement restrictions for labor and transport of farm inputs and produce, increase in food prices due to the unpredictable market, and change in consumer patterns (Figure 2). The interconnections of each of the nodes of agricultural supply chains would therefore be critical in affording a holistic and integrated response to ensuring food security and nutrition at all times, particularly during crisis.

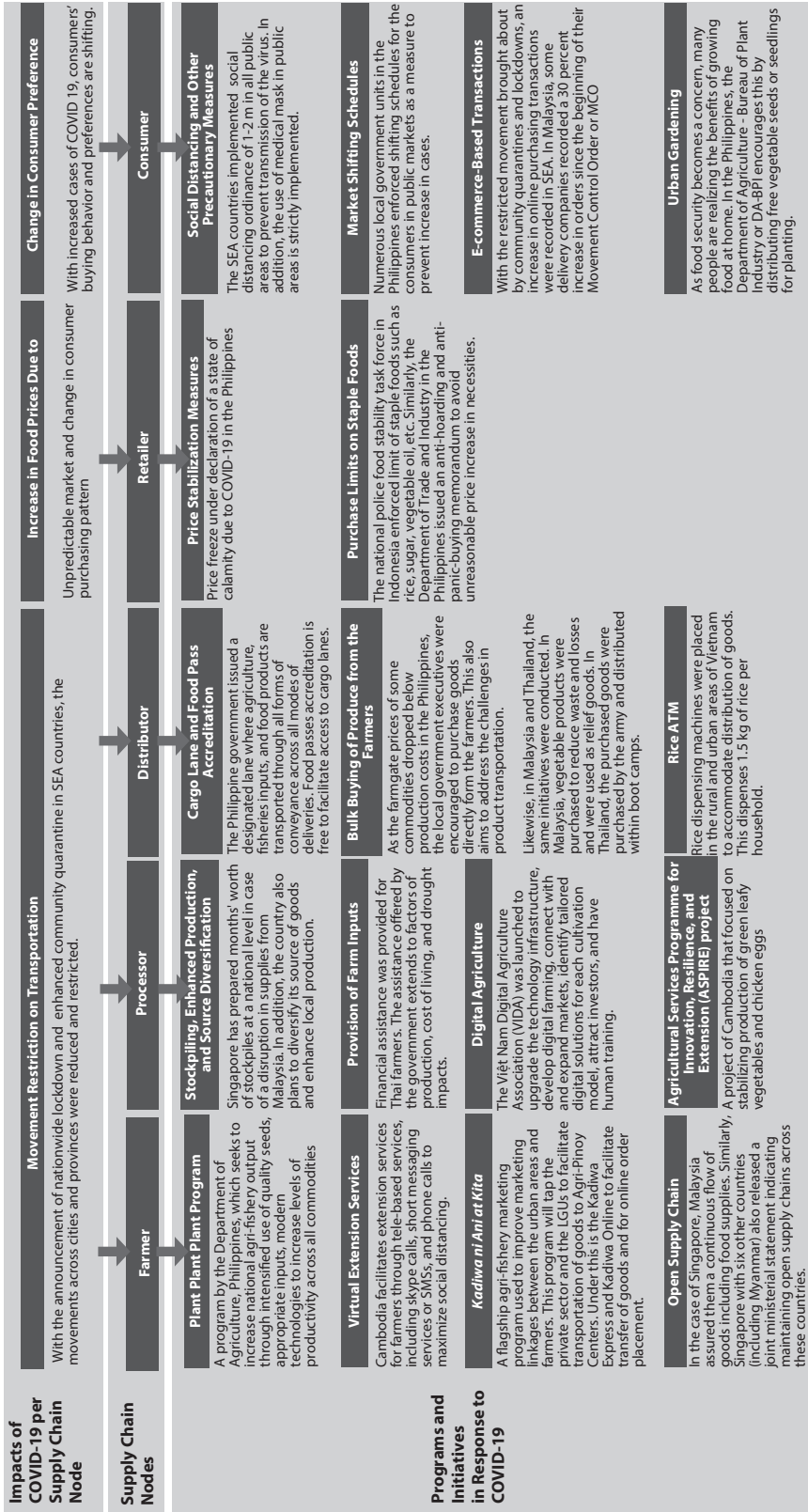
Across the region, several innovations were implemented by the Southeast Asian countries supporting the farmers, processors, distributors, retailers, and consumers (Figure 2). Notable interventions addressing the concerns of the farmers is the “Plant, Plant, Plant” program of the agriculture department of the Philippines,

