Policy Foundations in Singapore: Resilience in the Face of COVID

Authors: Jacinta I-Pei Chen*, Yik Ying Teo, Jason Chin-Huat Yap

All the authors are from the Saw Swee Hock School of Public Health, National University of Singapore
** Corresponding author: email:* ephcij@nus.edu.sg

Summary

This case study explores the broader models and policy foundations in Singapore's pre-COVID history that were relevant to the maintenance of population and economic wellbeing during the COVID pandemic.

Enablers

- Strong centralised government control and risk- and cost-sharing across providers in a broader healthcare system encompassing primary and long-term care sectors.
- Strong pre-existing focus and capabilities in pandemic preparedness, defined by close government-academic collaborations.
- Economic policy outcomes from earlier decades, including a dedicated strategy to grow the biomedical industry, a recognised need for trade diversification, and fiscal prudence with the accumulation of large fiscal reserves.
- Other inherent features – being a compact island nation, relative maturity in internet connectivity and data digitisation, model of political governance, and a psyche of vigilance to crises.

Vulnerabilities

- An economic growth model reliant on a large foreign workforce revealed the susceptibility to outbreaks across their accommodation and community networks. A model of political governance predominantly focused with economic performance further 'blind-sided' pandemic response policymakers from awareness of this vulnerability.
- The centrality of an 'open economy' model to Singapore's survival subjects the country to continued importation risks in the evolving pandemic situation.

Introduction

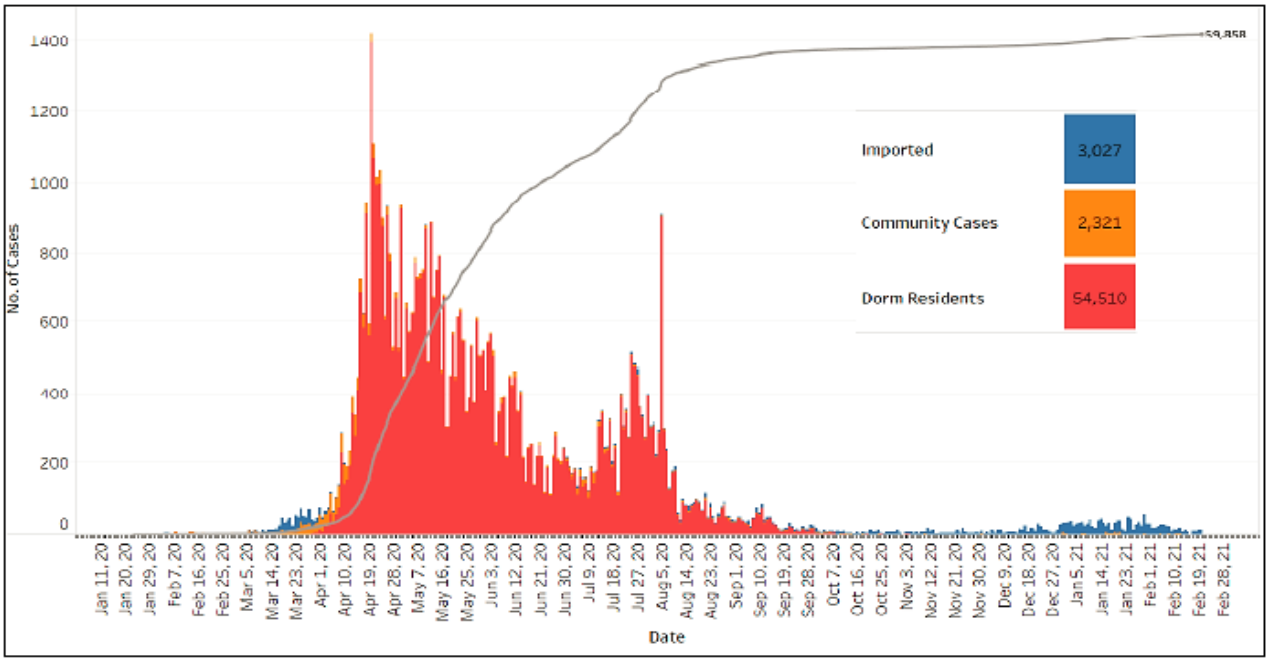
Singapore's management of the COVID situation during the pandemic has been noted for its efficiency and efficacy, with its case detection being cited as the "gold standard" by a Harvard University study as early as in Feb 2020. [1], [2] More recently, it was ranked top in Bloomberg's COVID Resilience Ranking. [3] This case study explores the broader models and policy foundations in Singapore's pre-COVID years that were relevant to maintaining population and economic health in the face of the pandemic shock.

