Original Article

Measurement of Relative Efficiency Levels of Southeast Asian Countries in Dealing with the Covid-19 Pandemic Over One Year

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ABSTRACT

Introduction: Handling the COVID-19 outbreak is one of the most novelties modern work is facing by many countries today. Massive outbreak needs countries efficacy and talent in creating new approaches. These approaches need to prevent the spread of the outbreak and increase the citizens' belief as the outbreak will damage the countries' functional capacity. Technical efficiency is used maximally to gain total control of the conditions. This study aims to measure the relative efficiency level of Southeast Asian countries in dealing with COVID-19 pandemic over one year.

Methods: The relative efficiency level of the most successful countries in Southeast Asia in managing COVID-19 infection was determined using Frontier 4.1 through Stochastic Frontier Analysis (SFA) and Excel software. The technical efficiency of the SFA model is defined as the ratio of observed output to maximum feasible production. If the country's technical efficiency (TE) is greater than 80%, it is the most effective in Southeast Asia at managing COVID-19 infection, but if it is less than 80% or close to 0, it is inefficient.

Results: This research aims at the COVID-19 epidemic in a Southeast Asian country, where the country with the highest technical efficiency score is the most efficient and indicates the country's ability to deal with the COVID-19 outbreak without any complications. Laos was ranked first (TE = 0.99901), with a technical efficiency score that was higher than that of most other Southeast Asian countries. Singapore comes in second position with a technical efficiency score of 0.99882. Brunei is in third place for COVID-19, with a technical efficiency score of 0.99870. Cambodia is in last place, with a score of 0.84675 for technical efficiency.

Conclusion: Laos is the highest technical efficiency score among the southeast Asian countries. Various things that can lead to inefficiency include lack of awareness about standard operating procedures (SOP) among the causes of COVID-19 case infection in the workplace, and the community continues to increase. This condition may also be due to the lack of medication or vaccines to cure COVID-19. All communities around the world are expected to adopt standard operating procedures (SOP) such as wearing face masks, hand sanitizers, and social distance to curb the increasingly violent spread of COVID-19.

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Introduction

Handling the COVID-19 outbreak is one of the most novelties modern work is facing by many countries today. Managing massive outbreaks is consuming many resources that need to be done quickly such as data gathering and analysing help contain the massive outbreak. The latest information to predict the next step is crucial in an enormous outbreak since it consumes more resources such as manpower and the economy. Multidimensional methods are being used to manage the data and predict the COVID-19 cumulative cases based on available data to increase predicting efficacy. The current method in predicting COVID-19 uses machine learning, such as support vector regression (SVR) in this outbreak to predict Brazil's COVID-19 cumulative cases.[1] Brazil as one of the huge-sized countries, needs good data managing tools in calming its outbreak. Machine learning is useful in managing huge data in a hospital operation.[2] This would be efficient in managing the effect of huge data influx into a medical centre. The machine or computing power is better than human resources in managing the data as a human can be diverted to focus on other management aspects.

As one of the first countries combating COVID-19, China scientists developed mathematical models and used several parameters that were frequently added, such as asymptomatic and symptomatic type of patients.[3] These models are used to estimate epidemics in China which is suggested to be useful in other countries. The models are achieving accuracy while some parameters are being added in a timely period. Although several methods can be used, the scientist needs to find the appropriate model based on the condition.

Grey system theory was used to predict death and recoveries of COVID-19 in China. Its fractional grey model FGM is suggested to be used in short-term prediction because it accurately predicts several parameters, including the total recoveries.[4] Corona Tracker project is one of the joint-effort created in order to have real-time data accuracy.[5] This project aims to get the latest case numbers, total recoveries, and death modelling of COVID-19. Massive outbreak needs countries efficacy and talent in creating new approaches. These approaches need to prevent the spread of the outbreak and increase the citizens' belief as the outbreak will damage the countries' functional capacity. Technical efficiency is used maximally to gain total control of the conditions. South Korea has been implementing good measures in dealing with COVID-19, such as the massive campaign for testing the disease and a 'drive-through testing system' throughout the country.[6] This innovative system is regarded as one of a good example in managing the outbreak. Kerala uses unique slogans such as SMS (sanitizer/ soap, mask, and social distance) with cartoon image drawing on the public wall.7 This method is best helped by the role of government agencies such as the police. In Southeast Asian, there is a lot of people potential to be infected by this virus. The efficiency in managing the massive outbreak needs to be strengthened and collaboration need to be done among the members.

