

Determinants of COVID-19 Vaccine Rollouts in Southeast Asia

Tham Siew Yean and Andrew Kam Jia Yi

tham_siew_yean@iseas.edu.sg

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1. Introduction

The emergence of the Covid-19 pandemic necessitated the administration of safe and effective vaccines to sufficient numbers of a population so as to achieve the herd immunity that is needed for halting transmission of the virus and its negative impact on mortality and the economy. There was thus a rush to produce vaccines for combating the virus, but these had to be produced at scale and priced affordably as well as made available where needed for it to be deployed globally. The safety features required vaccines to be authorised or approved for human use. Each country had to choose whether to use only WHO’s approved vaccines or to expand their choices based on their own assessment of available vaccines and their country’s needs.

The supply of vaccines to a country, especially developing countries that have no capacity to produce vaccines, became a critical factor for paving the road towards managing the pandemic. However, procuring vaccines became a serious challenge for many developing countries (Sheik et al., 2021) including those in South-east Asia (SEA) since vaccines were not accessible in most of these countries at the end of 2020 because high income countries have purchased a significant portion of available vaccines (Tagoe et al., 2021). Given budget constraints, procurement strategies for developing countries have to take into consideration different supply sources, including donations and aid.

Local production can also affect supply since some developing countries do have the capacity to manufacture vaccines. Unfortunately, intellectual property rights and limited technology transfer can stand in the way of local production (OECD, 2021).

In 2020, it was already established that several of the leading vaccine candidates require ultra-cold chains and have short shelf-lives once they are removed from storage. Hence, the deployment of vaccines is dependent on the logistics infrastructure and logistics capacity and capability of a country (OECD, 2021), especially beyond the better developed urban areas to the considerably logistically challenged rural parts of a country.

Another outstanding challenge that remains even once supplies are made available, is the state’s capacity (Tevdovski et al., 2022) to distribute and administer to their entire populations,

taking into account the risks factors of different age groups and vulnerabilities, geographical constraints as well as socio-cultural factors. The state capacity to implement a viable and effective vaccination strategy is therefore another key factor that can influence the vaccine roll-out of a country.

Besides these supply factors, demand is another crucial determinant of the vaccination rates in a country. Vaccine hesitancy and acceptance can facilitate or deter the roll-out of vaccinations in a country. The former can be influenced by misinformation about the nature and potential side-effects of Covid vaccines as well as prejudices against the country producing the vaccine. Misinformation maybe home grown or may have been spread to SEA from outside the region.

Bringing together supply and demand factors as in case of Deb et a., (2021), the vaccination rates of a country will depend on its procurement, including local production; state capacity; logistics infrastructure; as well as the demand for vaccines as reflected by the extent of vaccine acceptance. The chapter will discuss each of these determinants in the ten SEA countries, based on available data, to ascertain their influence on vaccination rates in these countries.

2. Vaccine Procurement

All countries in SEA used a diversified strategy to obtain vaccines, as reflected in part by the number and type of vaccines approved for use, which varies from country to country, as it is subject to the regulatory approval body of the respective countries (**Table 1**).

Singapore and Brunei have the smallest number of vaccines approved, followed by Malaysia and Thailand. Countries which are relatively more dependent on donations tend to have more types of vaccines approved. These include vaccines which are outside the list of approved vaccines by the WHO, such as selected vaccines from China, Russia or Cuba. In particular, archipelagic countries like Indonesia and the Philippines have approved more vaccines (11 in total in each country) than others in SEA. This includes single shot vaccines and vaccines that have less stringent storage requirements and are therefore easier to administer to reach the rural, less developed and less accessible parts of a country.

Vaccines are procured through different channels: multilateral, bilateral, doses obtained via COVID diplomacy, private purchase, as well as domestic production.

Table 1. Vaccines Approved in Southeast Asia

Country	Pfizer	Moderna	Astrazeneca	Janssen (J&J)	Serum Institute of India (Covishield)	Covaxin	Sinovac	Sinopharm	Novavax (Australia)	Other Chinese Vaccines*	Russian Vaccines**	Others
Brunei	/	/	/					/				
Cambodia												
Lao PDR	/			/			/	/			Sputnik Light Sputnik V	
Indonesia	/	/	/	/	/		/	/		CanSino, ZF2001, KConvac	Sputnik V	
Malaysia	/	/	/	/			/	/		CanSino		
Myanmar					/			/			Sputnik V	
Philippines	/	/	/	/	/	/	/	/(Two Types)			Sputnik Light Sputnik V	
Singapore	/	/					/					
Thailand	/	/	/	/			/	/				
Vietnam	/	/	/	/		/		/			Sputnik V	Abdala (Cuba)

Note: /: Vaccines in WHO's approved; **: Vaccines outside the approved list of the WHO, as at February 2022

Source: <https://covid19.trackvaccines.org/agency/who>

2.1 Multilateral Channel

The multilateral channel is provided by the Covid-19 Vaccines Global Access (or COVAX), which is a tripartite partnership between Gavi (the Vaccine Alliance), the Coalition for Epidemic Preparedness Innovations (CEPI) and the World Health Organisation (WHO) (Berkley 2020).

COVAX's role are twofold. First, it supports research, development, and manufacture of Covid-19 vaccines, and second, to negotiate prices of vaccines through the COVAX Facility, which is a global risk-sharing mechanism for pooled procurement and equitable distribution of these vaccines. The vaccines in turn can be procured through self-financing or Advance Market Commitment (AMC), which is a financing instrument that aims to support 92 lower- and middle-income economies in the COVAX Facility. The AMC is supposed to ensure that pharmaceutical partners will invest enough to produce and supply at scale when regulatory approval and licenses are obtained. To promote vaccine equity, half of the doses produced are meant for lower-income countries for protecting their front-line health workers and the high-risks groups such as senior citizens and those with co-morbidities.

SEA's participation in the COVAX Facility is determined by their income group as these countries are divided into three income groups based on World Bank's Atlas method (The World Bank 2020). Brunei and Singapore are categorised as high-income countries, while Malaysia and Thailand fall under Upper Middle Income (UMI). The rest of SEA countries are in the Lower Middle Income (LMI) categories.

