



## Effect of Covid-19 on Logistics of Thai Rice Export

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**ABSTRACT:** The purpose of this paper is to analyze the effects of Covid-19 on Rice Logistic to Thai rice export in terms of product and logistics. Starting from rice plantation, farmers, mills, labour, storage and transportation. In the later part, discusses the impacts of Covid-19 to Thai Rice Export Logistics with conclusion. The authors review Covid-19 situation in Thailand and Thai Rice papers. Followed by in-depth interviews influencers and experts from major Rice exporters, Rice Traders and Shipping Lines. The disruption from COVID-19 to Thai rice export logistics was from global supply chain disruption. Imbalance in world containers caused lacking of containers to export and increased Sea Freight were the major effects. High Sea Freight let to higher imported fertilizer cost for plantation. Shipping lines delayed calling some ports in Thailand. Traders delayed the order and waited for lower freight reflecting excess stock in the warehouse. Not only increased cost for carrying stock but also no space for new crop that linked to supply chain disruption as a whole. This paper studied the impacts from 2nd wave of Covid-19 pandemic (2019 to May 2021) in Thailand to Thai Rice logistics where the output could definitely be adopted for further strategy and further study.

**KEYWORDS:** Breakbulk vessel, Barge, COVID-19 pandemic, Global food supply chain, In-Depth Interviews, Shipping Lines, Sea Freight, Stevedore, Thai Rice Export

### 1. INTRODUCTION

On December 31, 2019, the Wuhan Municipal Health Commission (China) reported a cluster of pneumonia cases of unknown disease in the city of Wuhan to the World Health Organization (WHO). On January 9, 2020, a new coronavirus (SARS-CoV-2) was identified as the cause of the respiratory disease, then named COVID-19. On January 30, 2020, the WHO declared the Coronavirus epidemic in China and on March 11 it defined the spread of COVID-19 as a widespread global pandemic (WHO., 2020a; Vasavada, 2020). WHO explained that COVID-19 is the fifth pandemic, 1918 influenza virus (H1N1), 1957 influenza virus (H2N2), 1968 influenza virus (H3N2), and 2009 Pandemic flu (H1N1), that resulted in the human deaths of around 50 million, 1.5 million, 1 million, and 300 000, respectively (Liu et al. 2020). WHO indicated that this outbreak is a crisis that will touch every sector. Therefore, every sector and every individual should be involved in this struggle.

Thailand was the first country to report a case outside China, on 13 January 2020. The Ministry of Public Health (MOPH) announced the first confirmed case, a 61-year-old Chinese woman who came from Wuhan. She arrived at Suvarnabhumi Airport in Bangkok on 8 January, where she was detected using thermal surveillance and then hospitalized.

On 1 March, 2020 MOPH reported the first confirmed death in Thailand. The number of cases surged around mid-March and Prime Minister declared a state of emergency, effective on 26 March (The Standard Team, 2020) and Lockdown were implemented in varying degrees throughout the country. A curfew went into effect on 3 April (Bangkok Post, 2020). The rate of new cases gradually dropped throughout April, and by mid-May, locally transmitted infection rates had fallen to near-zero, and easing of restrictions was gradually implemented (Kuhakan 2020; Khaosod English 2020). The curfew was lifted in July and academic began reopening in August.

2nd wave outbreak occurred in SamutSakhon by mid-December 2020 (center of the fishing industry in the southwest of Bangkok) increasing the country's total confirmed cases by at least 20% (Masayuki 2020). Primarily impacted migrant workers from Myanmar. Over 1,300 cases were traced to a seafood market in SamutSakhon, as cases were detected in 27 provinces (Triukose et al. 2021).

3rd serious wave occurred in April 2021 following the emergence of clusters in entertainment districts in and around Bangkok early in the month. The wave led to the sharp increases in daily cases [1].

There is a great concern on the consequences of coronavirus (COVID-19) pandemic on health and on global food supply chain. Rice is one of the main source of carbohydrate to the world. Thailand, one of the top five Rice exporters to the world has also been unavoidable impacted from COVID-19. Many parts of the world consume rice as main food. Rice supply chain is one of the global food supply chain that inter-connected between continents. The consequence of disruption in one place has been spread all global supply chain all over the world.