which seeks to significantly increase national agri-fishery output. It is complemented with another flagship agri-fishery marketing program that aims to improve marketing linkages between the urban areas and farmers. Likewise, Cambodia has embarked on virtual extension services using telecommunications-based services to assist farmers amid the social distancing regulation. On the other hand, Singapore has long been implementing a program targeting its agricultural processing sector to beef up national food reserves in preparation for disruptions like COVID-19, while also maintaining an open supply chain with its neighboring country Malaysia, among other countries in the region. Vietnam, on the other hand, has invested on digital agriculture to upgrade the connectivity between farms and markets, while also setting up rice dispensing machines in the rural and urban areas providing 1.5 kg of rice per household.

Other notable responses and initiatives to COVID-19, particularly aiding the agricultural distributors, are the Philippines’ cargo land and food pass accreditation system, as well as the bulk buying of farm produce from farmers in some localities in Malaysia, Thailand, and the Philippines. For the retailers, some regulations related to price freeze for basic commodities were also implemented in the Philippines, including the imposition of purchase limits on selected staple foods. Common across many countries in the region are interventions targeting the consumers that include social distancing and precautionary measures, household marketing shifts/schedules, the boosting of e-commerce-based transactions, and the promotion of urban gardening. Overall, there have been a number of interventions implemented by countries in SEA in response to COVID-19. However, more focused analyses would be necessary to distill lessons from these interventions as bases toward a more long-term and integrated designing of the agricultural systems that must be more productive, resilient, inclusive, and sustainable.

For SEA, the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA) has identified the

Figure 2. Selected programs and initiatives in response to COVID-19 among Southeast Asian countries





necessary elements of transformative change of agricultural systems into food systems as outlined in its 11th five-year plan (2020–2025) (Figure 3). Under the banner of “Accelerating Transformation through Agricultural Innovation” or ATTAIN, SEARCA’s mission in the next five years is to elevate the quality of life of agricultural families through sustainable livelihoods and access to modern networks and innovative markets. As a leading enabler and champion of excellence in agriculture and rural development in SEA, SEARCA commits to better, bigger, and smarter outcomes and impact on the agriculture industry and its stakeholders. More effective and efficient delivery of context-relevant and valuable services is envisioned to reach more beneficiaries.

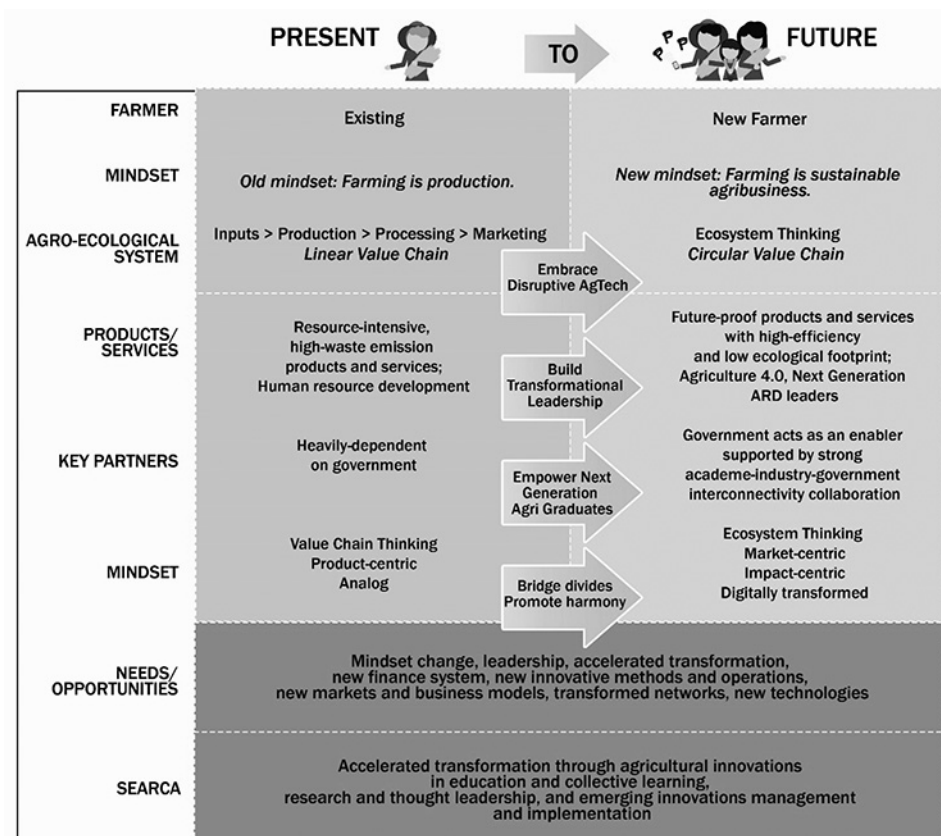
Central to SEARCA’s strategy is supporting more academe-industry-government (AIG)

models, which will be critical to operationalize the interconnectivity between and among the nodes in the supply chain, while also highlighting the linkage between the rural farming systems and the urban consumption patterns, and vice versa.