The objective of this research is to determine the relative effectiveness of Southeast Asian countries in dealing with the COVID-19 pandemic over the period of a year. The number of COVID 19 positive cases, the number of infection-related deaths, and the number of treated cases were the three main variables in this study. It is believed that the findings of this

study, which compared the relative efficiency levels of Southeast Asian countries, will aid other nations, particularly those still fighting COVID-19, by allowing them to learn from countries that have successfully and effectively contained this virus.

Methods

This research was carried out by looking at Worldometers.info's daily statistics for the COVID-19 Coronavirus Pandemic from March 2020 until February 2021. The total number of positive and recovered COVID-19 cases were the variables found in this study. Frontier 4.1 with Stochastic Frontier Analysis (SFA) and Excel software were used for statistical analysis. The method used in this study is Stochastic Frontier Analysis (SFA), which is based on the Battese and Coelli model.[8] For efficiency analysis by data scientists, stochastic frontier analysis is one of the simplest and most extensively used supervised machine learning techniques. Aigner et al.,[9] Meeusen and Broeck,[10] and Battese and Cora[11] pioneered the parametric technique to calculating stochastic production boundaries. This strategy, rather than utilising a specific distribution function, compiles the effectiveness of dealing with COVID-19 outbreaks according to its function. Because it is arranged at the most efficient level, the method's qualities are appropriate for measuring the efficacy of COVID-19 outbreaks. This is particularly useful for preventing and informing the public about the value of proper personal and family care. Other countries will be able to track and prevent COVID-19 pandemics because to the findings of this study. The stochastic frontier model is defined as follows:

$$1n\ Y_{it} = \beta_0 + \beta_1\ 1nx_{2it} + (V_{it} - U_{it})$$

where,

Y_{it} = Total recoveries cases of COVID-19 of the i-th country in the t-th time period

β = Vector of unknown parameters to be estimate

nx_{1it} = Total positive cases of COVID-19 of the i-th it country in the t-th time period

U_{it} = Non-negative random variables, associated it with technical inefficiency of Total recoveries cases of COVID-19

V_{it} = Assumed to be independent and identically distributed (i.i.d) $N(0, \sigma^2 v)$ andcaptures statistical noise, measurement error and other random.

The maximum likelihood test is used to estimate the parameters of the model and forecast future technological efficiencies. This method is more satisfying and effective than the Ordinary Less Squares (OLS) method.[12] Parameters (γ) must be between 0 and 1. The stochastic output function parameters are calculated using the maximum likelihood estimation method and the measurement using the Frontier version 4.1 software to indicate the relative efficiency level of the most effective country in Southeast Asian in managing COVID-19 infection. SFA model contains the technical efficiency defined as the ratio of observed output to maximum feasible production. TEi = 1 shows that the i-th country is most effective in Southeast Asian in managing COVID-19 infection, while TEi < 1 or close to 0 the country is ineffective and less efficient.

Results

The patterns of COVID-19 for the cumulative number of COVID-19 recoveries cases in

southeast Asian countries for one year from March 2020 until February 2021. In February 2021, Indonesia saw its highest increase in the cumulative number of recoveries COVID-19 cases (1142703 cases) to date. The second-highest cumulative number of COVID-19 recoveries cases in Southeast Asian countries is the Philippines (534271 cases) and Malaysia with 273417 cases. Myanmar has the fourth-highest cumulative number of COVID19 recoveries cases in with 131480 cases, followed by Singapore (59823 cases), Thailand (25128 cases), Vietnam (1876 cases), Cambodia (477 cases), Brunei (181 cases), Timor Leste (90 cases) and Laos (42 cases). (Table 1).