Brunei and Singapore were among the 64 higher-income economies that formally signed up with COVAX by 22 September 2020. COVAX then started signing formal agreements with vaccine manufacturers and developers after obtaining these 64 legally binding agreements. Malaysia joined later in November 2020, choosing the Optional Purchase arrangement that enables participants to decide which vaccines to buy. Thailand did not join COVAX in 2020 as it preferred to deal directly with manufacturers, and it also aimed for local production. Subsequently in November 2020, Thailand arranged with AstraZeneca to supply Covid vaccine and to transfer technology to local production in the country.

By July 2020, the Gavi Board had finalized the 92 economies (or AMC-92 countries) that will be supported by the COVAX AMC. The list included all the six LMI countries in SEA. These countries are eligible to purchase vaccines based on two cost-sharing principles. Donor-funded, fully subsidized doses (i.e., free vaccines) are distributed across eligible countries until each country has enough to cover 20% of its population (or until donor resources are exhausted). After 20% coverage is achieved, eligible countries can purchase vaccines for a price equal to 15% to 20% of cost (as per their cost sharing principle) (Agarwal and Reed 2021).

In 2020, COVAX AMC targeted to deliver to the AMC-92 countries at least 1.3 billion donor-funded doses of approved vaccines by the end of 2021. Donated sources were an importance source of COVAX supply as it amounted to 60% of the doses delivered in 2021 (or 543 million out of 910 million) (de Bengy Puyvallée and Storeng 2022).

2.1.1 Roll-out of COVAX Vaccines

Singapore had signed advanced purchase agreements and approved the Pfizer vaccine by December 2020. It is therefore not surprising that it was the first in SEA to receive COVAX vaccines as the first batch of the Pfizer vaccine in December itself (**Table 2**). Singapore also ordered two other types of vaccines, Moderna and Sinovac. Vaccination for health care workers began in December 2020, followed by seniors aged 70 and above in January 2021, and subsequently critical workers (Amul et al., 2021).

Brunei as one of those who booked early the COVAX vaccines received the first batch of 240,000 doses of AstraZeneca (AZ) in April 2021. Malaysia also received its first batch of COVAX AZ vaccines in April. However, an earlier batch of vaccines, Pfizer arrived in February 2021, which was procured through direct purchase from the Pfizer factory in Puurs, Belgium.

The AMC-92 countries, including the six in SEA, but excluding Myanmar, received their first batch of AZ vaccines from COVAX in March 2021, with Vietnam receiving a bit later in April. Although Myanmar has been allocated vaccines by COVAX, there is no published information of the country receiving these vaccines after the coup in February 2021.¹ As noted in Blanchett et al., (2021), sanctioned countries may have problems receiving vaccines from COVAX due to hindered access to goods and services including temperature-controlled equipment, fuel, software, insurance, or logistics operators.

By January 2022, COVAX had delivered more than **one billion** doses of COVID-19 vaccines to 144 participating economies, including more than **870 million** to AMC economies, which is less than originally targeted 1.3 billion doses, due to intense competition for vaccines, which led to delays in the delivery of early doses from the contracts COVAX had signed with manufacturers. Furthermore, majority of the donations were made in an ad hoc fashion and were provided with little notice and with short shelf lives thereby making it difficult for the recipient countries to plan their vaccination programs. Some of the donated doses were found to be earmarked, which violated the principle of equitable access (de Bengy Puyvallée and Storeng 2022).

Out of the 870 million doses delivered to AMC-92 economies, East Asia and the Pacific received 216 million (or 24.6 percent). South-east Asian countries in the AMC received in total, 98% of the 216 million. Nevertheless, as shown in Table 2, none of the AMC-92 countries in SEA have received the full number of doses that was allocated for them. The Table also shows that Laos, Vietnam, and Philippines are more dependent on COVAX allocation per capita than Cambodia and Indonesia.

Among the self-paying countries, Brunei and Singapore has received all that was allocated, while Malaysia has received 75% of the allocated number of doses. These countries also used more direct purchases than the other countries. Cambodia and Indonesia also utilized direct purchases more than the other AMC-92 countries in SEA.

Table 2. Vaccine doses allocated and distributed to SEA countries participating in the COVAX, as of January 2022

Country	AMC status	No. Of COVAX does allocated	No. Of COVAX doses distributed	Per capita no. of doses allocated	Per capita no. of doses distributed
Brunei	Self-financing	100,800	100,800	0.23	0.23
Singapore	Self-financing	938,400	938,400	0.17	0.17
Malaysia	Self-financing	1,840,800	1,387,200	0.06	0.04
Cambodia	Sponsored	3,925,260	3,925,260	0.23	0.23
Lao, PDR	Sponsored	6,557,800	5,088,150	0.90	0.70
Myanmar	Sponsored	12,252,600	n.a.	0.23	n.a.
Vietnam	Sponsored	68,341,910	49,606,820	0.70	0.51
Philippines	Sponsored	69,869,275	65,724,200	0.64	0.60
Indonesia	Sponsored	178,461,900	87,951,970	0.65	0.32

Note: Countries are ordered from the lowest to highest COVAX doses allocated.

Source: Katelyn J Yoo et al, 2022

2.2 Vaccine Diplomacy: Multilateral and Bilateral

2.2.1 China

China was the first to use the Covid-19 pandemic to strengthen bilateral ties in SEA. Before the use of vaccines, China donated masks, test kits and experts to SEA. Malaysia for example, in the first quarter of 2020, received protective gear, hand sanitizers and other materials for the fight against the virus and health authorities also held a teleconference with experts from China to discuss how to rein in the infection rate. China also sent large shipments of aid packages, including donated N95 face masks, medical masks, goggles, protective suits, kits for COVID-19 testing, and other paraphernalia to the Philippines, Indonesia, and Thailand.

China had some early advantages in vaccine diplomacy. It rapidly raced into vaccine development after the emergence of the virus in late 2019. Chinese state-owned and private companies, such as for example, Sinopharm, Sinovac and Convidecia with the Institute of Biology at the country's Academy of Military Medical Sciences were mobilised to accelerate the production of vaccines. China also has large manufacturing capacity which enabled speedy production at a large scale. It also gave conditional approval for domestic usage even before Phase 3² trials were completed. For example, in July 2020, China launched its controversial emergency use program, distributing doses from Sinovac, Sinopharm, and private Beijing firm Cansino to the Chinese population before the companies had completed Phase 3 trials to test how well the vaccines protected against the virus. China also had vested commercial interests which meant that more doses were sold rather than donated. Indeed, China's vaccine diplomacy is used for hard (or material benefits) as well as soft (image-building) objectives (de Bengy Puyvallée and Storeng 2022).