The aim of this study is to analyzes the effects of Covid-19 on Thai Rice in both domestic and export in terms of product and logistics. The product focusing on production whereby the cycle crops from the seasoning which was changed due to climate, rainfall variability, drought and labour. The Logistic focusing on production, labour, storage and transportation. In the later part, illustrates and discusses the long run changes with conclusion and providing some implications of the study.

**2. LITERATURE REVIEW**

Thailand is one of the world’s largest rice exporter and producers. Rice is the main food for domestic consumption as well as a major export to the world. In this paper, the Logistics were divided into two parts, including rice production (consisted of growing, harvesting, milling, rubbing, packing and stocking where farmers, fertilizers, labour and millers are related) and logistics for rice domestic consumption and exporting (comprising transporting as a whole from farm and mills to the destinations both domestic and export where trucks, tugs, barge and ocean vessels are concerned).

**Research Frame work of Rice Production and Logistics of Thai rice in Thailand.**

Frame work of Rice production and Logistics of Thai rice in Thailand starting from rice production through rice consumers both domestic and oversea consumers, stated in Figure 1.

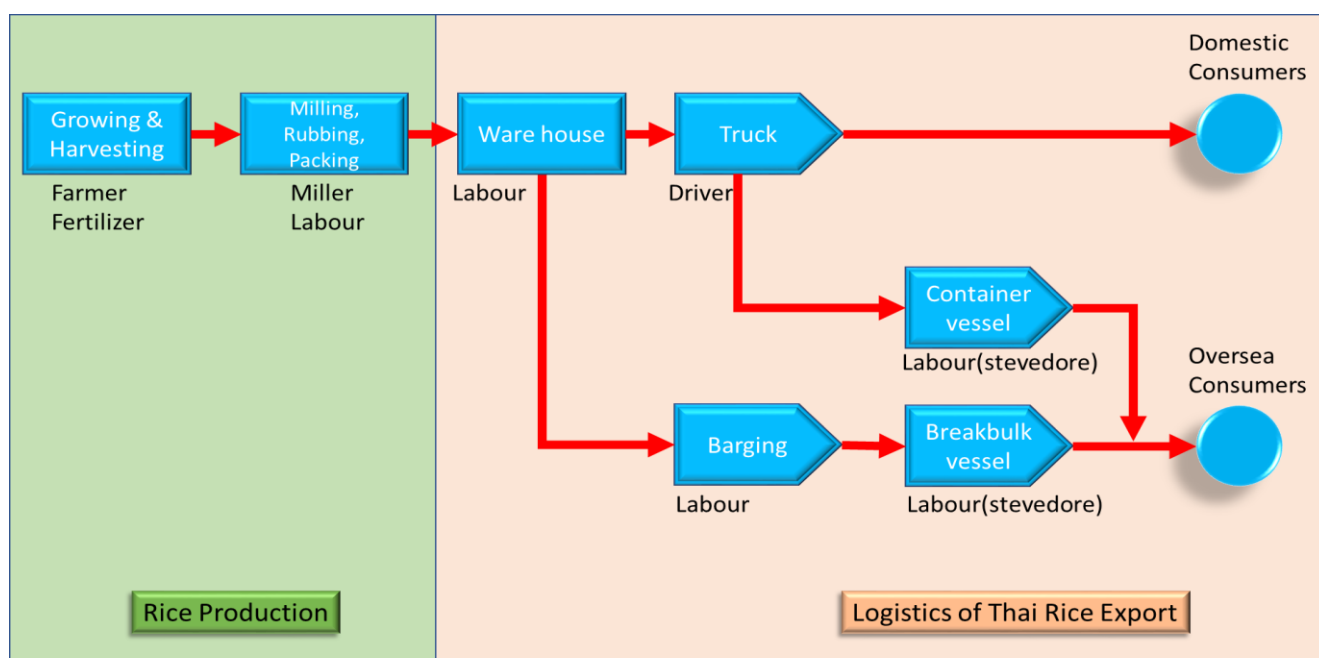


Figure 1 – Frame work of Rice production and Logistics in Thailand

**2.1 Rice Production**

Thailand’s rice production affects from climate, rainfall variability, drought and low soil fertility (Jiacheng 2018). Rice production in Thailand can be classified into four ecosystems: irrigated, rained lowland, deep-water and upland. Rained lowland is the most predominant and is 72 percent of paddy field, followed by irrigated 20 percent, deep-water and upland at 5 and 3 percent respectively.



