

Sustainability of Supply Chain: Analysis of Post-COVID Economic Recovery Possibilities in Selected Sectors in the ASEAN Region

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Abstract

The environment of financial uncertainty among the Global Supply Chain networks has been fueled by the impact of Covid-19 which saw major economies around the world imposing months of lockdown, slowing the pace and flow of raw materials and manufactured products resulting in an economic slowdown. It has also brought to light the vulnerabilities and susceptibilities of emerging economies, like the ASEAN nations. This has resulted in collapsing of both domestic and foreign sectors like retail, accommodation, and food services. This has prompted the regional governments to boost up regional cooperation through structural reforms for sustainable economic recovery. In this respect, three sectors of tourism, agro-processing, and garments can be improvised, while two other sectors like electronics and E-trade have greater potential for future growth. In this context, the paper using content analysis and exploratory methods focuses on the impacts of Covid-19 on the sectors of tourism, agro-processing, and garments in the ASEAN region and the possible options for improvising the sectors of Electronics and E-trade to further economic recovery in the ASEAN region.

Keywords: ASEAN, Covid-19, Economic Slowdown, Global Supply Chain, e-trade, e-economy.

Abstrak

Lingkungan ketidakpastian keuangan di antara jaringan Rantai Pasokan Global telah didorong oleh dampak Covid-19 yang membuat ekonomi utama di seluruh dunia memberlakukan penguncian selama berbulan-bulan, memperlambat laju dan aliran bahan baku dan produk manufaktur yang mengakibatkan perlambatan ekonomi. Ini juga menyoroti kerentanan dan kerentanan negara-negara berkembang, seperti negara-negara ASEAN. Hal ini mengakibatkan ambruknya sektor domestik dan luar negeri seperti ritel, akomodasi, dan jasa makanan. Hal ini mendorong pemerintah daerah untuk meningkatkan kerja sama regional melalui reformasi struktural untuk pemulihan ekonomi yang berkelanjutan. Dalam hal ini, tiga sektor pariwisata, pengolahan hasil pertanian, dan garmen dapat diimprovisasi, sementara dua sektor lainnya seperti elektronik dan perdagangan elektronik memiliki potensi pertumbuhan yang lebih besar di masa depan. Dalam konteks ini, makalah yang menggunakan metode analisis konten dan eksplorasi berfokus pada dampak Covid-19 pada sektor pariwisata, pengolahan hasil pertanian, dan garmen di kawasan ASEAN dan opsi yang memungkinkan untuk berimprovisasi pada sektor Elektronik dan Perdagangan Elektronik. untuk pemulihan ekonomi lebih lanjut di kawasan ASEAN.

Kata kunci: ASEAN, Covid-19, Perlambatan Ekonomi, Rantai Pasokan Global, e-trade, e-ekonomi.

INTRODUCTION

The Supply Chain concept was created in the early 1980s, and since then, theorists and practitioners' interests and concerns have grown significantly. Around this time, businesses realized that segregating suppliers and other functional units in the Supply Chain was not a viable strategy for long-term competitiveness. There aroused a sense of "*collaborative relationship within and beyond their organization*" (Felea & Albăstroi, 2013). Supply Chain and Supply Chain Management help to promote

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corporate efficiency. To integrate the Supply Chain, connecting and exchanging information on Supply Chain, Supply Chain Management, and Distribution Management characteristics have been provided. This integration led to the notion of an extended corporate supply chain, which is currently manifested as a cooperative supply chain that transcends intercorporate boundaries to increase value across the Supply Chain. (Janvier-James & Mbang, 2012).

With the globalization of the international economy, product sourcing and consumer items from hosts all over the globe are growing producers' and wholesalers' reliance on International Supply Chains. The efficiency of marine supply chains has also become important for positive competitiveness in emerging global markets as a result of trade barriers being eliminated (Fourie, 2006). Physical trade distribution's competitiveness with the rest of the globe will gradually impact economic growth and development. However, despite its importance from an academic and commercial standpoint, there is substantial ambiguity over its definition. As Habib points out, some consider it to be the interchange of raw materials and completed products, while others consider it to be a management philosophy, and just a few authors define it as an integrated system (Habib, 2010). The continuation of this uncertainty demands a distinct understanding of the notion.

The concept of Supply Chain has been defined by Beamon (1998) as a *"structured manufacturing process wherein raw materials are transformed into finished goods, then delivered to end customers."* (Beamon, 1998). Lambert, Stock, and Ellram (1998) viewed it as alignment of companies that sell products and services in the market (Lambert, Stock, & Ellram, 1998). Pienaar (2009) argued it as *"a general description of the process integration involving organizations to transform raw materials into finished goods and to transport them to the end-user."* (Pienaar, 2009). Chopra and Meindl (2007) mention that Supply Chains include *"all parties involved, directly or indirectly, in fulfilling a customer request. Within each organization, such as a manufacturer, the supply chain includes all functions involved in receiving and filling a customer request. These functions include, but are not limited to, new product development, marketing, operations, distribution, finance, and customer service."* (Chopra & Meindl, 2013). Chen and Paulraj (2004) on the other hand consider Supply Chain as a *"network of materials, information, and services processing links with the characteristics of supply, transformation, and demand."* (Chen & Paulraj, 2004). More extensive ideas concerning the Supply Chain has been presented by Ayers (2001), who suggest Supply Chain as a *"Life cycle processes comprising physical, information, financial, and knowledge flows whose purpose is to satisfy end-user requirements with products and services from multiple linked suppliers."* (Ayers, 2001). This divergence in the conception of the idea makes it difficult to be implemented in practice. A typical integrated supply chain involves three dimensions – *first*, the material flow, which includes purchasing, transformation, and distribution; *second*, informational flow, which includes electronic data exchange; and *finally*, the financial flow which includes payment for the products, services, and the retailer by the consumer on the finished product to suppliers and subcontractors.