Thus, by October 2020, China had already started to offer vaccine assistance to Southeast Asian countries, with Foreign Minister Wang Yi conducting vaccine diplomacy by touring SEA in October 2020 and again in January 2021 (Yeremia and Raditio 2021).

The use of China's vaccines was subsequently boosted when the WHO gave conditional approval for the use of Sinopharm in early May and for Sinovac in June 2021, despite the lack of transparency on data about the vaccines that were developed in China, especially with regards to data on preliminary or peer-reviewed data proving its safety and efficacy. Sinopharm and Sinovac's conditional approval meant that these two vaccines could be used in COVAX to mitigate the shortfall left by India's reduced exports, and especially to meet COVAX's envisaged supply of vaccines to the developing world.

Table 3 shows that the first batch of Chinese vaccines arrived in SEA mostly in February 2021, with the exception of Indonesia, Myanmar and Thailand. Indonesia became the first country besides China to issue emergency use authorization of Sinovac's vaccine, with the first batch of purchased vaccines arriving in December 2020. The Majelis Ulama Indonesia (Indonesian Ulema Council, or MUI) also issued a fatwa reaffirming the vaccine's halal status. On 13 January 2021, the Indonesian government then proceeded by conducting the inaugural Covid-19 mass vaccinations. The president of Indonesia received an injection of CoronaVac on live television at the same time. Subsequently Indonesia also received donations, starting in September 2021.

Thailand was the second country in SEA to receive China's vaccines as its first batch, which was purchased, arrived early in January 2021 while the first donated batch arrived in February 2021.

Myanmar received China's vaccine donation later than the rest of SEA due to the coup in February and ensuing sanctions which disrupted the logistics and delivery of

vaccines to the country. The vaccines therefore arrived much later in May 2021. India was the first country to send vaccines to the country, which arrived much earlier in the year in January.

Although Brunei did not need donations being in the high-income category, nevertheless donations were given in appreciation of the fact that at the outset of the Covid-19 pandemic in March 2020, Brunei had provided assistance to China.

Malaysia received its first batch of bulk purchase in Feb 2021 for bottling in the country. The then Minister Science, Technology and Innovation Minister Khairy Jamaluddin became the first person in Malaysia to receive China's Sinovac Covid-19 vaccine on Thursday on March 18.

Singapore also received the first batch of advances purchase of Sinovac in February 2021, but the vaccine had not yet been authorized by regulators at the time of arrival and so could not be used immediately. Approval was given in June for private use, after WHO approval was announced. Subsequently, Sinovac was added into the Singapore National Vaccination Program in October to cater to those who are medically ineligible for mRNA Covid vaccines.

The dates in Table 3 indicate that China's vaccines were among the first (be it purchased or donated) to arrive assist the SEA countries, even before COVAX vaccines arrived, except for Singapore. It also shows that purchased doses exceeded donations for all the countries except for Laos, which did not buy any. Indonesia was the largest buyer, followed by the Philippines and Myanmar.

In 2022, there were no increases in purchases or donations to Malaysia, the Philippines and Thailand. Purchases continued in 2022 for Cambodia, Indonesia, Myanmar, and Vietnam. Donations also continued to be received by Cambodia, Laos, Myanmar, and Vietnam in the same year.

Table 3. China's vaccines in SEA, as of June 2022

Country	Arrival of first batch of China's vaccines*	Doses Delivered**	Doses Purchased**	Doses Donated**
Brunei	Feb 2021	n.a.	n.a.	n.a.

Cambodia	Feb 2021	36.8 m (Dec 2021); 41.8 (June 2022)	28.5 m (Dec 2021); 28.5 (June 2022)	8.3 m (Dec 2021); 13.3 (June 2022)
Lao PDR	Feb 2021	8.7 m (Dec 2021); 9.1 m (June 2022)	0 (Dec 2021); 0 (June 2022)	8.7 m (Dec 2021); 9.1 m (June 2022)
Indonesia	First batch is purchased and arrived in Dec 2020	255 m (Dec 2021) 268.3 m (June 2022)	252 m (Dec 2021) 265.3 m (June 2022)	3 m (Dec 2021) 3 m (June 2021)
Malaysia	Feb 2021, bulk purchase; Donation, July 2021	10.9 m (Dec 2021); No change in June 2022	8.4 m (Dec 2021); No change in June 2022	2.5 m (Dec 2021); No change in June 2022
Myanmar	May 2021	44.0 m (Dec 2021);	33.4 m (Dec 2021);	10.6 m (Dec 2021);

		54.3 m (June 2022)	33.7 m (June 2022)	20.64 m (June 2022)
Philippines	Feb 2021	60 m (Dec 2021); No change in June 2022	55 m (Dec 2021); No change in June 2022	5 m (Dec 2021); No change in June 2022
Singapore	Feb 2021, Advance purchase agreement, not approved for use until June 2021	n.a.	n.a.	n.a.
Thailand	Jan, 2021	29.9 m (Dec 2021); No change in June 2022	26.5 m (Dec 2021); No change in June 2022	3.4 m (Dec 2021); No change in June 2022
Vietnam	Feb 2021	37.7 m (Dec 2021); 41.5 m (June 2022)	36.2 m (Dec 2021); 36.2 m (June 2022)	1.5 m (Dec 2021); 5.3 m (June 2022)

Note: ** There is no data for Brunei and Singapore

Source: *Media reports, embassy announcements

** The table only includes bilateral contributions directly from China as extracted from <https://bridgebeijing.com/our-publications/our-publications-1/china-covid-19-vaccines-tracker/> Feb 2022 and June 2022.

2.2.2 *United States of America*

In June 2021, it was announced that the Biden Administration will share at least 80 million U.S. vaccine doses globally by the end of June and the plan for the first 25 million doses. Specifically, the United States will share at least three-quarters of its donated doses through COVAX, to countries in need. For doses shared through COVAX, the United States prioritized Latin America and the Caribbean, South Asia, and SEA, as well as Africa. Approximately 7 million for Asia were allocated to the following: India, Nepal, Bangladesh, Pakistan, Sri Lanka, Afghanistan, Maldives, Malaysia, Philippines, Vietnam, Indonesia, Thailand, Laos, Papua New Guinea, Taiwan, and the Pacific Islands.