Drought and poor soil fertility are the most factors affecting upland systems while the biotic factors i.e. pests, diseases and water scarcity in the dry season are production constraints in irrigated ecosystems. The country can cultivate different varieties of rice in almost all areas, -the Central, Northeast, North, and the South.

There are two Rice Plantation seasons in Thailand (Jiacheng 2018). The major season is Wet season and minor one is Dry season. Wet season period is different between location. In Central, North, North Eastern part of Thailand, wet season begins from May up to October. For East of Southern part such as Nakhonsrithammaraj, Pattalung, Songkhla, Yala, Narathiwat and Pattani, wet season starts from June to February. Dry season period cover from November to April in Central, North and North Eastern part of Thailand. For East of Southern part starting from March to June.

### 2.1.1) *Growing and Harvesting*

“Farmers are the backbones of the country” was the famous sentences in Thailand for centuries. As economy is primarily agriculture-based country and Rice is the main agriculture product of Thailand. Thai Rice is famous for Tasty, Quality and so on. Needless to say, Farmer is the importance key to grow and harvest rice.

#### *Farmers*

Statistics reveals that rice farming occupied 50% of agricultural land. Most of Thai farmers is labour intensive (Pongsrihadulchai 2018). About 33% of head of rice farmer age are above 60 years with average age of 56 years. 80% finished primary school. Many of these are small-scale farmers. The output of farmer is paddy rice. As no storage facilities, farmer usually sells immediately to middlemen such as agricultural cooperative, paddy rice collectors who will distribute paddy rice to rice mills or sells directly to local mills. Outside plantation, young farmers migrate to urban to look for a job. Many of them are taxi drivers in Bangkok and will return home when the season starts.

#### *Fertilizers*

Fertilizers have been a crucial component of the increased productivity of rice plantation. Thai rice is relying on fertilizer supplied from overseas, especially from North America.

### 2.1.2) *Milling, Rubbing, Packing, Stocking*

#### *Millers*

Millers have been using appropriate post-harvest technologies to produce finished rice from paddy rice. Currently, Thai domestic milling capacity is higher than three times domestic rice output (TDRI). Big mills (processing capacity more than 20mt paddy per day) have their own silos for storage rice. Most of them are exporters or as producer for major exporters (Sowcharoensuk 2019). They have a better position than small rice mills as investing new technology to reserve rice quality, using appropriate packaging technologies to maintain and extend rice quality. Also, they are promoting the usage of qualified consolidation, warehouse and distribution center in provincial and regional scale of rice products. Rice is exporting in two types, loose bulk rice where rice milled from paddy and directly export with no package and another type is in packing bag rice (25kilograms or 50 kilograms bag or 1metric ton bag so called jumbo bag).

## 2.2. *Logistics of Thai Rice Export*

### 2.2.1) *Warehouse*

Most of warehouse belongs to Millers and exporters where some warehouses belong to local assemblers. After milling and rubbing, rice will be kept in millers' warehouse waiting for delivery to domestic buyers or oversea buyers. Warehouse is semi-labour intensive.

### 2.2.2) *Trucks*

Transportation of rice subdivided into two parts; Post-harvest and After milled. Post-harvest, paddy rice will be delivered directly from rice farms to mills or to local assemblers' warehouse and then to mills by either small truck or big truck. The suitable truck depends on rice volume. The later part, after milled, was decided by the destination of rice that are for domestic consumption or export. Domestic consumption, rice will be transported by trucks from mills to domestic destinations. Oversea consumption or export, there are two main transportations for export, in containers and in breakbulk form. Container export, truck will pick up empty container from container yard and do stuffing at mills or warehouses and then return loaded container to inland container depot where the container will be loaded to container vessel by container shipping lines. For breakbulk rice export, many warehouses have their owned jetty along Chao Prayariver. Rice to be loaded by conveyor from warehouse to barge at their jetty. For warehouses located far away from jetty, rice will be loaded in truck from warehouse to jetty along Chaoprayariver.