SCM, on the other hand, refers to the integration of all functional operations within the supply chain. SCM, according to Russel and Taylor, is in charge of coordinating the movement of information, products, and services across a network of consumers, businesses, and supply chain partners (Russel & Taylor, 2009). It is related to the globalization of manufacturing and manufacturers' proclivity to give their planetary inputs, which necessitates the management of profitable ways for regulating global input or output flows. In such cases, the primary focus of market rivalry is not just between commodities, but also between supply networks that deliver goods. Customer satisfaction is the hallmark of the success of the Supply Chain. Therefore, the rationale of the term is cost efficiency and customer support (Janvier-James

& Mbang, 2012). As Oliver and Webber note, “*Supply chain management (SCM) is the process of planning, implementing, and controlling the operations of the supply chain with the purpose to satisfy customer requirements as efficiently as possible. Supply chain management spans all movement and storage of raw materials, work-in-process inventory, and finished goods from point-of-origin to point-of-consumption.*” (Oliver & Webber, 1982). For Krajewski, Ritzman, and Malhotra, SCM is “*developing a strategy to organize, control and motivate the resources involved in the flow of services and materials within the supply chain.*” (Krajewski, Ritzman, & Malhotra, 2007).

The virus has jeopardized the supply chain and the industrial system's smooth operation. It has had a negative influence on long-term production and global consumption patterns. The supply chain network has been affected as a result of the national border closure. The pandemic's influence is likely to alter production and consumption patterns in the next years. In such a case, sustainable manufacturing may develop as a solution to this problem. The epidemic has severely affected national and international trade. The scenario has exacerbated the widening gap between supply and demand. Essential goods such as food, groceries, and pharmaceuticals are in high demand.

RESEARCH METHOD

As regards the methodology, we have used content analysis and exploratory methods in collecting data from secondary sources like books, journals, web reports, scientific papers, and publications of professional organizations and practitioners.

Research Questions

There are *four* research questions that we seek to investigate in this paper.

1. How will the production system and Supply Chain deal with the pandemic?
2. What are the impacts of Covid-19 on the sectors of tourism, agro-processing, and garments in the ASEAN region?
3. What are the possible options for improvising the sectors of Electronics and E-trade to further economic recovery in the ASEAN region?
4. What it will be to sustain the Supply Chains in the post-COVID world?

RESULT AND DISCUSSION

Supply Chains in the Era of Globalization

Global Supply Chains are a network of interrelated activities and processes that generate and transport goods and services from the manufacturer to the client. It links several functional units through logistics to maximize resource use. As a result, encouraging a cooperative climate among businesses (Reeds, 2000). Advanced transportation and communication infrastructures have redefined global connections in the era of globalization. Previously, moving products from one location to another was expensive and time-consuming. Due to restricted access to various locations, the scope of business was likewise constrained. Any individual or entity is now more linked than ever. Opportunities for inter-continental business have expanded as communication technology has advanced. It has also led to the establishment of a complex web of Supply Chain networks that connect various corporate organizations throughout the world, from manufacturers to suppliers. These networks assist businesses in lowering costs by delivering goods and services from regions of the world with low labor and manufacturing costs.

Globalization also provides access to pan-continental markets. As a result, business groups and manufacturing firms can sell their products in regions where demands are higher. Also, those manufacturing units that cannot make a profit through business in the developed world, can invest in the developing countries where market size is much bigger and customers favor diverse options. This interconnectivity promotes cost-effective businesses. Globalization further allows the regional manufacturing units that do not have high capital resources and limited market access to mutually collaborate and promote their business. These collaborations can take place through both G2G and B2B agreements. Two industries that have benefitted much from this cost-reducing effect of globalization are electronics and apparel (Chopra & Meindl, 2013). Electronic items like mobiles, tablets, smartwatches, etc., and clothing are in high demand throughout the world and are easy to transport. The rise and growth of e-commerce in this new century is the reflection of the success of interconnected Supply Chain networks. There are several advantages of participation in a globalized Supply Chain.

Cost Efficiency

Companies engaged in a global supply chain can reduce their expenses, ensuring a steady market position and commercial sustainability. One of the earliest strategies to apply cost reductions in supply networks has been global supply chains.

Access to Diverse Products

Global Supply Chain allows easy and efficient export of the highest quality products. The competitive nature of the global market makes it possible to get the best price for supplies. Customers get the scope of selecting products of their choice from a varied range and at the best price.

Better Motivation

Regional businesses participating in the global Supply Chain are encouraged to improve their quality standards and performance. There is a high level of competition and non-performance will allow other business groups to acquire the market and make profits.

Diverse Market Opportunities

Broader market prospects also come with accession to the global supply chain. For instance, if a firm chooses to get its products from Singapore, it will look for opportunities to explore markets to enter beyond Singapore. In short, as a company starts to outsource supplies, its urge to expand market opportunities increases.

Learning Opportunities

Across the globe, along with mode, the strategies of doing business vary. An important contribution of globalization is that it allows the functional units to learn from each other through collaborations. Through this learning of new production and distribution strategies, companies can cope up with emerging challenges in the domain of global trade.