Table 2 below show the patterns of COVID-19 for the cumulative number of COVID-19 positive cases in southeast Asian countries for one year from March 2020 until February 2021. At the end of February 2021, Indonesia saw its highest increase in a cumulative number of 19 positive COVID-19 cases

(1334634 cases) to date. The second-highest cumulative number of COVID-19 positive is the Philippines (576352 cases) and Malaysia with 300752 cases. Myanmar has the fourth-highest cumulative number of COVID-19, 19 positive cases with 141896 cases, followed by Singapore (59936 cases), Thailand (25951 cases), Vietnam (2448 cases), Cambodia (805 cases), Brunei (186 cases), Timor Leste (113 cases) and Laos (45 cases).

This study discusses the COVID-19 outbreak in a Southeast Asian country, where the country with the highest technical efficiency score is the most efficient and reflects the country's ability to deal with the COVID-19 outbreak, which is very well without any problems. Laos was ranked first (TE = 0.99901), with a technical efficiency score higher than the majority of Southeast Asian countries. Singapore comes in second place with a technical efficiency score of 0.99882. Brunei ranks third in COVID-19 with a technical efficiency score of 0.99870.

Table 1. Total Recoveries Cases of COVID -19 in Southeast Asian for One Year

COUNTRY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY
Malaysia	537	4171	6353	8354	8644	9054	9967	21248	54759	88941	166049	273417
Indonesia	81	1522	7308	24806	65907	125959	214947	337801	450518	611097	873221	1142703
Vietnam	58	225	279	335	373	707	1010	1062	1179	1325	1457	1876
Thailand	342	2684	2963	3056	3125	3252	3374	3590	3803	4240	11615	25128
singapore	240	1244	21699	38500	46491	55658	57488	57913	58134	58449	59228	59823
Philippines	49	1042	3909	10233	65178	157562	253488	331046	398658	439796	487551	534271
Cambodia	13	119	123	130	164	266	275	283	301	357	443	477
Laos	1	8	16	19	19	21	22	22	26	40	40	42
Myanmar	2	27	130	222	296	354	3755	32774	70156	107069	125072	131480
Brunei	45	124	138	138	138	139	142	143	145	149	170	181
Timor Leste	1	16	24	24	24	25	28	29	30	37	55	90

Table 2. Total Positive Cases of COVID -19 in Southeast Asian for One Year

COUNTRY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY
Malaysia	2766	6002	7819	8639	8976	9340	11224	31548	65697	113010	214959	300752
Indonesia	1528	10118	26473	56385	108376	174796	287008	410088	538883	743198	1078314	1334634
Vietnam	212	270	328	355	546	1044	1094	1180	1346	1465	1817	2448
Thailand	1652	2954	3081	3171	3310	3412	3564	3780	3998	6884	18782	25951
singapore	926	16169	34884	43907	52205	56812	57765	58015	58218	58599	59536	59936
Philippines	2084	8488	18086	37514	93354	220819	311694	380729	431630	474064	525618	576352
Cambodia	109	122	125	141	234	274	277	291	323	378	465	805
Laos	9	19	19	19	20	22	23	24	39	41	44	45
Myanmar	15	150	224	299	353	882	13373	52706	90713	124630	140145	141896
Brunei	129	138	141	141	141	144	146	148	151	157	180	186
Timor Leste	1	24	24	24	24	27	28	30	30	44	70	113

Cambodia is ranked last with a technical efficiency score of 0.84675. (Table 3 and Figure 1).

Table 3. Technical Efficiency in Dealing with COVID-19 based on Southeast Asian for One Year

Country	Technical Efficiency	Rank
Laos	0.99901	1
Singapore	0.99882	2
Brunei	0.99870	3
Thailand	0.99842	4
Myanmar	0.99213	5
Philippines	0.98714	6
Malaysia	0.98248	7
Timor Leste	0.96553	8
Indonesia	0.95179	9
Vietnam	0.93663	10
Cambodia	0.84675	11

Overall, the results obtained show that all Southeast Asian countries show an improvement in dealing with COVID-19 cases, namely recoveries cases. This can be evidenced by the increase in the number of recoveries cases which is increasing every month. The results also show that all relative efficiency scores for each country are at the efficiency level of 80% and above. This is supported by a previous study by Cummins et al. (2004), who stated that a score showing 80% was considered efficient.