2.2.3) Ocean vessels

There are two types of ocean vessels transporting rice export that are container vessels and breakbulk vessels. Container vessel is the ocean vessel carries cargo by containers where rice will be stuffed in container. Loaded rice container will be returned to shipping line at depot and loading to container vessel at container port. The major container port in Thailand is Laemchabang port. Breakbulk vessel is the vessel carries general cargo that in bulk or bagged rice. The major rice port for breakbulk vessel in Thailand is Kongsichang area. Kongsichang is the Island in the Gulf of Thailand, 12 km off the shore. All breakbulk vessels dropped anchor nearby Kongsichang and start their operations at the anchorage such as loading or discharging their cargo. Rice will be carried from warehouse by truck and being transferred from truck to barges along Chao Praya river jetty. Then barges will sail along Chao Praya river to Kongsichang and alongside Breakbulk vessel, anchorage at Kongsichang, and load rice from barge to the vessel.

3. METHODOLOGY

Thailand has sufficient rice for domestic consumption while some countries government impose export restrictions to maintain rice for domestic. The export restrictions reduce exporter’s reputation and will lose the opportunity in the world market (Espitia et al.,2020). Thailand has no restriction for export. Furthermore, rice export volume has been decreased due to uncompetitive price to our competitor from 2020.

In-depth interviews were used as qualitative research tools to gather better rich insight information. The selected respondents are the influencers of each group of the related parties to Thai Rice export, consisted of The Thai Rice Export Association, Top 5 Thai rice exporters, Exporters, Rice brokers, Rice Traders and Shipping lines (Main cargo as Thai Rice). The interviewees are Presidents of organization, owners or Senior Managers who have long experience in Thai Rice field and are the decision makers. The interviews started from open ended questions and followed by Structured Interviews. The respondents to answer if Covid-19 affects on the particular topics in three options (Yes, No or Likely). The answers will be scored by “Yes” equal to 2, “No” equals to 0 and Likely equals to “1”. The scores from each topic was round up from all interviewers. Highest score was considered as highest impact from Covid-19. The In-Depth Interviews discovered the impacts of Covid-19 on Thai rice logistics export in the following topics ; Farmers, Fertilizer, Surveyor, Mill (Labour), Packing (Labour), Warehouse, Truck (driver), Barge (stevedore and master), Ocean Vessel (stevedore), Freight and Ocean Transportation.

4. RESEARCH FINDING AND DISCUSSIONS

The outcomes of the research showed major impacts ranking from the highest to the lowest scores are Freight and Ocean transportation, Warehouse, Lacking of labor availability (Stevedore, Labour), Fertilizers and Farmers as per Table 1.

Table I .The impacts of Covid-19 to Thai rice logistics export.

Topics		Effect from Covid-19													Total Score**
		Thai rice Export Association	Top 5 Rice exporter	Top 5 Rice exporter	Top 5 Rice exporter	Top 5 Rice exporter	Rice exporter	Rice exporter	Rice exporter	Rice broker	Rice broker	Rice trader	Rice trader	Shipping Lines	
Production	Farmers	0*	0	0	0	0	0	0	0	1	0	0	0	0	1
	Fertilizer	1	2	2	1	0	0	0	1	0	0	0	0	0	4
	Surveyor	0	0	0	0	1	0	0	0	1	0	0	0	0	2
	Mill (Labour)	1	0	0	2	0	0	1	0	0	0	0	0	0	3
	Packing (Labour)	1	0	0	1	0	0	1	0	0	0	0	0	0	2
Logistics	Warehouse	0	0	2	2	0	2	1	2	0	0	1	0	0	10
	Truck (driver)	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	Barge (stevedore and master)	1	1	0	0	0	2	2	0	0	0	2	0	0	6
	Ocean Vessel (stevedore)	0	0	0	0	0	0	1	1	0	0	0	0	1	3
	Freight and Ocean Transportation	2	2	2	2	2	2	2	0	2	2	2	2	2	20

\* Scores: Yes = 1 / No = 0 / Likely = 1

\*\* Summation of scores from each respondents The impacts of Covid-19 to Thai rice logistics export ranking from major effect to minor effect are as per below.