Sustainable Management of Global Supply Chain

The World Commission on Environment and Development in its Brundtland Report (1987) viewed sustainability as development that fulfills the requirements of the present generations without jeopardizing the demands of the future generation (WCED, 1987). In the words of Elkington, to become sustainable, a firm needs to calculate the total expenditure of all its activities – people, planet, and profit (Elkington, 1997). But there remains a divergence of perspective among stakeholders in realizing these terms, which slows down concrete progress towards more sustainable economic practices. Sustainable Supply Chain Management can be seen as a comprehensive idea, not confined to Green Supply Chain Management (GSCM) and reverse logistics. Today, as global trade has become more intense and diverse, there are increasing financial, environmental, and social risks to Supply Chains. As a result, sustainability has emerged as a crucial aspect for conducting global trade.

Sustainable Supply Chain Management is an effort to induce sustainability in different levels of the Supply Chain – purchasing, manufacturing, designing of products, packaging, storing, transporting, etc. (Linton, Klassen, & Jayaraman, 2007). Also, SSCM may be seen as a Supply Chain integrated process involving sustainable internal Supply Chain integration, supplier sustainable Supply Chain integration, sustainable integration of the customer Supply Chain, and the community sustainable integration of the Supply Chain (Wong, Wong, & Boon-itt, 2015). As Fritz (2019) notes, for sustainable Supply Chains, there is a need to incorporate sustainability at various levels of Supply Chains through “*governance mechanisms and top management; at the operational level; at the product/service level; and, through supply chain partners.*” (Fritz, 2019). This integration is not necessarily hierarchical but can take place simultaneously in a different order.

Governance refers to the management of an organization at the top level. For the Sustainability of Supply Chains, this is done through the directors, board of management, partnership firms, and at the level of federation. Sustainability has to be treated as a goal or an objective that needs to be achieved by an organization. As Pagell and Wu note, “*The specific managerial actions that are taken to make the supply chain more sustainable with an end goal of creating a truly sustainable chain.*” (Pagell & Wu, 2009). Therefore, the stakeholders at the highest level in any organization need to be engaged in promoting awareness, undertaking sustainable initiatives, and educating people. These policies, activities, and sustainability partnerships must be coordinated at the Supply Chain level to administer material, information, and capital flow most efficiently and effectively in the different stages of SC (e.g. design, purchasing, production) and to integrate short and long-term stakeholder needs while continuously maintaining and improving. This coordination includes sustainable management in multiple manufacturing processes and across different organizational and geographical borders.

At the operational level, sustainability needs to be integrated among various departments like finance, production, accounting, technology, and logistic transport. Involvement of these departments that play a crucial role in planning, designing, outsourcing, production, logistic related activities, etc. to make a Supply Chain sustainable. Such integration needs a robust information system to handle all information, finance, and product flows along the Supply Chain which contains both environmental, social, and sustainable criteria to meet Sustainable Supply Chain objectives (Badurdeen, et al., 2009). Integrating product-level sustainability indicates that sustainability should be part of the product/service design, to limit or eliminate its harmful environmental and social effects during the manufacturing, use, and end-to-life period. Sustainability at the product or service level is also important as it is the only means of contact between a manufacturing firm and the consumer of the product. The customer assessment of the sustainability of a firm might thus focus on its product/service features, which can be expressed by a

ranking of products/services, such as the NGO Greenpeace Guide to Greener Electronics (Greenpeace, 2017), or rating applications for smartphones. Finally, The transfer of sustainability to Supply Chain partners implies strengthening the abilities and skills of suppliers so they can achieve the same performance of sustainability as the originating company. Here collaboration is key to manage the process of sustainability. Specific measures to transmit and monitor suppliers' sustainability performance include training and the development of information systems. In order to take care of sustainable development goals, collaboration with Supply Chain partners is required and usually promoted by clients and stakeholders. The role of the government is also crucial in promoting a sustainable Supply Chain (Seuring & Muller, 2008). Today, for Sustainable Supply Chain Management there is also the need to underline ethical issues beyond the economic, social, and environmental aspects of sustainability. These ethical issues are related to employment opportunities and job losses. The pandemic of COVID-19 has made this ethical concern far more revealing. In the course of the pandemic, several millions of people have lost their jobs or opportunities for better livelihood throughout the world due to the almost collapse of Global Supply Chain Management.

Challenges to Production System during COVID-19

The course of the pandemic has been marked by a sharp rise in the demand for medical equipment like PPE kits, ventilators, oxygen cylinders, face shields, sanitizers, etc. As a result, several big manufacturing houses have used their production facilities to meet the growing demand of society. In order to manage the production of essential and nonessential products during a pandemic, government machinery, manufacturing organizations, and health institutes should be equipped before time to confront pandemics. There must be a buffer plan in place to address the potential challenges. The post-COVID period offers an opportunity for a sustainable business transformation and requires a more robust supply and production chain. It offers room for the development of a flexible and resilient production system to preserve economic and social sustainability in the production process. To combat the pandemic or other disruptive event, the company needs to have Supply Chain network resilience and manufacturing resilience. Because of such disruptive situations, material scarcity and delivery delays are observed throughout the supply chain, leading to the ripple effect and lower service level, income, and process productivity (Ivanov, Sokolov, & Dolgui, 2014).

The next major problem for nations concerns the planning of skilled medical staff, the distribution of jobs, and the programming for medical and diseased individuals. In the actual world, producing urgent items before a pandemic outbreak is extremely difficult. An event such as COVID-19, therefore, places pressure on the workers to adapt to the new production system. Many developments, such as modifications to manufacturing and processes and conventional working practices for maintaining social distance at work, have supplemented this. This makes it more challenging to achieve staff productivity goals since additional time is needed to adapt to the new regime.