Discussion

The total number of COVID-19 cases in Southeast Asia keep on an increase from month to month. With a population of 270 million people, Indonesia was hit hard by the disease in February 2021, with 1334634 people infected. The technical efficiency score for Indonesia is among the lowest (rank 9). Indonesia reported its first case of COVID-19 on 2nd March 2020, it is quite late compared to its surrounding countries such as Singapore, Malaysia and Philippines. Despite this, the number of infected people has been growing at an exponential rate since the first case was identified. This rise in cases was attributed to a number of factors, including a shortage of healthcare facilities and a late and ineffective lockdown. Indonesia only has 321,544 hospital beds to accommodate its entire population in
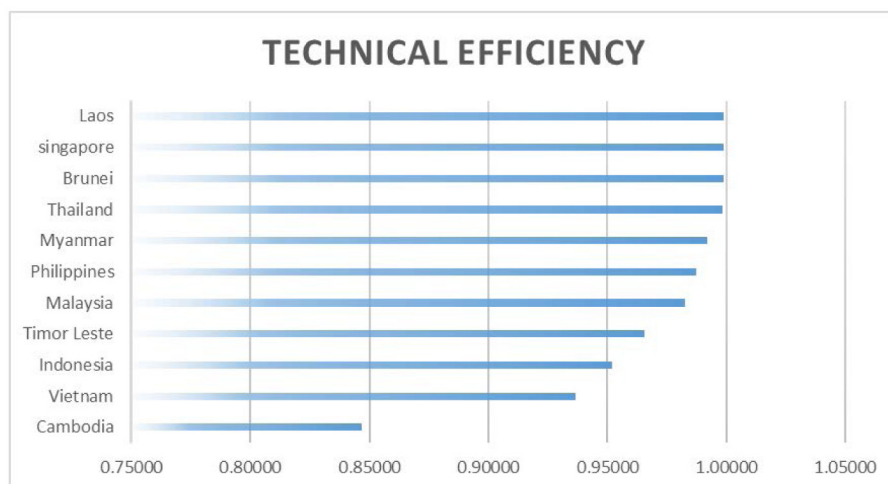

Figure 1. Technical Efficiency (TE) in Dealing with COVID-19 Outbreaks Based on Southeast Asian for One Year

January 2020. It translates to around 1.2 beds per 100,000 people, which is significantly lower than other ASEAN countries.[13] In addition, Indonesia stated a shortage of protective gear, medical supplies, and a COVID-19 testing kit. Other countries, including China, Australia, and Japan, have donated to it.[13,14] The government's slow and poor response to the spread of COVID-19 pandemic also causes an exponential case of COVID-19 infection in Indonesia. President Joko Widodo announced a state of Emergency Public Health Status on 31 March 2020. The government has not used lockdown or quarantine as a choice to tackle the spread of Coronavirus to prevent severe economic impact.[15] However, after the number of infection and death due to COVID-19 increased, the government has agreed to introduce Large-Scale Social Restrictions (Pembatasan Sosial Berskala Besar or "PSBB") which is the local version of lockdown in May 2020.[15] This action was late and non-efficient as the COVID-19 cases and death keep on increasing. COVID-19 threats and mitigation steps have not been communicated by the government. Instead, it resulted in a patchwork of national and local policies. Consequently, community interest in the fight against the disease is low.[15, 16]

Philippines was the second country that was hit hard by COVID-19. It records as many as 576532 cumulative positive cases in February 2021. More than 12000 death recorded makes the death rate of 2.1%.[17] Responded to an increasing number of positive cases, President Rodrigo Duterte announced an Enhanced community quarantine (ECQ) on 16th May 2020.[18] The lockdown in the Philippines is one of the world's longest and most intense. Thousands of Filipinos were detained under Duterte's watch for breaking quarantine laws.[19]