**4.1. Freight and Ocean transportation**

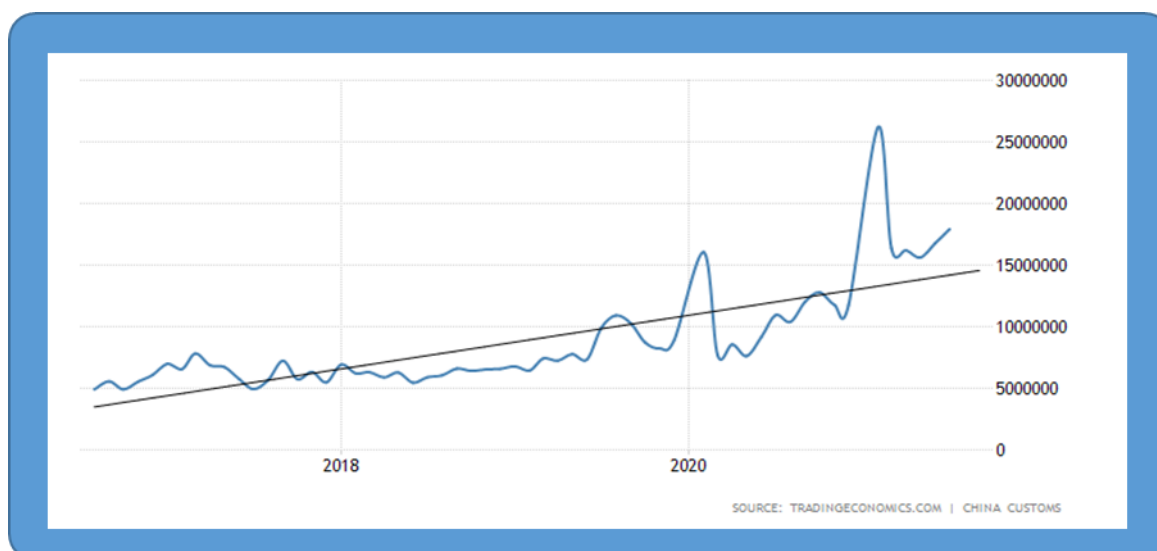
One of the most significant impacts of the pandemic on the global rice trade has been the shortage of containers and the surge in container and breakbulk freight prices.

It started from first reported case of COVID-19 on Dec. 27, 2019. Chinese government reduced physical contact with the rest of the world to limit the virus' spread. This caused the number of container ships calling on Chinese ports and the number of containers leaving China significantly declined in January 2020 (Bedi 2021).

In Spring time 2020 (March-May), many countries in Europe and America entered lockdown, and restricted economic activities. This reduced the number of port staff and slowed down cargo handling speed. Meanwhile, factories temporarily closed, warehouses and distribution centers extending containers turnaround times from a few days to up to a month. An enormous of containers lying in those continents. The situation caused lacking of container on the other places of the word due to unbalance of containers. In the autumn of 2020, world economic activities gradually recover. Countries resumed their production and export volumes increased, especially from China to North America and Europe. However, some countries were opening their factories for production on and off. This irregular goods flow created huge problems with port congestion, staff deficits. Shipping lines avoid calling certain ports due to the long waiting times (Larsen, 2020). Therefore, shipping lines operated with fewer ships or cancelled 61 sailings on the Asia-Europe trade route in Q1 2020 which represented a 151,000 TEU. The imbalance of containers caused increase in freight rates that was particularly marked in Q4 2020, as trade resumed after lockdowns were lifted.

Freight increases were seen in almost all Asian rice exporting origins. Exporters reported that freight costs from Thailand to major European ports still ranged from \$4,000-\$5,000/TEU in February, up fourfold from the middle of 2020. Lagging of container movement, and with lower number of vessels to call regular ports, the demand shifted to breakbulk shipments. That caused higher demand for breakbulk vessel and freight for breakbulk increased after Chinese New Year 2021. Compare with India where volumes were better, they got a better share of the empty containers compared to Thailand, and hence the freight increase was worse in Thailand. Likewise, container vessels situation, demand shifted to breakbulk vessel and freight for breakbulk became increased.

After Chinese New Year 2021, China demand for iron ore and coal picked up. Ship owners preferred to carry iron ore and coal to rice, as turnaround time better than carry Rice. Many of ships have been used for Iron ore and coal.