Although the US did give out its donations for free, it mobilised its Defense Protection Act to ensure American Vaccine manufacturers prioritized deliveries to the US government leading to virtually no exports or donations abroad in the first half of 2021 (de Bengy Puyvallée and Storeng 2022). Moreover, President Biden also made sure that that its donations would not impact its own vaccine supply by purchasing one billion doses for COVAX at cost, which included the 700 million doses for donation. The donations were also bought from an American producer thereby guaranteeing production and employment in the country.

Overall, 45 percent were delivered via COVAX and 55 percent were delivered direct, but there were no regional or country breakdowns for the direct delivery. Over time, the countries which received significant increases in US donations of vaccines are Indonesia, and the Philippines, and Vietnam (Table 4). Although delivery was slower and came on board much later in 2021 and 2022, it helped the region to fight the surge in COVID cases with the emergence of the Delta variant from April till August 2021 (The Economist 2021).

Table 4. US Vaccine Diplomacy, as at September 2021 and June, 2022

Country	Cumulative Doses Received September 2021	Cumulative Doses Received February 2022
Cambodia	1.1 m	1.1 m
Indonesia	4.5 m	35.8 m
Laos	1.1 m	2.7 m
Malaysia	1 m	1 m
Philippines	6.4 m	33.3 m
Thailand	1.5 m This amount was negotiated bilaterally with the US as it is not a member of COVAX.	2.5 m
Vietnam	5 m	61.5 m

Source: <https://www.kff.org/global-health-policy/issue-brief/u-s-international-covid-19-vaccine-donations-tracker/> June 2022

2.2.3 *Other Countries*

Certainly, vaccine diplomacy is not confined to China and the US alone. The EU is also an important party to this. In **Table 5**, the European Union, with its Member States, the European Investment Bank and the European Bank for Reconstruction and Development (or Team Europe) is the second largest donor, after the US, to the GAVI COVAX AMC. Japan is another large donor to COVAX. Australia and China, each contributed USD100 million. Some SEA countries have also contributed smaller amounts, with Singapore taking the lead.

In March 2021, Quad leaders launched the Quad Vaccine Partnership (QVP), to help enhance equitable access to safe and effective vaccines in the Indo-Pacific and the world. Quad countries have pledged to donate more than 1.2 billion vaccine doses globally, in addition to the doses we have financed through COVAX. By September 2021, QVPs have collectively delivered nearly 79 million safe and effective vaccine doses to the Indo-Pacific region. Later in Feb 2022, the Quad Leaders (US, Australia, India, and Japan), announced that Quad partners have provided 500 m doses and have pledged to donate 1.3 billion doses globally (US Department of State, 2022). Unfortunately, there is no detailed country breakdown of by source and recipient countries.

Table 5. Vaccines Donations (2021-2025), as at January 2022 (USD million)

Country	Direct Contributions	Total Contributions
Australia	72	100
Canada	414	470
China	100 (August 2021)	100
Team Europe		3,220
EU	489	489
Japan	1,000	1,000
Korea	210	210
UK	63	731
US	3,500	4,000
Malaysia	0.1	0.1
Philippines	1.0	1.0
Singapore	5.0	5.0
Vietnam	0.5	0.5
Total Donor* Governments	8,444	10,377
Total Foundations, Corporations and Organisations	443	473
Total Pledged to date	8887	10,849

Note: * Including those not shown in this table but can be seen in the report

Source: <https://reliefweb.int/sites/reliefweb.int/files/resources/Break%20COVID%20now%20-%20the%20GAVI%20COVAX%20AMC%20investment%20opportunity.pdf>

2.3 Private Purchase

The relatively slow rollout in vaccination in the first half of 2021 led to the use of private purchase to supplement government purchases. Indonesia was the first to allow private companies to purchase government-imported vaccines for their employees and their families (Table 6). However, reportedly this program was terminated in July 2021 amidst criticisms from public and civil society groups.³

As noted in Hudes and Chen (2021), the intention to use private purchase to boost public vaccination programmes would have widened gaps in access in each country, especially for the informal workers who are not covered under private purchase programs. It ultimately reflects global vaccine inequity which COVAX was supposed to surmount.

Nevertheless, there were several other countries in SEA which also utilized private purchases to supplement their respective vaccination programmes, as shown in Table 6.

Table 6. Private Purchase of COVID vaccines in SEA, 2021

Country	Date of Program in 2021	Private Purchase Program
Indonesia	25 February	Private business-funded Gotong Royong scheme, which allows private and state-owned companies to purchase vaccine supplies from the government to inoculate workers and their family members.
Malaysia	June	State governments and private hospitals can purchase their own COVID-19 vaccines, including those not used in the National COVID-19 Immunisation Programme (NIP) but which are approved by the WHO, such as Moderna and Sinopharm.
Myanmar	15 November	Hemas Mandalay Pharmaceuticals Ltd. in Myanmar imported 200,000 doses of filled and finished Sinovac from Malaysia
Philippines	29 March	Firms are allowed to enter tripartite deals with the national government and vaccine manufacturers.
Singapore	15 September	Livingstone Health International was appointed by the Ministry of Health (MOH) to lead in the procurement of Sinovac Biotech COVID-19 vaccines on behalf of private healthcare institutions.
Thailand	June	Allowed private organisations and local administrative organisations to procure COVID-19 vaccines but only through government channels.
Vietnam	July	Issued Resolution to allow T&T Group to

		purchase Sputnik V vaccines from Russia, without using funds from the State Budget or Vietnam's COVID-19 Vaccine Fund.
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Source: Various media reports

2.4 COVID-19 Vaccine Production in SEA⁴

The 2019 ASEAN Vaccine Baseline Survey (AVBS) (ASEAN Secretariat, 2019) found four countries in SEA with vaccine production capacity. They are Indonesia, Myanmar, Thailand, and Vietnam. It is therefore not surprising that these countries, apart from Myanmar due to its internal situation, are keen to develop their own vaccines, be it with existing producers from the developed countries and or on their own. Domestic production is meant to ensure adequate supply for their own needs, reduce their dependency on imports as well as to enhance their learning and capabilities to cope with future health pandemics. The latter is especially important in the face of lingering uncertainties over the future development of the virus and the need to manage the transition from pandemic to endemicity as well as learning to live with COVID-19.