COVID and Singapore

Singapore is an island country with a 5.6 million population. It is more than 2,500 kilometres from the southwest of mainland China (where Wuhan is situated) but received a large number of tourists from mainland China on more than 400 flights between Singapore and mainland China per week prior to the COVID pandemic. [4]

It was one of the first countries to report imported cases and had the highest number of cases outside mainland China for a time in early Feb 2020. The government implemented a series of broadscale public health measures and the rise in cases plateaued towards the end of Feb. Shortly after however, returning residents from other countries in the evolving pandemic situation triggered the start of a second and much larger wave of infections. [5] A suite of significantly stricter island-wide measures, termed the 'Circuit Breaker', was implemented on 7 Apr in view of the large clusters that emerged in foreign worker dormitories across the island. Daily reported new cases shifted into the hundreds as cumulative cases reached tens of thousands. Concurrent with the Circuit Breaker, multi-pronged efforts tackled the situation in the dormitories. [6] Cumulative cases peaked after crossing 50,000 in Aug 2020 before subsequently dropping. [7] Singapore has been gradually phasing out of the Circuit Breaker since Jun 2020 and since Oct 2020, new local community cases and cases in dormitories have been in the low single digit range. Daily new imported cases continued but were managed with test/quarantine/isolation protocols. [7]

Figure 1: Epidemic curve of COVID-19 cases in Singapore by press release date [7]



The Response

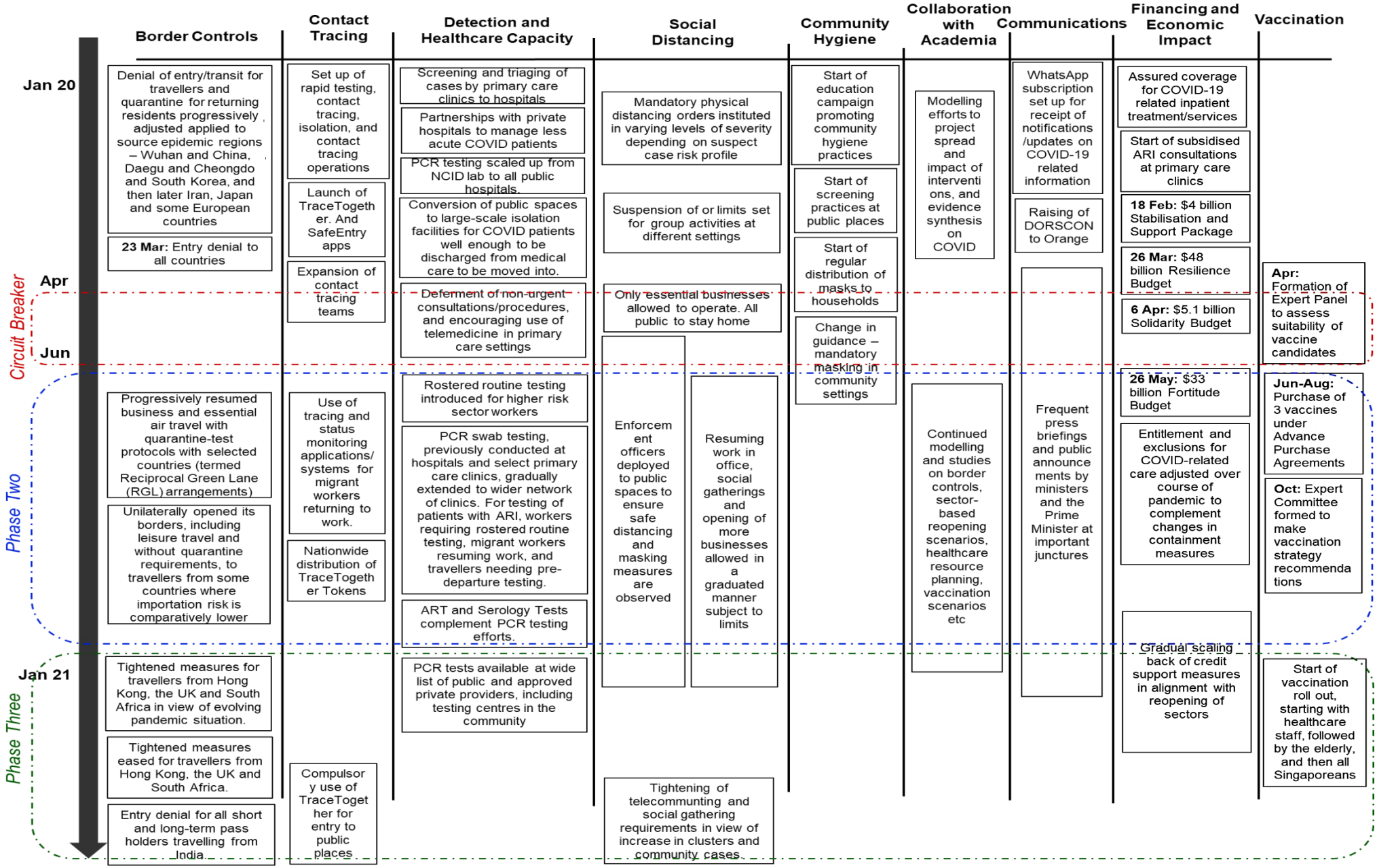
Singapore's COVID response was characterised by broad-scale, coordinated and cross-sectoral public health measures, driven and led by a centralised, whole-of-government leadership team. On 22 Jan, a day before the country reported its first imported case, a multi-ministry taskforce of ministers from sectors such as health, trade, communications, manpower, and transport, was set up to oversee the COVID-19 response. [5], [8]