Listed below are the major interventions where the AIG models could be applied to strengthen the role of agricultural and rural development in ensuring food security, particularly in responding to crises like COVID-19:

1. The likes of the COVID-19 pandemic have raised the need to support local capacity toward being self-sufficient through well-planned local food production systems. While sustaining the efforts to significantly improve productivity and income among rural farmers, urban communities could be supported on

Figure 3. SEARCA’s transformation framework



Source: SEARCA 11th Five-Year Plan (SEARCA 2020)

engaging in urban agriculture initiatives at the community and household levels. Supporting more studies on how physical and financial technologies and social organizations could be better wielded to make these initiatives work and be made more efficient across scales is a priority.

2. It is paramount to provide more incentives to support innovation studies and activities that significantly improve production, reduce production losses, and promote value-adding activities covering both agriculture and related non-agriculture ventures. For SEA, these would particularly include support activities related to development of new and relevant crop varieties and livestock breeds; seed and livestock production and distribution of technologies; agricultural systems technologies like water management, pests and diseases management, weather and climate forecasting, etc.; postharvest management like drying, processing, and storage; farm produce transport and logistics systems; facilities supporting food quality, nutrition, and safety maintenance; and diversified farming, as well as support livelihoods complementary to that of major crops and livestock produced, among many others.
3. As risks and uncertainties arise related to price volatilities, inclement weather, and climate-change related hazards that characterize farm production systems, there is a need to support more studies and activities related to improving design of financial technologies for farmers, and to encouraging wider participation in these financial systems like loans and credit systems and agricultural insurance facilities, among others. Policies and interventions to support institutional and organizational interventions made suitable to the cultural nuances of a group or community would be particularly relevant for countries in SEA.
4. It is high time that the general public significantly appreciates the value of agriculture. Consumers are now becoming more aware of the intricate link between what

they have on their plates and the quantity and quality of farm production, which could be capitalized on to encourage more programs and budget allocation from governments, as well as private initiatives related to agriculture such as farm-based small-and-medium enterprises. In turn, there is a need for a massive promotion of sustainable and responsible consumption pattern that provides strong signals for agricultural products that support and observe cleaner production, environmental conservation, and social inclusion. At the individual and household levels, massive promotion of information related to healthy diets and lifestyles, agricultural produce that are nutritious and rich in micronutrients, food preparation and preservation techniques, as well as waste management strategies must be made accessible using various knowledge platforms and modalities.

5. The growing interest in agriculture needs to be sustained with more targeted capacity building activities of relevant government agencies and groups to specifically promote and generate more agri-entrepreneurs. Encouraging all sectors' participation, particularly the youth and women, through a number of systematic education and mentorship programs with well-thought-out and sustained incentives and innovative training modalities and backed with social safety net systems will be instrumental to sustain these efforts.
6. In addition, while most of the efforts above are targeted within a country, it would be critical that policies supporting trade in SEA must be designed to simultaneously support productive and inclusive agricultural systems that ensure food security in the region. At the current rate, more studies must be done to ensure the balance between trade priorities and food security goals particularly under the tenets of the Association of Southeast Asian Nations (ASEAN) Economic Cooperation. At the minimum, efforts to support the collective capacities of Southeast Asian countries to increase agricultural productivity must be

sustained as it will benefit all ASEAN member countries. However, analyses toward effective coordination mechanisms among countries to reduce trade and food insecurities both at the national and regional levels must be continuously pursued.