2.4.1 Production with Existing Vaccine Producers

Indonesia was quick to act as the Indonesian embassy in Beijing had sought to establish contact with Sinovac in as early as March 2020. Three months after that, Sinovac agreed to cooperate with Bio Farma in conducting clinical trials as well as vaccine manufacturing. In August 2020, a phase-three clinical trial for Sinovac's vaccine were conducted. Under the agreement with China, Bio Farma of Indonesia acquired the license to produce CoronaVac and has been designated a production hub for the region. The company started to "fill and finish" 15 million CoronaVac doses for distribution from mid-January 2021.

Thailand also negotiated for vaccine production, signing an advance agreement in November of 2020 to secure an undisclosed number of doses of the AstraZeneca/Oxford vaccine and authorization for local production by the Thai drug manufacturer Siam Bioscience, which had no prior experience in vaccine production.⁵ Thailand considered it strategically important to gain from technology transfer as well as make the country self-reliant in vaccine production. Domestic production would also promote and push the Thai pharmaceutical industry ahead of its ASEAN neighbours.⁶ The deal was to produce up to 200 million doses a year as the sole SEA production hub for this vaccine.⁷ The Thai government had reserved about a third of those doses, with the rest bound for export to Indonesia, the Philippines, Vietnam and other neighbours.⁸

In June 2021, Siam Bioscience started the country's first production of a COVID-19 vaccine, using AstraZeneca's technology. However, there were teething problems,

which led to a shortfall in the projected production. This affected the projected number of doses available for Thailand as well as the country's exports. Thailand has since surmounted the teething problems as it has emerged as a major manufacturer of the Oxford/AstraZeneca vaccine, producing 52.5 million doses in September 2021, compared with just 8.4 million in August of the same year.⁹

Malaysia also signed a deal in January 2021 with Sinovac to “fill and finish” the vaccines in Malaysia with Pharmaniaga, a government-linked pharmaceutical company.¹⁰ Pharmaniaga is importing the bulk material from Sinovac and performs the fill and finish process at the Pharmaniaga LifeScience plant. This also involves transfer of technology and required testing. Subsequently, Pharmaniaga reported that it had supplied 12 million doses of the vaccine to the National COVID-19 Immunisation Programme and the final batch was supplied on July 21, 2021. There are subsequently two media reports of further collaboration with China on vaccine R&D and production, although the partners are not named. Moderna is reportedly moving into vaccine production in Malaysia in 2022.

Vietnamese conglomerate Vingroup has teamed up with a U.S. vaccine maker to begin production of its COVID-19 vaccine in Vietnam early next year. On August 15, 2021, it was reported that Vingroup began Phase 1 trials of a vaccine developed by Arcturus Therapeutics Holdings, based in the U.S. city of San Diego.¹¹ Arcturus has agreed to provide the Vietnamese company with an exclusive license to make its mRNA COVID-19 vaccine candidate -- the same type as those developed by Pfizer and Moderna -- solely for sale and use in Vietnam. Arcturus is reportedly preparing to start production in March 2022 with a production facility in Hanoi that can produce 200 million doses annually.¹²

2.4.2 Producing Home-Made Covid-19 Vaccines

The desire to produce home-made vaccines is to achieve self-sufficiency in the vaccine, improve coordination among research and development agencies and enhance national capability in Covid-19 vaccine production. There are four countries in SEA that are actively pursuing the development of home-made vaccines.

Table 7 shows the home-made vaccines that have advanced to clinical trials. Vietnam's Nanocovax that is being developed by the Nanogen Pharmaceutical Biology Joint Stock Company in cooperation with Military Medical Academy has progressed to Phase 3 trial. But the debut of the first Vietnamese vaccine may be pushed back beyond September 2021 as health authorities take extra care to ensure the safety and effectiveness of the vaccines.¹³

The ART-021 vaccine that is being developed in Singapore and the Merah-Putih vaccine in Indonesia are both at Phase 2 trials. Indonesia is pressing to launch the latter's vaccine in the third quarter of 2022.¹⁴ The Nusantara vaccine is however mired

in domestic debates as it is being developed by an American company Aivita Bio Medical Inc., and its choice of vaccine technology is based on dendritic cells, which are components of blood cells that are a part of the immune system. But there are as yet no dendritic cell-based Covid-19 vaccines that have entered Phase 3 clinical trials in the world, nor any that have been approved by any drug regulatory authority as yet.¹⁵

Thailand's two home-grown vaccines are still as Phase 2 trials, with the Chula-Baiya vaccine being plant-based, while its developer Baiya is the first Thai company to enter the university's CU Innovation Hub, a research center for start-ups, to develop the technology to manufacture recombinant proteins that can produce medicines and vaccines. Mass production of the vaccine Chula Cov-19 is estimated to be in June-September 2022, while the Chula-Baiya vaccine is also expected to be approved for use in the 3rd or 4th quarter of 2022.¹⁶

Table 7. Vaccine candidates in development in South-east Asia, as at 26 February 2022

	Candidate	Mechanism	Sponsor	Trial Phase	Institution
1	Nanocovax	Recombinant vaccine (Spike protein)	Nanogen Biopharmaceutical	3	Military Medical Academy, (Vietnam)
2	ART-021	RNA vaccine	Artucus Therapeutics and Duke Medical School	2	Duke-NUS Medical School, Singapore
3	Merah-Putih	Inactivated Vaccine	Indonesia-MoH; Airlangga University; Biotis Pharmaceuticals	2	Dr. Soetomo General Hospital, Indonesia
4	Nusantara*	Dendritic cell vaccine, AV Covid-19	Aivita Bio Medical Inc.	2	National Institute of Health and Development, Ministry of Health, Republic of Indonesia
5	ChulaCov19	mRNA-based vaccine	Chulalongkorn University's	2	Chula Vaccine Research

			Center of Excellence in Vaccine Research and Development		Center (ChulaCRC), Faculty of Tropical Medicine, Mahidol University
6	Chula-Baiya	Protein sub-unit	Baiya Phytopharm Co. Ltd., National Vaccine Institute, Thailand	2	Chula Clinical Research Center; Queen Saovabha Memorial Institute

Source: <https://www.raps.org/news-and-articles/news-articles/2020/3/covid-19-vaccine-tracker>, * <https://www.who.int/publications/m/item/draft-landscape-of-covid-19-candidate-vaccines>

In January 2022, it was announced that two types of Covid-19 vaccines are being developed in Malaysia. The Institute of Medical Research (IMR), a biomedical research arm of the Ministry of Health, Universiti Putra Malaysia and the Veterinary Research Institute are collaborating for the development of the first vaccine.¹⁷ This is an inactivated vaccine like the Sinovac-CoronaVac vaccine. The second is an mRNA (messenger RNA) vaccine, which is solely an IMR initiative for now. The latter is scheduled for clinical trials in 2024.