Many manufacturing and service organizations are developing pandemic preparation strategies. To meet consumer demand during the COVID, stock of vital products and raw materials must be maintained. In order to deal with unforeseen disruptions, the organizations should focus more on the manufacturing delivery system. The WHO has also published different preparation instructions. The WHO has established a prevention and response framework of COVID-19 that places greater focus on livelihood potential and reduces COVID-19 morbidity and death. To limit the impact of such a pandemic, Hale and Moberg proposed that the policy on procurement, stock planning, travel planning, and production planning should

be reconsidered (Hale & Moberg, 2005). Different mitigation techniques are explored, including delay, strategic stocks, flexible supplies, flexible movement, and dynamic disaster response planning (Tang, 2007).

The pandemic's impact on the global Supply Chain has been multidimensional. *First*, a sharp rise in demand for certain companies and their products among consumers; *second*, supply failure and raw material supply uncertainty; *third*, a decline in demand for products like automobiles, textiles, etc.; *fourth*, impacting the ability of workers to assemble and distribute items; and *finally*, impacting capacity to send and receive items on time because of scarcity and logistic constraints. To mitigate these challenges, a feasible manufacturing strategy is required. The manufacturing units are required to reflect greater resilience and production flexibility to meet consumer demands. Artificial Intelligence (AI) technologies can be used to create maps that allow companies and individuals to avoid areas of risk, manage risks, and the government to disperse resources to mitigate those risks. In the industrial production units, digital production would help to maintain social distance and regulate the mobility of the worker as a result. Likewise, drones can be used for the delivery of essential commodities in big towns and cities to avoid direct contact.

As a result of the COVID-19, there is a need to reinvigorate production capacities and raw materials supplies to most manufacturing sectors worldwide or local (automotive, transport, pharmaceutical, food, etc.), etc. Additional funding from national and regional governments is also needed to revamp the sector. Disruption of trade routes due to containment policies adopted by various governments has significantly hampered international trade. The service Supply Chain has been severely hit. Hotels, restaurants, tourism, etc. are witnessing a gradual decline. The pandemic has put to challenge the survival of the workers. Many manufacturers and business groups are cutting down manpower to reduce losses incurred. Also, in pursuance of COVID protocols, most of the manufacturing units are working with a reduced workforce that has significantly lowered production output. The manufacturing and service sectors are expected to remain vulnerable to the effects of the pandemic for a long time. Therefore, with an aim towards the future, these vulnerable sectors need to prepare and educate their workforce to become more resilient. Companies need to compensate and introduce policies that take into account the existing vulnerabilities of their employees while at the same time enabling the latter to work with reduce the impact of the virus. There is also the need to stress on worker's mental and physical well-being to boost production output.

COVID-19 & Disruption of Global Supply Chain

Any global event that has the potential to adversely impact the major exporting countries can give a shock to the Global Supply Chain. These events include world war, regional conflicts, inter-state conflicts, major health crises (e.g., COVID-19), and trade wars (e.g., The US-China trade war). Due to either of these challenges, the exporting economies are unable to conduct business as usual with their trading partners. The smooth functioning of Supply Chains is hindered. The onset of an economic recession due to the pandemic reflects this disruption across manufacturing and service industries. This is due to the containment measures imposed by countries around the world to mitigate the health crisis. As a result, there have been restricted movements, closure of national borders, reduced production output, and an overall decline in economic activities.

The outbreak of the pandemic was first reported in China, which is also one of the major global manufacturing and distribution hubs (PWC Nigeria, 2020). China is the world's largest exporter accounting for nearly 16% of the total global exports. Many countries are depended on China for the supply

of electronic hardware components, pharmaceutical producing items, and other finished or semi-finished products. Due to the pandemic and related restrictions, many foreign industries and production firms that are dependent on China for the supply of raw materials are witnessing lower production. As a result, there has emerged a global demand-supply imbalance. This has severe implications for lower and middle-income countries.

The continuity of a Supply Chain requires an effective transport system. But due to the containment measures, the global transport system has collapsed. The World Trade Organization (WTO) reported a substantial decline in international trade volume by the end of the previous year. It noted a two-digit decline in all the continental regions especially in Asia and North America. This disruption of the Supply Chain has also impacted the World Food Program. It is expected to significantly increase the number of people suffering from acute hunger. The World Bank too has projected a decline in global GDP. This means there will be a decline in *“the amount of global incomes and wealth available to finance production and consumption will reduce by 5.2%”* (PWC Nigeria, 2020). This will have a repercussive effect on global purchasing power. In such a situation, countries are renewing their Supply Chain policies while the MNCs are reshaping their outsourcing policies to overcome the disruptions caused due to the containment measures. The developed economies have stepped up their push on companies to tackle carefully procedures that will provide resilience in the face of potential disruptions in the global Supply Chain.

Due to the pandemic, some countries are adopting protectionist policies to meet their growing domestic demands. The WTO has also permitted the member states temporary trade restrictions on essential commodities. This can have serious implications for those countries that cannot produce domestically and have to rely on the import of these essential commodities. This is a serious challenge in the path of economic development when many of these emerging economies are already tormented by the disruptions in Global Supply Chain, commodity market, and human resources.