**Figure 2:** China Iron Ores & Concentrate import value

**Source:** Tradingeconomics.com National bureau of statistic of China [II]

From historical data (Figure 2) China Imports of Iron Ores & Concentrate averaged USD 4,237,355.05 from 1960 until 2021, reaching an all-time high of USD 26,223,700 in February of 2021. The number of conventional vessels have been carried Iron Ore





& Concentrate to China. Increased in demand for commodities has been reflected in the high prices of most commodities except rice (mainly due to India where the rice remained cheap). Volume of rice exporting from India increased tremendously, many breakbulk vessels were calling India and waiting in ports. The number of vessels in the market were used for China and India reduced the number of the whole ship supply. Apart from preferred cargo, the scrap value of vessel was good, lot of vessels went to scrap and were not replaced. That expedite the decreased on the availability of the ships in the market. It was low supply and high demand, freight market continued raising, plus breakbulk owners have struggled with lower charter hires for long. The Shipping Lines believed this is a market correction they long deserved. Thailand, as the rest of rice export, were affected too by the rising freights.

#### **4.2 Warehouse**

Due to Lagging of containers, rice that has been sold to over sea buyers has no container or a few conventional vessels coming to take rice from Thailand to the destination. Also freight increased effect CIF trade terms (Cost insurance and freight) where total cost increased. Traders delayed the shipment and prefer to wait for cheaper freight. Rice was kept in the warehouse waiting for delivery. This created accumulated stock pile in the warehouse. The warehouse had no sufficient space for sold rice and new crop was unable to keep in the warehouse. It happened as bottle neck for the whole supply chain. There were a few effects from Covid-19 to logistics of Thai rice export as per below issues.

#### **4.3 Lacking of labor availability (stevedore)**

Transportation of rice for export in breakbulk was different from in container where rice was moving from warehouse to breakbulk vessel by loading into barge in Chao Praya River and sailed to Kongsichang where the ocean vessel was waiting at the anchorage. Rice export was in loose bulk rice and in bagged rice where both type of rice to be loaded into barge.

The method of loading bulk rice from warehouse to barge was done by conveyor, connected from warehouse to the barge, spray bulk rice into barge where no human contact in the operation. However, loading small bag rice of 25kg or 50 Kg has labour or stevedore get involved. Using conveyor but at the end of conveyor from warehouse to barge, the stevedores in the barge will carry bagged rice and rearrange bagged in the barge hold while 1mt of jumbo bag was operated by one man driving the crane.

During Covid-19 pandemic stevedores to keep social distancing. In order to keep the productivity of loading bagged rice, the number of stevedores to be increased and the cost of labour increased due to increased stevedores. However, the barge master and crew usually lived individually in their owned barge, therefore, no effect of Covid-19 to the barge master and crew.

Apart from stevedore in barge, stevedore in the mills or warehouses or packing places had no effect from Covid-19 as they were permanently hired and lived near working place or some lived in nearby place provided by millers. Due to Rice export volume has been increased for the last few years and so does during Covid-19, the mills have been working less than their capacity. There were sufficient labour for the production and no demand for additional stevedore or requirement for external stevedore.

The last group of stevedores was the stevedores who worked on board the ocean vessel. Most of them came from our neighbor countries mainly from Cambodia. Due to long operation to load rice to ocean vessel at Kongsichang, they worked and stayed on board the working vessel. Once the loading finished, they moved from one vessel to another and start loading new vessel. So far hardly found Covid-19 case occurred from ship stevedore as they cooked and lived on board without contacting outside people.