Overall, vaccine procurement in SEA benefited from the provisions for the AMC-92 countries, Covid diplomacy, private purchase, and domestic production. Doubtless the increase in production capacity in SEA, whether in collaboration with existing producers or by home-grown varieties will also increase future supply although demand for the latter may be low based on ISEAS's "The State of Southeast Asia's 2022 Survey Report". The survey indicates that trust in home-made vaccines is rather low.¹⁸ The most trusted vaccine brands among Southeast Asians – selected by 54.8% of all respondents – are mRNA vaccines Pfizer and Moderna. Domestic vaccine brands, on the other hand, is the second lowest to be trusted, at 0.9 %, which is only slightly higher than the Russian made vaccine, Sputnik-V. Therefore, citizens may still prefer to use other established brands, unless these are prohibited from being imported or they are priced too high and made unaffordable, through domestic taxes imposed on imported drugs.

3. State Capacity

The proxy for state capacity is taken from World Bank's World Governance Indicator database, which compile and summarize information from various data sources that report the views and experiences of citizens, entrepreneurs and experts in the public, private and NGO sectors from around the world, on the quality of different dimensions of governance.

A study by Tatar *et al.* (2021) shows that good governance, in particular government effectiveness, voice and accountability, and regulatory quality, are the most important indicators in predicting COVID-19 vaccinations across countries. These indicators are shown in Table 8.¹ **Government effectiveness** captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. **Voice and accountability** indicate perceptions of the extent to which a country's citizens can participate in selecting their government, as well as freedom of expression, freedom of association, and free media. **Regulatory quality** covers perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.

Overall, state capacity is higher for Singapore, Brunei, and Malaysia, relative to Thailand, Indonesia, and the Philippines. Singapore has the highest score for government effectiveness and regulatory quality. The quick actions taken by the public service and the strong ability of the government to implement the policies have enabled Singapore to administer the vaccines efficiently. Other countries with relatively strong governance are Brunei and Malaysia. Each executed the vaccinations program and movement control policies relatively efficiently. In the case of Malaysia, information dissemination from MySejahtera apps was current and well-trusted by the people. Indonesia is the best performer in voice and accountability. A higher level of openness is shown with President Jokowi even acknowledging and encouraging criticisms on the handling of the COVID situation.² The weakest performer is Myanmar, followed by Lao PDR, and Cambodia.

However, the urgency for managing the pandemic, including rolling out the vaccinations, gave rise to digital innovations in the measures used by the state for managing the pandemic. Lee et al., (2021) found that mobile apps released or updated with COVID-19 related functions emerged and evolved in the first half of 2021 for

¹ Table 8 are composite indicators based on over 30 underlying data sources Data sources include Surveys of households and firms, including the Afro barometer surveys, Gallup World Poll, and Global Competitiveness Report survey, Commercial business information providers, including the Economist Intelligence Unit, IHS Markit, Political Risk Services, Non-governmental organizations, including Global Integrity, Freedom House, Reporters Without Borders, and Public sector organizations, including the CPIA assessments of World Bank and regional development banks

²<https://abcnews.go.com/Health/wireStory/president-widodo-pandemic-changed-indonesias-culture-79474662>

some of the countries in SEA, notably Indonesia, Malaysia, the Philippines, Thailand, and Vietnam. These apps were used to complement public health measures for tracking COVID-19 cases, information dissemination, as well as COVID-19 vaccination management functions. Although Brunei, Cambodia, Laos, and Myanmar were not included in the study, mobile apps were also used in these countries for managing the pandemic, including vaccinations. Hence, the use of digital technology enabled all countries in SEA, especially those with weaker state capacity, to conduct their vaccination programs. These apps are also used to issue digital vaccination certificate in the respective country.

Table 8. Selected Governance Indicators Score

Country Name	Government Effectiveness		Voice and Accountability		Regulatory Quality	
	2019	2020	2019	2020	2019	2020
Brunei Darussalam	87.0	90.4	21.7	22.2	73.1	76.9
Indonesia	60.1	65.4	51.7	52.2	51.4	55.3
Cambodia	31.7	38.0	15.0	12.6	30.3	29.8
Lao PDR	20.7	22.6	3.4	3.4	23.6	21.2
Myanmar	11.5	14.4	23.2	21.7	21.6	28.4
Malaysia	79.3	82.2	43.5	40.1	73.6	74.0
Philippines	54.8	56.3	45.4	41.1	55.3	53.4
Singapore	100.0	100.0	38.6	38.2	100.0	100.0
Thailand	66.3	63.5	23.7	26.1	60.1	58.7
Vietnam	53.4	61.5	11.6	12.1	41.8	46.6

Note: *0-100, with 100 being the highest score.

Source: <http://info.worldbank.org/governance/wgi/>

4. Logistics Infrastructure

While the effectiveness of vaccine policies and government action plans are important, the deployment of vaccines, however, requires good logistics infrastructure. Table 9 indicates the level of logistics infrastructure in SEA countries. Singapore has the best Logistics Performance Index (LPI) score in comparison to other countries within the region. This is followed by Thailand, Vietnam, and Malaysia.

As many of these countries rely on imported vaccines, the efficiency in customs and border management, as well as the competence and quality of logistics services – trucking, forwarding, and customs brokerage play a key role in vaccine deployment. Again, Singapore ranked the highest in all these categories. The difference in rank between Singapore and the next top three countries is at a wide margin. Between

Thailand, Vietnam, and Malaysia, the quality and competence of the logistic services are almost similar.