Border controls, screening processes, contact tracing operations, quarantine orders and community measures were instituted and adjusted regularly according to evolving epidemiological developments and national infrastructural capacity. Regular guidance and control orders issued by the government under legislative powers steered these response operations. Such orders include traveller quarantine-test protocols for different countries of departure, suspect case criteria and definitions, management protocols for healthcare professionals/institutions, and physical distancing and masking orders to individuals and operating businesses. A close governmental-academic partnership supported an evidence-based approach to the development and modification of these orders. [5], [9]–[12] See Figure 2 for a timeline representation of the key measures in Singapore's COVID response.

In tackling the clusters in foreign worker dormitories, an inter-agency taskforce was set up to drive the multi-pronged efforts in the face of the large numbers and the challenges in quarantine operations with structural space constraints. Efforts involved the deployment of medical facilities/triage clinics into dormitories, a multi-layered and broad-based testing strategy, conversion of spaces into community-based isolation facilities or alternative accommodation for the workers, and the institution of safe measures for their resumption of work. [6], [13]–[17]

The development of technology-enabled applications, conversion of infrastructural spaces, and scaling up of diagnostic capacity, supported Singapore's border control, screening, and contact tracing and quarantine/isolation efforts. [18]–[20] Singapore's detection and contact tracing/quarantine operations have been noted for their effectiveness. Studies have noted Singapore's comparative detection effectiveness vis-à-vis other countries and, as of Mar 2020, experts have also remarked on how 40% of infections were detected through contact tracing while still asymptomatic. [2], [21]–[23]

Figure 2: Key events/measures in Singapore's response to the COVID-19 pandemic [5], [12]



Extensive fiscal measures accompanied the implementation of public health measures, totalling almost $100 billion, some 20% of the country's GDP, to cushion the impact of the pandemic and Circuit Breaker on the economy and employment. [24], [25] The economic performance for 2020, while turning in a deficit and registering contraction, turned out to be better than initially forecast. [26] Foreign investments received also remained healthy in the year. [27] The government has been gradually scaling back on credit support measures to businesses in a calibrated and sector-based manner as it reopened from the Circuit Breaker, while supporting job opportunities and entrepreneurship in post-COVID growth areas. [28]–[30]

All in all, the national response has been keeping the epidemic curve under control and preventing a devastating systemic shock to the economy, enabling minimal resumption of cross border travel under controlled conditions and an acceptable level of economic functioning to carry on over the course of the pandemic.

Pre-COVID Years: Models and Policy Foundations

While the national response to the pandemic is only slightly over a year in duration, it is largely shaped by models of governance, administrative structures and policy decisions set decades earlier. This section identifies and describes the development of these key elements in Singapore's pre-COVID historical years.

Healthcare and Infectious Disease Control

Healthcare delivery and Financing

Singapore's healthcare delivery system operates on the somewhat contradictory collective principles of centralised governmental control, market competition, and cost/risk sharing across a broad spectrum of providers. This chain of accountability and flexibility was well-placed for the pandemic response. The delivery landscape comprises a mix of public, private, and voluntary welfare organisation (VWO) providers. The public sector is dominant across the tertiary care sector, the private sector is dominant across primary care, and VWOs are dominant across the long-term care sector. Healthcare financing is through multiple mechanisms, including tax-based subsidies, government-managed pooled funding mechanisms, private health insurance, and citizen out-of-pocket expenses. [31]–[33] Meanwhile, the government regulates the sectors through quality monitoring and licensing mechanisms effected through statutory boards and national agencies. [32], [34]–[37] It also shapes sector development through the development and leasing of land for healthcare facilities and healthcare workforce planning policies [31], [38].