The poor people affected most during this lockdown and most of the citizen confuse regarding the implementation of the quarantine law.[20] This makes people in Philippines lost their interest in fighting the disease. The inefficient contact tracing, lack of protective gear and inefficient targeted testing also contribute to high cases in Philippines.[20] Vongfong typhoon which entered Philippines on 14th May 2020 complicate the thing further. When typhoons strike urban and heavily congested areas, such as the capital of Metro Manila and its suburbs, where 80 percent of the country's COVID-19 cases are found, it becomes a challenge [21]. The implementation of social distancing and frequent hand washing becomes very challenging. All these problems cause increase the COVID-19 cases in Philippines from day to day.

Malaysia in other hand shows that they can handle COVID-19 in first and second wave and even recognized by WHO for their efficiency in handling the pandemic.[22, 23] However, from September 2020, the cases of COVID-19 increase exponentially. Malaysian government had implemented lockdown known as movement control order (MCO) as early as 18th March 2020. This early lockdown, active contact tracing and optimization of healthcare equipment seems able to control the COVID-19 spread as the daily cases reduced from more than 100 daily cases on April 2020 to only 1 case on 4th August 2020.[23, 24] Seeing the number of cases decrease, Malaysian government open up their economy and reduced the intensity of lockdown. They even held a state election at Sabah. This mass gathering causes new outbreak of COVID-19 infection that severely impact whole Malaysia.[25] Noncompliant of standard operating procedure given by ministry of health was also part of the causes

of increasing number of the COVID-19 cases despite a good healthcare facility and contact tracing procedure.

Laos is the country with the highest technical efficiency score in Southeast Asia, led by Singapore in second place. So far, these two countries have shown that they can successfully handle COVID-19 situations. Since last year, Laos has only reported 45 cases of COVID-19, prompting the Centres for Disease Control and Prevention (CDC) to classify the country as level 1 (low risk) for COVID-19 infection on their travel warning website.[26] Laos, a country with a border with china recorded its first case of COVID-19 on 24 March 2020 make an early respond by implement of lockdown on 29th March 2020. The government implemented strict WHO protocol including social distancing and mask wearing to reduce transmission rate.[27] After 59 days of no new infection, the government declared Laos ad free of COVID-19 on 10th June 2020.[28]

Singapore is another country which can handle COVID-19 well with its technical efficiency score of 0.9988. Although the positive cases of COVID-19 were as high as 59936 cases in February 2021, 59823 patients recovered from the disease and only 29 deaths recorded. The death rate of 0.05% is among the lowest in the world.[29] Several factors contribute to Singapore's ability to handle COVID-19 incidents. After the SARS pandemic in 2003, which had a major effect on Singapore, the country reacted quickly and aggressively to the COVID-19 pandemic. Singapore government was among the first who close their border and quarantined all the travellers who comes from overseas not only from China. They also implement aggressive contact tracing and upgrade their Healthcare facility.[30] Their

public society fully supported the work of the government. The city-made mandatory mask wearing as early as April 2020 and all Singaporean need to record their movement by scanning barcode even when entering a Taxi.[31] Early and active action, together with the participation of community members, has shown that the COVID-19 disease can be regulated.

Until this day, Southeast Asian countries still struggle to bring down the COVID-19 infection cases. This technical efficiency data can give general and overall data on which country successfully contains the virus and which country is still struggling. Learning from a successful country is vital to bring down the cases and to learn from the struggling country are also important so that we did not make the same mistake as they did.

Conclusion

All Southeast Asian countries show improvement in COVID-19 recovery cases, especially Indonesia's highest increment in cumulative recovery and positive COVID-19 cases. Laos is the highest technical efficiency score among the southeast Asian countries. Various things that can lead to inefficiency include lack of awareness about standard operating procedures (SOP) among the causes of COVID-19 case infection in the workplace, and the community continues to increase. This condition may also be due to the lack of medication or vaccines to cure COVID-19. We only have three 'vaccines' in the current situation: face masks, hand sanitizers, and social distance. Hopefully, we will come up with a powerful vaccine to treat this disease.