Post-COVID Recovery of Various Sectors in the ASEAN Region

The pandemic has thrown the ASEAN region's rising economies into disarray. Containment measures and shutdown of national borders have impacted the demand-supply relationship to a great extent. As a result, the members of ASEAN adopted several structural reforms to move towards sustainable economic recovery (Seng, Swee, Mangal, Ng, & Zara, 2021). In this paper, we are going to emphasize three key areas that need greater focus like tourism, agro-industry, and garments. Also, two other sectors have the potential to reflect future growth – electronics and digital trade. Strengthening regional coordination in Southeast Asia is essential to aiding states in dealing with future crises more successfully.

COVID-19 & Tourism Industry

The region of ASEAN is a highly diverse region with richness in flora, fauna, deep-rooted tradition, history, and culture. Tourism in the region has boomed in the last few decades. Several beach cities have emerged as favorable and cheap honeymoon destinations for foreigners. Cheap transportation, budget hotels, local delicacies, and colorful nightlife have attracted tourists from all around the world. This has contributed to the significant growth of regional tourism in the last few years. In comparison to 2005, the number of tourists visiting has increased three-fold by 2019 (ASEAN Statistics Division, 2021). Tourism is a vital driver of regional GDP and job growth, but the COVID-19 has had a significant impact on it, and it must adjust appropriately. Though even before the outbreak of the pandemic, regional tourism suffered

from several challenges: **first**, unplanned tourism policy with a focus on limited destinations leading to overcrowding; **second**, tourism mainly dominated by foreign tourists from few particular countries; **third**, underdeveloped infrastructure at most tourist spots, resulting in a lack of potential diversification; **fourth**, the amount of money spent each by visitor falls short of regional goals; and **finally**, lower wage and informal job.

With the onset of the pandemic in 2020, the popular regional tourist destinations have witnessed a sharp decline in the number of tourists arriving. In some places, the rate of decline in the number of foreign tourists ranged from 80% to 100% (Mufti & Akhlas, 2020). With government restrictions in place and growing fear of infection among tourists, people have become health cautious and selective of travel destinations. This is expected to change the pattern of international tourism as people tend to prefer short-distance or proximity tourism. A poll conducted by the World Economic Forum found that a high percentage of tourists are looking for destinations with proper hygiene and less congestion. Also, with a decline in overall household incomes, cheaper domestic holiday spots are gaining more tourists' attention. In a situation when countries around the world have embarked on the process of mass vaccination and showing signs of recovery, the region needs to make efforts to promote regional tourism with proper emphasis on health protocols and travel norms. It is more likely that during the pandemic, regional governments are more likely to stress ecologically sustainable tourism instead of mass tourism (Winterflood, 2020).

For the tourism sector to revive in the post-COVID period, ASEAN nations will need to develop methods for promoting safe tourism and convincing international tourists. This will need the coordination and execution of suitable activities to close information gaps and reduce risks. Passengers will feel safer when vaccines are distributed. Countries should strive to diversify their tourism attractions and establish lesser-known places of attraction. Ecotourism is a growing tourist trend that has the added advantage of helping to protect natural places. With a greater emphasis on health and premium wellness experiences, these locations have the potential to attract more tourists. To address the challenges of lower wage and job insecurity, authorities should engage in training tourist sector workers in both digital and non-digital skills. Higher-skilled workers will attract higher-spending visitors, while new technology will boost worker productivity in the tourism industry. Each country's tourism industry will need to work closely with national and provincial governments to improve communication channels. The formation of a permanent crisis management task force can help to ensure that a country's tourism industry is better equipped to deal with future crises.

Agro-Processing Industry & COVID-19

Agriculture is one of the major contributors to regional GDP. The availability of cultivable land and skilled farming is a great advantage for the industry. But despite these benefits, certain challenges hinder the growth of this sector. Inconsistent raw material supply owing to unfavorable weather conditions, shifts in global market pricing and exchange rates, geographical limits, and considerable post-harvest food waste. Seasonality in raw material availability, as well as a lack of access for local smallholder farmers to official markets and enterprises, also impede agro-processing companies from operating efficiently year-round. Most Southeast Asian countries have a labor-intensive agro-processing sector. Adopting more sophisticated and productive processing technologies can assist the agro-processing sector in increasing output quantities while also adding value. The growth of the agro-processing sector has been hampered by underdeveloped utilities, transportation, and logistics infrastructure, particularly in rural regions. Lack of financing, innovative technology, skilled personnel, stable and high-value markets, and hospitable

business environments are restricting the access of agro-industry operators to key enablers. Shifts in customer desire toward ecologically friendly products have also occurred, placing certain regional producers at a disadvantage owing to their inability to supply. Labor shortages at factories, warehouses, and logistical hubs disrupted supply chains during the Pandemic, and several nations put limitations on food product exports and imports to prioritize local needs. Fortunately, some of these restrictions were only temporary, and they were phased out within a few months. While agriculture was less affected by the COVID-19 than other sectors, regional governments must now assist attempts to shift toward higher-value-added businesses such as agro-processing (ITC, 2021).

Improving the efficiency and openness of Supply Chains will assist agro-processing businesses to avoid delays and needless compliance expenses. Improving cross-border food product and production inputs will decrease food wastage due to handling and provide simple access to key raw materials such as insecticides. According to the OECD, digital technologies combined with adequate information and communications technology infrastructure may help cut export delays in Asia and the Pacific by 44% (Jouanjean, 2019). Today's customers are more aware, and there is a greater desire for healthy food alternatives such as organic, "free-from" (e.g., gluten-free), functional, and reformed. Operational improvements, such as organic cultivation; sales tactics, such as targeting high-end stores to expatriates; and technical skills, such as educating staff in reformed food processing, are all factors in expanding the food product diversity. Countries might assist businesses in increasing their sales channels, particularly digital ones, and adding value in agro-processing by enhancing digital connections (e.g., expanding internet coverage) and assisting firms in accessing digital platforms.