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## REFERENCES

- Atkeson, A. 2020. "What Will Be the Economic Impact of COVID-19 in the US? Rough Estimates of Disease Scenarios." *NBER Working Paper* 26867. National Bureau of Economic Research, Cambridge, MA. <https://www.nber.org/papers/w26867>
- ADB (Asian Development Bank). 2020. *Asian Development Outlook (ADO) 2020: What Drives Innovation in Asia?* <https://www.adb.org/publications/asian-development-outlook-2020-innovation-asia>
- FAO (Food and Agriculture Organization). 2003. *Trade Reforms and Food Security: Conceptualizing the Linkages*. Commodity Policy and Projections Service Commodities and Trade Division: FAO, Rome. <http://www.fao.org/3/y4671e/y4671e00.htm>
- \_\_\_\_\_. 2017. *The Future of Food and Agriculture: Trends and Challenges*. Rome: Food and Agriculture Organization.
- \_\_\_\_\_. 2019a. *The State of Food Security and Nutrition in the World, Safeguarding against economic slowdowns and downturns*. Rome: Food and Agriculture Organization.
- \_\_\_\_\_. 2019b. *FAOSTAT data*. <http://www.fao.org/faostat/en/#data/>
- IMF (International Monetary Fund). 2020. "World Economic Outlook, April 2020: The Great Lockdown." *World Economic Reports*. Source: <https://www.imf.org/en/Publications/WEO/Issues/2020/04/14/weo-april-2020>
- OECD (Organization for Economic Co-operation and Development). 2020. *OED Interim Economic Assessment, Coronavirus: The World Economy at Risk*. <https://www.oecd.org/berlin/publikationen/Interim-Economic-Assessment-2-March-2020.pdf>
- Ravallion, M. 2016. *The Economics of Poverty: History, Measurement and Policy*. Oxford University Press
- SEARCA (Southeast Asia Regional Center for Graduate Study and Research in Agriculture). 2020. "SEARCA 11th Five-Year Plan (2020-2025): Accelerating Transformation Through Agricultural Innovation (ATTAIN)." Unpublished. Los Baños: SEARCA.
- The Economist Intelligence Unit. 2020. *Regional Report: Asia Pacific Global Food Security Index 2019*. <https://foodsecurityindex.eiu.com/Resources>
- UNICEF, WHO, and World Bank (UN Children's Fund, World Health Organization, and World Bank). 2019. *Levels and Trends in Child Malnutrition, Key findings of the 2019 edition*. <https://apps.who.int/iris/bitstream/handle/10665/331097/WHO-NMH-NHD-19.20-eng.pdf?ua=1>
- Vos, Rob, Will Martin, and David Laborde. 2020. "How much will global poverty increase because of COVID-19?" *IFPRI Blog: Research Post*, 20 March 2020, International Food Policy Research Center (IFPRI). <https://www.ifpri.org/blog/how-much-will-global-poverty-increase-because-covid-19>

## APPENDICES

Appendix Table 1. Estimated reduction in the volume of agricultural production due to decrease in agricultural labor force in Southeast Asia

Country	Total Labor Force (LF) (Millions)				Agricultural Labor Force (ALF) (Millions)		% Share of Agriculture Employment in Total Labor Force (LF)		Volume of Agricultural Production* (Million Tons)		Labor Productivity (Tons/Worker)**		With Covid Scenario			
	Average annual growth rate 2014-2019	Average annual growth rate 2019	Average from 2014-2019	Average annual growth rate	Agricultural Labor Force (ALF)	Average annual growth rate	2019	2018	2018	2018	2018	2018	2020	2020	2020	2020
													Estimated ALF in 2020 Due to COVID-19 (Million)***	Estimated Volume of Agricultural Production (Million Tons)****	% Change in Volume of Agricultural Production Due to	Reduction in Volume of Agricultural Production (Million Tons)
Brunei	0.21	1.95%	0.01	0.00%	5%	0.16	15.793	0.01	0.156	-1.40%	-0.002					
Cambodia	8.91	2.17%	3.35	-4.77%	32%	4.88	1.580	2.98	4.705	-3.63%	-0.177					
Indonesia	128.48	1.83%	40.22	-1.77%	29%	0.05	0.001	38.05	0.045	-3.28%	-0.002					
Laos	3.62	2.12%	2.34	0.69%	62%	12.30	5.211	2.35	12.230	-0.56%	-0.069					
Malaysia	14.98	1.88%	1.70	-1.47%	10%	132.73	80.932	1.60	129.274	-2.60%	-3.454					
Myanmar	24.61	0.00%	12.48	-1.32%	49%	64.47	5.302	11.90	63.096	-2.13%	-1.373					
Philippines	43.52	1.07%	11.57	-4.07%	23%	99.98	9.379	10.34	97.011	-2.97%	-2.972					
Singapore	3.47	1.00%	0.03	0.00%	1%	0.18	6.163	0.0296	0.182	-1.40%	-0.003					
Thailand	38.83	0.00%	12.43	-1.08%	32%	112.53	9.002	12.16	109.442	-2.74%	-3.084					
Timor-Leste	0.51	3.20%	0.24	0.87%	44%	0.38	1.595	0.24	0.377	-1.40%	-0.005					
Vietnam	56.33	0.71%	23.29	-3.53%	37%	120.67	5.492	21.13	116.056	-3.82%	-4.614					
Southeast Asia	323.46	1.17%	107.66	-2.31%	31%	548.33	5.272	100.77	531.295	-3.11%	-17.034					