Conflicts of interest

Acknowledgment

References

1.   Ribeiro, M.H.D.M., da Silva, R.G., Mariani, V.C. and dos Santos Coelho, L., 2020. Short-term forecasting COVID-19 cumulative confirmed cases: Perspectives for Brazil. Chaos, Solitons & Fractals, 135, p.109853.

2.   Alimadadi, A., Aryal, S., Manandhar, I., Munroe, P.B., Joe, B. and Cheng, X., 2020. Artificial intelligence and machine learning to fight COVID-19.

3.   Liu, Z., Magal, P., Seydi, O. and Webb, G., 2020. Predicting the cumulative number of cases for the COVID-19 epidemic in China from early data. arXiv preprint arXiv:2002.12298.

4.   Liu, L., Chen, Y. and Wu, L., 2020. Forecasting Confirmed Cases, Deaths, and Recoveries from COVID-19 in China during the Early Stage. Mathematical Problems in Engineering, 2020.

5.   Hamzah, F.B., Lau, C., Nazri, H., Ligot, D.V., Lee, G., Tan, C.L., Shaib, M.K.B.M., Zaidon, U.H.B., Abdullah, A.B. and Chung, M.H., 2020. CoronaTracker: worldwide COVID-19 outbreak data analysis and prediction. Bull World Health Organ, 1(32).

6.   Park, H., Lee, M. and Ahn, J.M., 2021. Bottom-up solutions in a time of crisis: the case of Covid-19 in South Korea. R&D Management, 51(2), pp.211-222.

7.   Sarkar, S., 2021. Breaking the chain: Governmental frugal innovation in Kerala to combat the COVID-19 pandemic. Government Information Quarterly, 38(1), p.101549.

8.   Aigner, Lovell, Schmidt P. Formulation and estimation of stochastic frontier production function models. Journal of Econometric. 1977;6(1):21-37.

9.   Battese GE, Coelli TJ. Frontier production functions, technical efficiency and panel data: With application to paddy farmers in India. Journal of Productivity Analysis. 1992;3(2):153–169.

10.   Battese GE, Corra G. Estimation of a production frontier model: with application to the pastoral zone of eastern Australia, Australian Journal of Agricultural Economics. 1977;21(2):167-179.

11.   Meeusen W, van den Broeck J. Efficiency estimation from Cobb-Douglas production function with composed error. International Economic Review. 1977;18(1): 435-444.

12.   Richmond J. Estimating the efficiency of production. International Economic Review. 1974;15(1):515- 521.

13.   Deloitte. Deloitte Indonesia Business

and Industry Updates Rising to the COVID-19 Health Care Challenge in Indonesia. 2020 [cited 2021 May 11]. Available from: https://nasional. kompas.com/read/2020/04/24/07505631/ update-23-april-7775-orang-terinfeksi-covid-19-pemerintah-ungkap-basis-data

14. Mansour H. Covid-19's toll on Indonesia's healthcare system. The Strategist. 2020 [cited 2021 May 11]. Available from: https://www.aspistrategist.org.au/covid-19s-toll-on-indonesias-healthcare-system/

15. Andriani H. Effectiveness of Large-Scale Social Restrictions (PSBB) toward the New Normal Era during COVID-19 Outbreak: a Mini Policy Review. Vol. 5. 2020 [cited 2021 May 11]. Available from: www.covid-19.go.id

16. Sutarsa IN. "Nine months and no progress": what went wrong in Indonesia's COVID-19 responses and what can be done. The conversation. 2020 [cited 2021 May 11]. Available from: https://theconversation.com/ nine-months-and-no-progress-what-went-wrong-in-indonesias-covid-19-responses-and-what-can-be- done-145850

17. WHO. Philippines Coronavirus Disease 2019 (COVID-19) Situation Report #71. WHO. 2020.

18. Merez A. Luzon under enhanced community quarantine as COVID-19 cases rise. ABS-CBN News. 2020 [cited 2021 May 16]. Available from: https://news.abs-cbn.com/ news/03/16/20/duterte-places-luzon-under-enhanced-community-quarantine-to-fight-covid-19