There are also opportunities to improve productivity through concentrating on research and enabling regulations to provide a more constant supply of high-quality, safe raw materials and promoting digital transformation in the agricultural processing business. The COVID-19 crisis revealed that Southeast Asia's agro-industry is particularly sensitive to shocks. The regional governments can introduce strategies to promote greater resilience. This may include enhancing regulatory functions, enhancing the local agro-processing environment by emphasizing diversity, shorter supply chains, local alternative suppliers, and local markets, implementing food-related circularity strategies to reduce post-harvest and supply chain waste, and fostering collaborations between agro-processing stakeholders in the corporate sector, the government, and other neighboring countries beyond the region.

COVID-19 & Southeast Asia's Textile Industry

Because of their cheap labor costs, strategic location, preferential market access, and supporting government policies, several Southeast Asian nations are competing in the labor-intensive textile, clothing, and footwear manufacturing industries. Simultaneously, several of these nations continue to emphasize large volumes of low-value-added products, relying on low labor costs as their primary competitive advantage (Huynh, 2015). Southeast Asia's garment industries are vulnerable to supply chain disruptions because they rely on raw material suppliers, timeliness, and size of local input production, and unpredictable energy sources. Associated with this is an increasing labor expenditure while a simultaneous decline in productivity rate.

COVID-19 has had a significant impact on the Southeast Asian clothing sector. Order cancellations and manufacturing constraints have prompted numerous Southeast Asian firms to close their doors and lay off workers. The industry's pre-pandemic difficulties have been compounded, resulting in higher volatility and shortages of production due to a lack of raw materials, which affect various areas of the value

chain. Closures of manufacturing operations in other nations have slowed the delivery of imported materials and impeded garment production. The pandemic has also revealed the industry's lack of support services for vulnerable workers and increasing disparities. In the short term, women working in these industries are more vulnerable due to a lack of access to essentials, uneven home duties, gender-based employment discrimination, and an increased risk of gender-based violence (Seng, Swee, Mangal, Ng, & Zara, 2021). Long-term implications include restricted access to social assistance, uncontrolled working conditions, and reduced access to health care, which may weaken women's economic and social empowerment. The pandemic may also have a significant impact on children since economic constraints and insufficient safety nets may force many under-aged youths into child labor (ILO & United Nations Children's Fund (UNICEF), 2020).

To mitigate these challenges, as a temporary measure the government has come forward to extend monetary support to the garment industry. Beyond such immediate support, for the industry to achieve sustainable growth and resilience, governments of the region will have to adopt certain long-term strategies. This could help the textile industry to expand and become globally competitive in the post-COVID period.

Improving competitiveness via productivity is important to sustaining the industry's development potential. This would require emphasis on scrutinizing policies that stifle growth, such as high raw material tariffs and time-consuming export permission procedures, which lead to high manufacturing costs, improving vocational curriculum and expanding training availability, particularly in remote areas, and encouraging the use of digital technology such as smart factories and additive manufacturing to allow mass customization of products (Seng, Swee, Mangal, Ng, & Zara, 2021). Furthermore, the region's exports are currently focused on certain markets such as the European Union and the United States. As a result, more end markets must be developed. To stay appealing, the textile sector must also pursue product differentiation and develop better value-added clothing.

Improving productivity and using better manufacturing technology might help the sector withstand future demand shocks. According to ADB research, implementing new technology in the sector may boost employee productivity by an average of 22% over the following five years (Asian Development Bank, 2021). Shorter supply chains, local alternative suppliers, and local markets should be prioritized. Governments might also fund machinery, train employees, and recruit international investors to encourage higher value-added industrial processes. To make this industry capable of sustaining any future shocks, flexibility has to be promoted. To satisfy shifting customer demand, garment manufacturers should be able to make a transition between diverse manufacturing methods.

Electronic Industry & COVID-19

The manufacture of electronic products and spare components is a prominent sector in the region. The products created range from capital-intensive products such as hard drives to labor-intensive products such as electrical components. While the great majority of electronic products are exported, some, such as consumer electronics, are still sold in domestic markets. Southeast Asia's electronics manufacturing industry is frequently underdeveloped, with inadequate industrial infrastructure and a lack of comprehensive upstream and downstream value chains (Seng, Swee, Mangal, Ng, & Zara, 2021). Electronics manufacturers continue to rely heavily on a global industrial chain based in China, particularly for raw materials and components. Many countries prioritize the assembly and testing stages of the industrial value chain above the upstream stages that provide more economic value, such as R&D and product design. One reason for the sector's inability to go beyond assembly tasks is its predominantly low-

skilled workforce. Manufacturers must constantly improve and adapt their manufacturing inputs and processes in response to technological advances, which can be costly in the long term. Furthermore, due to economic and geopolitical reasons, the diversification of production away from traditional regions such as the PRC gives opportunities for nations in the region to extend their electronics manufacturing footprint or risk being left behind. Furthermore, due to economic and geopolitical reasons, the diversification of production away from traditional regions such as the PRC gives opportunities for nations in the region to extend their electronics manufacturing footprint or risk being left behind.

The virus has accelerated the global digital transformation while harming the sector. As a result of supply chain interruptions, several regional electronics manufacturers are facing manufacturing delays, leaving them unable to meet the rising demand for different consumer products during the COVID. Manufacturing and shipping interruptions have an impact on transportation, sales, prototyping, and the launch of new goods throughout the industry (Leopold, 2020). The COVID-19 outbreak has pushed customers to adopt new ways of working and living, which may drastically impact demand for Southeast Asian-made electronics components.