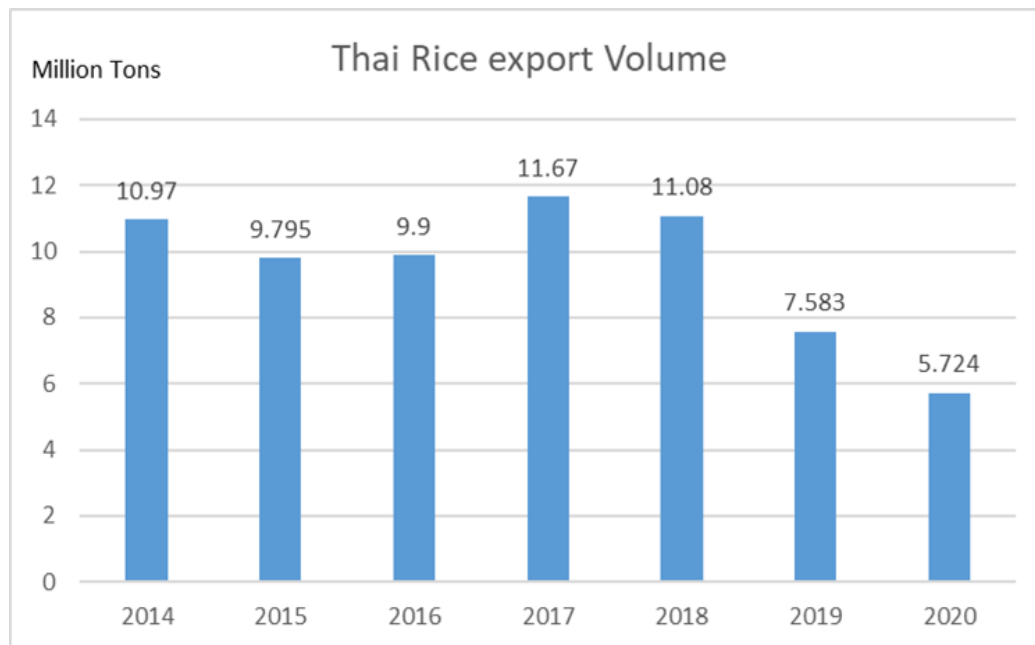
#### **4.4 Fertilizer**

As fertilizer was imported from oversea, increased freight led to increased logistic cost. It was unavoidable that the price of fertilizer increased. This could affect in the cost of rice production in long run.

#### **4.5 Farmer**

Most of the farmers lived together in a big family from great grandparents to the children. Working in the opened area field daytime providing vitamin D and flow air providing immunity to the body. Farmers had low chance to get Covid-19, only in harvesting season, farmers from different family would join harvesting activity. That increased the spread of COVID-19 transmission.

During off-season, some of the farmers migrated to Bangkok to drive Taxi. Being lockdown prohibited them return back to the field.



**Figure 3:** Thai rice export volume

**Source:** Thai Rice exporter association

As per Figure 3, the volume of Thai rice export has been reduced year by year from 2018-2020. The capacity of rice production was still sufficient for domestic consumption and export. Therefore, Covid-19 is not a major effect on farmer.

## 5. CONCLUSIONS AND RECOMMENDATIONS

The Covid-19 outbreak affected global supply chain including food chain. The aim of this study is to analyze the effects of Covid-19 on Thai Rice Export in terms of rice production and logistics of Thai Rice Export. The study applied In-Depth Interviews using both open ended questions and Structured Interview. Respondents were selected from Thai Rice concerning parties who are Thai Rice Export Association, Top 5 Rice exporters, Rice exporters, Rice brokers, Rice Traders and Shipping lines. The interviewees are president, owners or senior manager in the organization who are influencers and the decision makers on the business. The findings from study revealed that shortage of containers to export and increased freight on ocean transportation was the major effects on Logistic of Thai Rice Export. Shipping lines delayed calling some ports or reroute or cancel ports in order to utilize their containers and financial result. Deficient containers for rice export and also increased freight affected increased total supply chain cost. Rice trader delayed the order and wait for market correction to lower freight. This led to excess stock in the warehouse and the cost of carrying stock increased. No space in the warehouse for new crop. The situation would be better once global shipping market is making correction to normal market.

High sea freight also led to imported fertilizer cost increased and if freight is still volatile, cost of rice production would be increased. Thai farmers should increase domestic fertilizer used. Research on domestic fertilizer consumption should be conducted in order to reduce imported fertilizer.

Another impact from Covid-19 was the labour/stevedore who were loading bagged rice to the barge for conventional vessel. Due to restriction of social distancing, number of manpower in barge were unable to move around the barge, the productivity of loading became less. In order to maintain productivity, more stevedores were hired. Cost of loading bagged rice to barge became higher.

There was less impact for stevedore in rice mills or warehouse due to rice export volume dropped from 2018 and expect to continue in 2021. Mills had excess capacity as demand for rice has been less than the volume of product that mills could potentially supply. There was sufficient stevedore both in mills and warehouse, no additional hired labour.



Stevedore working on ocean vessel also had less impact from Covid-19 as they lived and worked on board the vessel and switching to other vessels once finished operation. There have been a few Covid-19 cases on this group of stevedores.

There were very less impacts from Covid-19 to farmer due to working atmosphere, opened air even though a small impact when short lockdown in Bangkok area where some farmers who works in Bangkok during off season and unable to return home during harvesting.