Table 9. Logistics Performance Index (LPI), 2018 (Rank based on 160 countries).

	overall LPI score	overall LPI rank	Customs	Infra-structure	Int. shipments	Logistics quality and competence	Tracking and tracing	Timeliness
			(A)	(B)	(C)	(D)	(E)	(F)
Singapore	4.00	7	6	6	15	3	8	6
Thailand	3.41	32	36	41	25	32	33	28
Vietnam	3.27	39	41	47	49	33	34	40
Malaysia	3.22	41	43	40	32	36	47	53
Indonesia	3.15	46	62	54	42	44	39	41
Philippines	2.90	60	85	67	37	69	57	100
Brunei Darussalam	2.71	80	73	89	113	77	88	80
Lao PDR	2.70	82	74	91	85	83	69	117
Cambodia	2.58	98	109	130	71	111	111	84
Myanmar	2.30	137	131	143	144	128	143	108

Source: World Bank, The Logistics Performance Index (2018)¹⁹

However, the LPI above (Table 9) only represents logistics and customs efficiency at the borders of a country. While port efficiency plays an important role in the speed of distribution of vaccines, equally important is the efficiency of land logistics in dispersing the vaccines through its supply chains. Another indicator that can be used in this regard, is the domestic LPI on the supply chain shown in Table 10. Unfortunately, the dataset is limited and cover eight out of the ten SEA countries. The data indicates country size can affect the distribution process. Smaller countries like Singapore and Brunei which require smaller coverage fare better compared to larger countries such as Thailand and Indonesia. Hence, the size of Brunei compensated for its weaker LPI score in Table 9 since it made domestic delivery easier to achieve. Geographical constraints for a landlocked country like Laos may face more challenges in transporting and dispersing the vaccines from the nearest port.

Table 10. Import time and distance (Land supply chain)^a

	Distance (kilometers)
Brunei	25
Indonesia	277
Lao PDR	750
Malaysia	75
Myanmar	579
Singapore	33

Thailand	300
Vietnam	131

Notes:

^aFrom the point of origin (the seller’s factory, typically located either in the capital city or in the largest commercial center) to the buyer’s warehouse (EXW to DDP). *Ex works (EXW)* is a shipping arrangement in international trade where a seller makes goods available to a buyer, who then pays for transport costs, and *DDP* is the “delivered duty paid”.

Source: World Bank

5. Demand for Vaccines

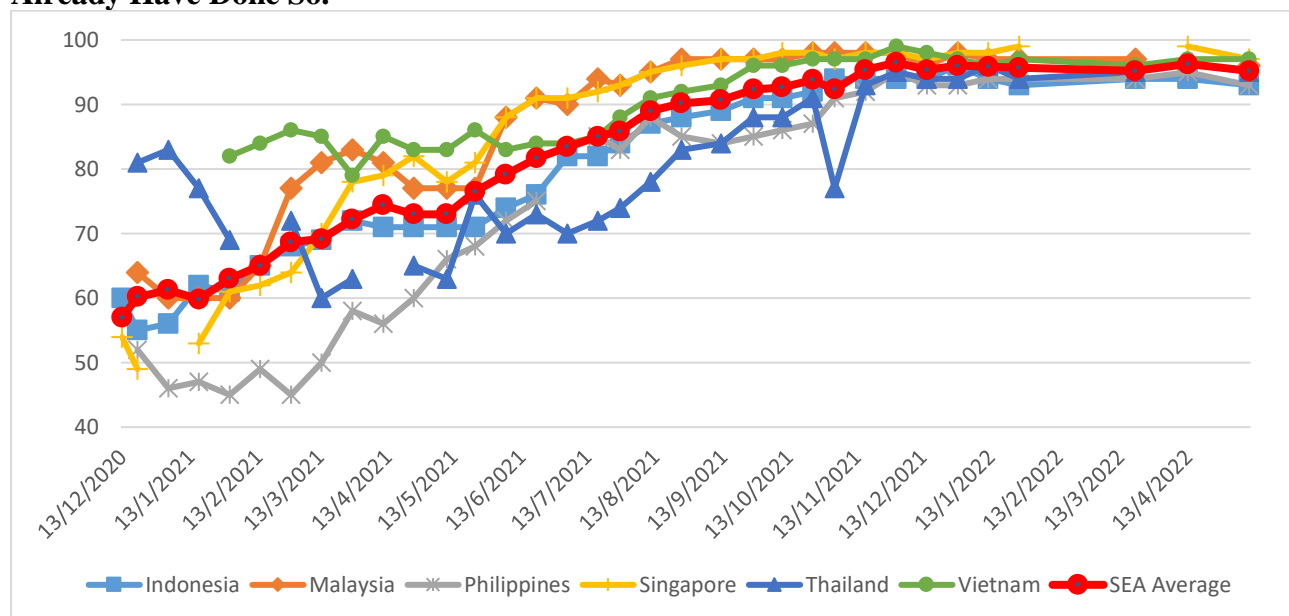
Vaccine acceptance in Southeast Asian countries follows a common pattern: greater hesitation the early days of the pandemic before a gradual increase in acceptance of the vaccine (Figure 1).

The Philippines, Thailand, and Indonesia are generally below the Southeast Asian (SEA) average. The finding for the Philippines is supported by the World Bank’s High Frequency Monitoring Surveys which shows that the Philippines have significantly lower share of respondents who will get vaccine when available compared with other countries in the region. This is attributed to a lack of information about vaccines, misinformation about their efficacy or side effects, mistrust, and underestimation of benefits compared to overestimation of risks and costs of vaccination (World Bank, 2021).

Thailand initially has a high vaccine acceptance rate, but the willingness fluctuated the most in comparison with other SEA countries. In the second half of 2021, while other countries are gradually accepting the vaccines, Thailand has one of the lowest vaccine acceptance rates in the region. The reasons for vaccine hesitancy varied from widespread complaints at government disorganization, and dissatisfaction with the military-backed government's vaccine strategy, to delays in getting vaccines and the effectiveness of Sinovac and locally made AstraZeneca doses (Chayut, 2021). Vaccine hesitation in Indonesia on the other hand was due to uncertainty about the “halal” status of the vaccines (Rising and Taringan, 2021). Countries that are above SEA average in vaccine acceptance rates are Malaysia, Singapore, and Vietnam.

Although there are no data for four SEA countries in Figure 1, there is some anecdotal evidence on vaccine hesitancy in Myanmar due to lack of trust in the current administration (Liu 2022). On the other hand, 87 percent of Laos have indicated their willingness to be vaccinated (Runde, et al., 2022 and World Bank 2021). Cambodia also reportedly has low vaccine hesitancy and a sense of communal responsibility (Macdonald 2021).