SEZs are geographically delimited areas where governments stimulate economic activity by offering fiscal and regulatory incentives as well as infrastructure support. SEZs bring together firms to profit from economies of scale while also facilitating potential spillovers in technology, labor skills, and market opportunities. SEZs for the electronics sector can improve industrial links, resulting in greater collaboration and resource pooling while boosting competitiveness. Creating industry-specific laws, such as boosting electronics export through free trade agreements, would also benefit the region's firms. Finally, better coordination between the government and industry, as well as local and foreign investors, can assist to smooth the transition to high-value sectors in the electronics supply chain.

Southeast Asian countries must aggressively improve human capital to attract foreign direct investment, remain competitive, and transition to high-value electronics manufacturing. Governments might provide resources to industry-specific training programs, collaborate with other stakeholders, and establish specialized government agencies. Governments must also prioritize the upskilling and reskilling of employees in the electronics industry, for example, by collaborating with private sector partners and educational institutions. Similarly, encouraging and investing in STEM education to assure a supply of highly qualified people may contribute to an enabling climate for innovation. Southeast Asian governments should also highlight the need for mutually beneficial agreements between foreign and domestic enterprises that enable knowledge transfer, as well as explore giving incentives for local firms to invest in R&D. Emerging industrial fields such as biotechnology may give case studies for the region's electronics industry.

COVID-19 & E-trade

Digital trade is a young and expanding business. While the contributions to GDP of digital products (software); digitally enabled services (business process outsourcing, online advertising, data processing service export); and indirect digital services are not yet well captured in Southeast Asian national statistics, their importance is likely to grow dramatically as more activities shift online in the post-COVID-19 world. The digital economy in the region is currently dominated by information technology and business process outsourcing (IT-BPO). Certain Southeast Asian nations have also seen an upsurge in the development of software applications.

While digital technologies have accelerated the growth of the IT-BPO sector of the digital trade sector and may boost worker productivity in Southeast Asian countries, the increasing sophistication of artificial intelligence technologies may eliminate the need for human involvement in many IT-BPO functions. Although mobile and internet connectivity is critical, there are regional differences in availability and speed. This is a serious impediment to inclusive growth since it prevents companies and consumers from accessing the market. Poor or costly digital connectivity hurts future economic prospects. Many small and medium-sized businesses (SMEs) cannot explore overseas sales opportunities, build a global business network, and market their products on a global scale. Although digital technologies may be advantageous, many SMEs are ignorant of the available digital solutions, software, or business platforms, as well as the accompanying trade possibilities.

Economic activities and employment in the digital commerce industry are more adaptable to remote labor and have shown to be more robust to the COVID-19 epidemic than in other industries. To grow the industry in Southeast Asia and ensure the potential benefits of greater digital exports, an enabling environment is required. A comprehensive national road map that reflects an awareness of new technological prospects, talent needs, and specific policies will help the growth of the IT-BPO business. Some Southeast Asian nations' underdevelopment of broadband networks can be attributed to a lack of access to supporting infrastructure or to restricted expenditures in network expansion owing to commercial unviability. As a result, larger expenditures will be required to develop the enabling network infrastructure and incentivize investment. To assist the development of digital skills, a variety of activities are required. Increased business participation in curriculum creation can assist in guarantee that important skills like English language proficiency, critical thinking, and complex problem solving are included. This must be complemented by company assistance and financial incentives to encourage more and higher-quality workplace training (Asian Development Bank, 2021). Cross-border trade would benefit substantially from eliminating the need for local registration, eliminating disclosure requirements for essential intellectual property, and lowering needless procedures and levies. Adopting bilateral (or multilateral) approaches to data flows would also enhance cross-border trade. Adopting the APEC Privacy Framework and joining its Cross Border Privacy Rules System, as well as adopting international standards that describe measures to protect personal data, would be a good place to start. This may be aided by fostering interoperability between digital frameworks, particularly payment gateways, to reduce the expenses associated with firms having to tailor their techniques to every market. Finally, nations within ASEAN will need to make progress on the data management effort outlined in the Master Plan on ASEAN Connectivity 2025 (MPAC 2025), which intends to increase openness and accountability on data regulatory standards in ASEAN and identify areas for improvement (ASEAN Secretariat, 2016).

Knowledge- Based Economy and Intellectual Supply Chain

Since the 1960s, various state authorities of the world have been trying to introduce a knowledge-based economy (Jarman and Chopra, 2008). To develop knowledge economies, governments have replaced knowledge instead of machinery, land, and labour as the key source in economic progression and production (Bell, 1973; Beniger, 1986; Drucker, 1993) Knowledge-based economy has been a very prominent sector of the economy and an important part of the supply chain. After introducing globalization and liberal economic policy, most of the South East Asian nations emphasized 'soft power' and a knowledge-based economy (Nandy, 2021a). The government of Malaysia has emphasized a knowledge-based economy. Malaysia has developed a lot in the education and service sector very tactfully. In terms of intellectuality, Malaysia is not superior. After emphasizing education and service sectors

Malaysia has started to hire manpower from outside. Through the marketization of the education system, Malaysia has started to offer higher and professional degrees by taking huge capitation fees from the students(Nandy,2021c). Malaysia's transition towards the k-economy immensely helped to increase the country's economy. The foreign resource persons and students are two major pillars of its intellectual capital. The k-economy is a key part of its broader plan to succeed in the objective of the nation's 'Vision 2020'. The Vision 2020 is a 30-year plan to improve the Malaysian economy at optimum level aiming to establish it as an industrial nation in terms of economic performance and technological capability (Mustapha & Abdullah, 2000). As an important part of the k-economy, IT holds an important part of its economy. Thousands of IT foreign experts are working in Malaysia which is performing as the key digital supply chain.