\* Computed using crops and livestock production

\*\* Computed using the agricultural production in 2018 as base year

\*\*\* Computed assuming 1.4 percent reduction in agricultural labor force (Vos, Martin, and Laborde 2020)

\*\*\*\* Estimated based on 2018 production and with 1.4 percent reduction in ALF

Appendix Table 2. Estimated reduction in GDP due to decrease in labor supply in Southeast Asia

Country	Agriculture, Forestry, and Fishery GDP Contribution (Billion USD)					Agricultural Labor Force (Millions)				Labor Productivity (LP) = GDP/worker (Thousand USD)			With COVID Scenario			With COVID Scenario		
	Average annual growth rate (%)	Average from 2014-2019	Average annual growth rate (%)	Average from 2014-2019	Average annual growth rate (%)	Average from 2014-2019	Average annual growth rate (%)	Average from 2014-2019	Average annual growth rate (%)	Average from 2014-2019	Average annual growth rate (%)	Estimated ALF in 2020 due to COVID (million)*	Estimated GDP (Billion USD)**	Difference in GDP (Billion USD)	% Change in GDP	Total Population (Millions)	Percent Increase in Poverty Ratio Due to ALF Reduction***	Estimated Increase in the Number of Population Living Below \$1.90 a Day (Millions)
Brunei	0.14	-1.22	0.01	0.00	14.00	-1.22	0.01	0.00	0.00	0.00	0.00	0.14	0.000	0.00	0.43			
Cambodia	4.99	-0.01	3.35	-4.77	1.50	5.11	2.978	-0.066	-1.39	16.50		4.70	-0.066	-1.39	16.50			
Indonesia	128.69	4.09	40.22	-1.77	3.21	5.97	38.05	-2.022	-1.40	266.10		142.50	-2.022	-1.40	266.10	2.07	5.51	
Laos	2.71	5.36	2.34	0.69	1.16	4.64	2.347	-0.043	-1.39	6.70		3.03	-0.043	-1.39	6.70	2.97	0.20	
Malaysia	27.21	-0.76	1.70	-1.47	16.07	1.05	1.597	-0.402	-1.42	32.60		27.90	-0.402	-1.42	32.60			
Myanmar	16.79	-0.59	12.48	-1.32	1.35	0.76	11.901	-0.244	-1.40	54.10		17.16	-0.244	-1.40	54.10	2.97	1.61	
Philippines	30.58	-0.93	11.57	-4.07	2.66	3.37	10.343	-0.430	-1.40	108.80		30.26	-0.430	-1.40	108.80	2.97	3.23	
Singapore	0.10	-6.04	0.03	0.00	3.17	-6.04	0.0296	-0.001	-1.33	5.71		0.08	-0.001	-1.33	5.71			
Thailand	38.18	-0.89	12.43	-1.08	3.07	0.08	12.157	-0.542	-1.40	66.56		38.06	-0.542	-1.40	66.56	2.36	1.57	
Timor-Leste	0.31	8.20	0.24	0.87	1.30	7.40	0.237	-0.005	-1.25	1.30		0.41	-0.005	-1.25	1.30	1.63	0.02	
Vietnam	34.11	1.24	23.29	-3.53	1.47	4.96	21.13	-0.490	-1.40	96.48		34.51	-0.490	-1.40	96.48	0.96	0.93	
Southeast Asia	278.02	-0.76	107.66	-2.31	2.59	1.61	100.769	-3.758	-1.40	655.28		264.60	-3.758	-1.40	655.28	2.24	14.68	

\* Computed assuming 1.4 percent reduction in agricultural labor force (Vos, Martin, and Laborde 2020)

\*\* Computed using the estimated 2020 ALF and the computed labor productivity

\*\*\* Based on the estimates of IPFRI from 1.4 percent reduction in labor supply, except for Brunei, Cambodia, Malaysia, and Singapore, as data is not available