19. Wong AC. The Philippines' struggle with

COVID-19 under the Duterte administration. Asia Media Centre. 2020 [cited 2021 May 16]. Available from: https://www.asiamediacentre. org.nz/opinion/the-philippines-struggle-with-covid-19-under-the-duterte-administration/

20. Walden M. How did the Philippines overtake Indonesia as the COVID-19 epicentre of South-East Asia? ABC News. 2020 [cited 2021 May 16]. Available from: https://www. abc.net.au/news/2020-08-18/how-did-the-philippines-overtake-indonesia-as-covid-19-epicentre/12562712

21. Lucero-Prisno DE, Bernardino GD, Camua AAR, Lin X, Adebisi YA. Philippines braces for the typhoon season amidst COVID-19. Lancet Reg Heal - West Pacific. 2020 Aug 1 [cited 2021 May 16];1:100003. Available from: https://doi.org/10.1016/j.lanwpc.2020.10

22. Bernama. WHO praises Malaysia's handling of Covid-19 pandemic. new straits times. 2020 [cited 2021 May 17]. Available from: https://www.nst.com.my/ news/nation/2020/10/632582/who-praises-malaysias-handling-covid-19-pandemic

23. Wan Muhamad Amir WAhmad, Wan Mohd Nazlee Wan Zainon, Mohamad Arif Awang Nawi FMMG. Malaysia's Efficiency in Dealing with COVID-19 Outbreaks Compared to Other Asian Countries by Using Stochastic Frontier Analysis (SFA). Ann King Edward Med Univ. 2020 [cited 2021 May 16];26(02):324–9. Available from: https:// annalskemu.org/journal/index.php/annals/ article/view/3920/2343

24. DG of health. Kenyataan Akhbar KPK 4 Ogos 2020 -Situasi Semasa Jangkitan Penyakit

Coronavirus 2019 (COVID-19) di Malaysia. MOH. 2020 [cited 2021 May 17]. Available from: https://kpkesihatan.com/2020/08/04/kenyataan-akhbar-kpk-4-ogos-2020-situasi-semasa-jangkitan-penyakit-coronavirus-2019-covid-19-di-malaysia/

25. The Straits Times. Malaysia's PM Muhyiddin admits Sabah state polls in Sept caused current Covid-19 wave. The Straits Times. 2020 [cited 2021 May 17]. Available from: https://www.straitstimes.com/asia/se-asia/malaysias-pm-muhyiddin-admits-sabah-state-polls-in-sept-caused-current-covid-19-wave

26. CDC. COVID-19 in Laos - COVID-19 Low - Level 1: COVID-19 Low - Travel Health Notices. CDC. 2020 [cited 2021 May 6]. Available from: https://wwwnc.cdc.gov/travel/notices/covid-1/coronavirus-laos

27. Vijay Prashad. Laos has tackled COVID-19, but it is drowning in debt to international finance. Peoples Dispatch. 2020 [cited 2021 May 16]. Available from: https://peoplesdispatch.org/2020/07/14/laos-has-tackled-covid-19-but-it-is-drowning-in-debt-to-international-finance/

28. Johnson K. Health officials praise Laos after coronavirus-free declaration. Reuters. 2020 [cited 2021 May 6]. Available from: https://www.reuters.com/article/us-health-coronavirus-laos-idUSKBN23P1XU

29. WHO. Singapore Situation report 27 feb 2021. 2021.

30. Moss D. Singapore's Covid Success Isn't Easily Replicated . Bloomberg. 2021 [cited 2021 May 16]. Available from: https://www.bloomberg.com/opinion/articles/2021-01-03/singapore-s-covid-success-isn-t-easily-replicated

31. Geddie J, Aravindan A. Why is Singapore's COVID-19 death rate the world's lowest. Reuters. 2020 [cited 2021 May 16]. Available from: https://www.reuters.com/article/health-coronavirus-singapore-explainer-idUSKBN2680TF