There are many foreign enterprises from China and elsewhere looking for cross-border investment in the field of advanced science and technological knowledge. Malaysia is also trying to enhance its investment in the knowledge economy through FDI. In the education sector of Malaysia, Chinese investment has become an important stake. COVID-19 has immensely hampered this sector, especially foreign students who wanted to come to Malaysia for higher and technological study. The existence of high-tech organizations is very supportive of the k-economic process. Due to pandemic, the supply chains has been interrupted; that is why, demand for the industry to open up for further acceleration knowledge-based manpower support (MIDA,2020). Among the ASEAN countries, Singapore, and Malaysia are emphasizing a knowledge-based economy.

To control China's Information and Communications Technology and Services Supply Chain(Nandy,2021b). As the US has claimed that China is responsible for spreading coronavirus across the globe, that is why the Donald Trump administration tried to interrupt the Chinese global supply chain as a part of the Washington-Beijing ongoing trade war.

Due to visa issues of COVID-19, many Ph.D. students have been compelled for holding an admission offer from various universities of Malaysia and Singapore as per their earlier plan (UWN,2020). However, Singapore has been a lucrative destination for foreign students for the quality of education, facilities, placement, standard of life, etc. As a destination of international study, Singapore pulls thousands of students into its various governmental and non-governmental educational institutions. Singapore has ensured a highly-successful knowledge-based economic system over the decades due to having a stable democratic government, good governance, transparency, cosmopolitan environment, modern and quality education system, high-standard of livedoid. In 2019, Singapore is ranked 20th as the best student city. Singapore is emphasizing a knowledge-based economy. The foreign students are part of a knowledge-based economic supply chain and it works in two ways. (1) every year thousands of foreign students used to go to Singapore to study from whom the government of Singapore earns a huge amount of revenue. (2) Many brilliant students are absorbed by the Singaporean government and non-governmental agencies as a workforce. This is called the 'intellectual supply chain'. Due to pandemic COVID-19, in 2020 the flow of foreign students was reduced. After the pandemic was started, initially the curve of foreign student flow was descending. But this curve has been started to move as an ascending curve since September 2020. In September 2020, 41%, and in March 2021, it grew to 52%. This percentage is better than the USA (51%), Netherlands (49%), and Australia (43%). Singapore has been highly affected by a coronavirus. But in many ways, Singapore performed strongly during COVID-19 (Chew and Hudson, 2021).

CONCLUSION

COVID-19 has caused significant social, political, and economic disruption. Closing non-essential enterprises, social distance, smaller public gatherings, indefinitely postponing athletic events, canceling conferences, and ordering people to shelter in place are all examples of global viral containment approaches. While this crisis presents chances for long-term sustainability, it may also lead to disappointment. Although doubts and worries persist, we may anticipate a move to greater supply chain sustainability as a result of this crisis. Sustainability strategies and practices help to supply chain resilience by, for example, ensuring the preservation of ecosystem services, supporting more sustainable 'buy local' behaviors, and fostering community trust (Sarkis, 2020). Risk reduction and crisis response are two reasons why the crisis provides a transformative opportunity for reducing risk and building resilience via sustainability. In a recovery, jobs and economic considerations will take precedence over any pretense of environmental concerns. Several countries have previously suggested an economic growth agenda that includes scaling down or eliminating some environmental restrictions. This tendency is concerning for social and environmental sustainability. The post-COVID-19 recovery might result in worse environmental effects.

As part of Industry 4.0, manufacturing technology is moving toward automation and data exchange platforms. Manufacturers may use Industry 4.0 technologies such as cyber-physical systems (CPS), the Internet of Things (IoT), cloud computing, and cognitive computing to supplement human judgments with decentralized decision-making. In response to COVID-19 efforts, these technologies may play significant long-term roles (Kumar, Raut, Narwane, & Narkhede, 2020). Data-driven awareness-based collaborative action is a potential big change. This activity entails collectively discussing issues and then modifying behavior in response to the COVID-19 crisis. As systems begin to collapse, particularly market and governmental regulatory systems, companies must alter their behavior. Similarly, similar techniques can help with sustainability. A significant development that is probable is data-driven awareness-based collective action. This activity entails addressing issues cooperatively and then modifying behavior in response to the COVID-19 dilemma. Organizations require behavior modification as systems, particularly market and governmental regulatory systems, begin to fail. Similar approaches can help with sustainability. Ensuring vital equipment and supplies through more agile manufacturing and quick supply logistics to hot zones might amount to more lives saved or the spread of positive cases being slowed—a social sustainability problem.

By manufacturing only what is required, localized production can help to maintain sustainable supply chains. Shorter supply chains result in less waste, less transit, and less demand for inventory storage; each has long-term supply chain consequences. During the COVID-19 crisis, social distance, remote employment, and reduced business travel provide lessons for a sustainable supply chain. Employee commute and business travel are decreased, which contributes to lower corporate carbon footprints. As governments seek to re-establish their economy, they must help sectors that have been adversely affected by the epidemic while simultaneously investing in new development areas. Improving the investment climate and improving infrastructure will help to achieve these objectives. Investing in digital skills will become more vital as digital transformation becomes more significant. Many of the next issues will need strong collaboration between governments and companies.

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