Even though Thai government does not regulate or enforce any laws or the recently introduced COVID-19 restrictions on business or farming operations, the major impacts from global chain like world containers imbalance, sea freight volatile were uncontrollable but further study on domestic fertilizer improvement is necessary as that would create more demand on domestic fertilizer and reduced imported one. The vaccinated labour/ stevedore / truck driver and farmers are required.

This study was conducted during January 2020 to May 2021 when Thailand was facing 2nd wave of Covid-19. Next phase of Covid-19 might have different effects on Logistics of Thai Rice Export. Further study on the impacts of Covid-19 for the next wave is also interesting.

## REFERENCES

1. Athanasios, P. (2020). Transport and trade connectivity in the age of Pandemics: Contactless, seamless and collaborative UN solutions. The maritime supply chain component of the United Nations Development Account (UNDA), Geneva.
2. Bangkok Post, 2020. Curfew starts today. 3 April 2020, Bangkok.
3. Binh, N.T., Huong, T.T.T. (2020). Impact of Decisions in Freight Transport Management on Rice. Transportation Research Procedia, Volume 48, 540-554.
4. Espitia et al. (2020). Covid-19 and Food Protectionism. Policy Research Working Paper 9253, Washington DC, World Bank.
5. Jiacheng, M. (2018). An Analysis of Competitiveness of Thai Rice Export. Independent Study, Siam University, Thailand.
6. Kuhakan, J. (2020). Thai traffic back to gridlock as coronavirus measures ease. <https://www.reuters.com/article/us-health-coronavirus-thailand/thai-traffic-back-to-gridlock-as-coronavirus-measures-ease-idUSKBN22U0EV>. Accessed 10 June 2020.
7. Larsen, s. (2021). How COVID-19 is affecting the shipping industry – and how to navigate through the storm. <https://blog.greencarrier.com/how-covid-19-is-affecting-the-shipping-industry-and-how-to-navigate-through-the-storm/>. Accessed 18 July 2021.
8. Masayuki, Y. (2020). Thailand to test thousands as COVID-19 strikes Myanmar workers. <https://asia.nikkei.com/Spotlight/Coronavirus/Thailand-to-test-thousands-as-COVID-strikes-Myanmar-workers>. Accessed 22 December 2020.
9. Pongsrihadulchai, A. (2018). Food and Fertilizer Technology Center of Asian and Pacific Region. FFTC Agricultural Policy Platform.
10. Serpil, A., Mehmet, A. (2020). Impact of COVID-19 on the food supply chain. Food Quality and Safety, Volume 4 Issue 4, 167–180.
11. Sowcharoensuk, C. (2019). Industry Outlook 2019-2021: Rice Industry. <https://www.krungsri.com/en/research/industry/industry-outlook/Agriculture/Rice/IO/io-rice-20>. Accessed 11 July 2021.
12. The Standard Team, (2020). Prime Minister declares state of emergency effective 26 March in response to COVID-19; maintains there is no curfew yet. <https://thestandard.co/promulgating-the-emergency-decree/>. Accessed 24 March 2021.
13. Triukose et al., (2021). Effects of public health interventions on the epidemiological spread during the first wave of the COVID-19 outbreak in Thailand. Plant Phenomics and Precision Agriculture. <https://doi.org/10.1371/journal.pone.0246274>.
14. Vasavada, P. (2020). COVID-19 and the food industry: What we know [Online]. <https://www.foodqualityandsafety.com/article/covid-19-and-the-food-industry-what-we-know>. Accessed 20 December 2020.
15. WHO (World Health Organization), 2020a. 2019 Novel Coronavirus(2019-nCoV): Strategic preparedness and response plan [Online].





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[https://www.who.int/docs/default-source/coronaviruse/srp-04022020.pdf?sfvrsn=7ff55ec0\\_4&download=true](https://www.who.int/docs/default-source/coronaviruse/srp-04022020.pdf?sfvrsn=7ff55ec0_4&download=true). Accessed 25 December 2020.

16. [I] [https://en.wikipedia.org/wiki/COVID-19\\_pandemic\\_in\\_Thailand](https://en.wikipedia.org/wiki/COVID-19_pandemic_in_Thailand). Accessed 10 July 2021.

17. [II] <https://tradingeconomics.com/china/imports-of-iron-ore-concentrates>. Accessed 14 Aug 2021.

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