Figure 1. Percentage of People Who Say They Will Take The Vaccine, Or Who Already Have Done So.



Note: There is no data for Brunei, Cambodia, Laos, and Myanmar

Source: <https://yougov.co.uk/topics/international/articles-reports/2021/01/12/covid-19-willingness-be-vaccinated>

6. Vaccination Rates in SEA

WHO's *Strategy to Achieve Global COVID-19 vaccination* by Mid-2022 aimed to cover 40% of total population by end 2021 and 70% of population by June 2022.²⁰ These figures are based on all country sources of supply and not just from COVAX.

In Table 11, the 40% target for fully vaccinated was achieved for all SEA countries except for Myanmar. Despite supply glitches in the first half of the year, supply eased towards the end of the year and SEA's strategy to procure from multiple sources as well as different vaccines rather than through COVAX alone certainly helped as COVAX supply constraints persisted until the last quarter of 2021. SEA indeed fared better than the 34 out of the 89-AMC countries which did not achieve the 40% target as they are most dependent on COVAX access.²¹

In fact, by December 2021, five out of 10 SEA countries have already achieved the WHO's 70% vaccination target. Brunei has the highest vaccination rate of 91 percent in December 2021. This is followed by Singapore, Cambodia, Malaysia, and Vietnam.

Thailand achieved the WHO 2022 threshold in June 2022. Laos came close at 69 percent. The Philippines (63 percent), Indonesia (61 percent) and Myanmar (49 percent) are the other countries with vaccination rates that are still lower than the targeted 70 percent by June 2022.

The relatively higher vaccination rates can be attributed to the multiple sourcing strategy used. The AMC-92 countries, in particular, benefited from the supply of vaccines through Covid-diplomacy. Importantly, digital technology such as the use of mobile apps facilitated the roll-out of vaccination programs in all countries in SEA. This greatly enabled countries with weaker state capacity to overcome some of their challenges.

Countries which have not yet met WHO's 2022 targeted rates are countries with logistics challenges such as Indonesia and the Philippines. Certainly, the higher than SEA average vaccine hesitancy in the Philippines and Indonesia also contributed towards holding back the vaccination rates in their respective countries.

Cambodia, on the other hand, overcame bureaucratic and logistic challenges during the time of crisis. The high Cambodian vaccination rate is a combination of support from China in vaccine procurement and the success of the Cambodian bureaucracy in marshalling a strong campaign for administering the vaccines (Hutt, 2021) as well as technical assistance from different international institutions. Cambodia, like most SEA countries, also used technology to overcome its challenges. A mobile app was used for helping people to register for COVID-19 vaccinations and for contact tracing (Munemo and Nyantakyi, 2022). The app had substantial reach since reportedly 90 percent of the population has internet mobile subscription in 2021.

Table 11. Share of People Vaccinated against COVID-19, December 2021, and June 2022.

	Partly vaccinated		Fully Vaccinated	
	Dec-21	Jun-22	Dec-21	Jun-22
Brunei	92	100	91*	97
Cambodia	84	89	81*	85
Indonesia	58	73	41	61
Laos	51	79	42	69
Malaysia	79	85	78*	83
Myanmar	34	60	24	49
Philippines	51	68	34	63
Singapore	87	92	83*	92
Thailand	74	81	66	75
Vietnam	79	87	70*	81

Note: *indicates the WHO's 2022 goals of vaccinating 70 % of the population.

Source: <https://ourworldindata.org/covid-vaccinations>

7. Conclusion

SEA, like all other countries, used vaccination as a tool for managing the COVID-19 pandemic that emerged in 2020. All these countries utilized a multiple sourcing strategy that included procuring different vaccines from different sources. For some countries, this included vaccines that were not yet approved by the WHO, but which were approved by the domestic regulatory bodies in each country.

This made SEA less dependent on the COVAX facility and enabled the countries to fare better than the developing countries that were completely dependent on COVAX alone as their main source of supply. COVAX had problems delivering to the AMC-92 countries in the first half of 2021 due to supply constraints and over-buying from the developed world. Over time, supply did ease up and by 2022, the supply of COVID-19 vaccines is no longer as binding a constraint as it was in the first half of 2021. Vaccine hesitancy has also eased up over time, albeit there are still some remnants of anti-vaxxers in each country. Digital technology greatly facilitated each country to manage the pandemic, including the roll-out of vaccination and the issuance of digital vaccination certificates.

Nevertheless, logistic challenges as well as vaccine hesitancy continue to dog countries like Indonesia and the Philippines, so that these countries have yet to achieve the WHO targeted 70% vaccination rate by June 2022. Myanmar's internal problems continue to hold up the vaccination rates in the country.

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² Vaccine development is tested in phases. Phase 3 takes place when the vaccine is given to thousands of volunteers – and compared to a similar group of people who didn’t get the vaccine but received a comparator product – to determine if the vaccine is effective against the disease it is designed to protect against and to study its safety in a much larger group of people.

³ <https://www.thejakartapost.com/news/2021/07/17/govt-drops-self-paid-covid-19-vaccinations-after-public-outcry.html>

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¹⁹ The LPI is constructed from these six indicators using principal component analysis (PCA). A standard statistical technique used to reduce the dimensionality of a dataset. The output from PCA is a single indicator—the LPI—that is a weighted average of those scores. The weights are chosen to maximize the percentage of variation in the LPI’s original six indicators that is accounted for by the summary indicators:

- (A) The efficiency of customs and border management clearance (‘Customs’). 1 = very low, 5 = very high.
- (B) The quality of trade and transport infrastructure (‘Infrastructure’). 1 = very low, 5 = very high.
- (C) The ease of arranging competitively priced shipments (‘Ease of arranging shipments’). 1 = very difficult, 5 = very easy
- (D) The competence and quality of logistics services – trucking, forwarding and customs brokerage (‘Quality of logistics services’). 1 = low, 5 = very high.
- (E) The ability to track and trace consignments (‘Tracking and tracing’). 1 = very low, 5 = very high.
- (F) The frequency with which shipments reach consignees within scheduled or expected delivery times (‘Timeliness’). 1 = hardly ever, 5 = nearly always.

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