This has evolved a healthcare system characterised by a unique balance between autonomy and market competition among multiple providers on the one hand, and strong and comprehensive government intervention on the other. The system also facilities risk- and cost-sharing between the government and across players/sectors while enabling varied government intervention through a broad range of other fiscal, organisation and regulatory levers. [31], [39]–[41]

Faced with new demographic and epidemiological challenges and increasing societal expectations, the government since the 2010s accelerated efforts to broaden the national healthcare model and include primary and community care sectors more centrally. This was done through the extension of broader portable subsidies into private primary care clinics and long-term care providers, the introduction of public-non-public partnerships, and the development of long-term care capacity and workforce. In so doing, the government established stronger fiscal, organisational and regulatory levers across these sub-sectors, achieving better control of and access to their clinical practice and data. [31], [42]–[47]

The pre-existence of a centralised command-and-control culture, public-private partnership structures, and multiple levers for governmental intervention across a broader healthcare system has enabled swift and effective implementation of community surveillance, case triaging, and isolation and treatment capacity in the COVID response. Governmental control and collaborative networks in the long-term care sector have also supported robust infection control structures and a comprehensive testing strategy in the sector during the pandemic. In fact, Singapore's low transmission rates within long-term care facilities was cited as a success story. [48] Singapore's multi-payor cost-sharing financing system has also helped to reduce the burden of COVID healthcare expenditure on government spending, with nationally pooled funding and private insurers bearing some components of the cost. [49]–[52]

Pandemic preparedness

Pre-existing capabilities in pandemic readiness has been cited as a central component in Singapore's COVID response. The country's population heterogeneity, territorial compactness, global connectivity, and location in the tropics makes it vulnerable to infectious diseases outbreaks. The country has remained vigilant to this evolving threat and has been fighting respiratory diseases and vector-borne diseases such as dengue and chikungunya since the 2000s. [53], [54] The SARS experience in 2003, deeply etched in the national collective consciousness, further strengthened in the pre-COVID years a culture and practice of readiness for future outbreaks in the healthcare sector. [5]

This has led to investment directed towards epidemic intelligence infrastructure and expertise, such as the setting up in 2011 of a public health intelligence unit, and in 2018 the National Centre for Infectious Diseases (NCID), a 330-bed purpose-built facility designed to strengthen Singapore's

capabilities in infectious disease management. Training courses were also established since 2010 to nurture field epidemiology specialists, and the Saw Swee Hock School of Public Health at the National University of Singapore was established in 2011 to develop public health leadership on a broader front. [54]

To develop pandemic response and management capacity, all public acute hospitals participate in the national simulation exercises for outbreak situations to train in pandemic preparedness. Isolation capacity has been expanded since 2014. [5], [55] Private primary care clinics have also been trained for activation (as "Public Health Preparedness Clinics") during public health emergencies to perform outbreak-specific roles (eg dispensing medications, administering vaccinations, and triaging or supporting the acute care hospitals). [5], [9] Beyond the clinical spaces, a colour-coded "Disease Outbreak Response System Condition" (DORSCON) disease outbreak plan was developed to guide a nationwide and multi-sectoral response through escalating stages of infectious disease spread. [56]

Such investments and readiness enabled swift and efficient implementation of surveillance and disease management structures and operations at the advent of COVID-19.

Government-academic partnerships and mathematical forecasting

Collaboration between the government and academia has been a common feature in policy design in Singapore. [57]–[62] For public health and infectious disease control, regular engagement sessions in the past decade identified areas for research to inform policymaking and established partnerships for research collaboration. These areas include cost-effectiveness analyses of specific vaccinations and screening tools at a population level, observational studies on factors for predisposing physical conditions, and literature reviews on the evidence on tobacco and sugar intake control policies. [63]–[65]

Mathematical modelling in particular has been a critical tool in public health policymaking. MOH has harnessed the epidemiological and modelling research capabilities in academic institutions to understand the dynamics and interplay within complex public health problems to formulate interventions for our ageing population and increasing chronic diseases and for infectious diseases. Academia's projection of the incidence and burden of diabetes and its associations triggered Singapore's War on Diabetes in 2016, a multi-sectoral whole-of-nation plan to tackle the disease's rising burden. [62], [65] The projection of disease spread based on existing surveillance systems and different intervention scenarios also guided policy decisions and planning operations on dengue, Zika and Hand, Foot and Mouth Disease. [59]–[61]

Such pre-established structures and networks, coupled with strong biomedical research capabilities (see page 8), enabled the government to quickly harness expertise in academia and research institutes to mount a scientific and biomedically-enabled COVID response. [5] Some notable outcomes include rapid evidence synthesis on pharmaceutical/non-pharmaceutical measures earlier on in the pandemic [66], [67], the simulation of reductive impact/disease spread under different intervention and sector-based reopening scenarios [68]–[70], the estimation of importation risk under different pre-departure and post-arrival quarantine-test protocols to guide border control decisions [71], forecasting for healthcare resource planning [72], [73], and the early use of serological testing for contact tracing and analysis of extent of spread in worker dormitories. [6], [74]

Singapore's Economic Trajectory

Becoming a regional biomedical hub

Singapore's biomedical capabilities is an outcome of a deliberate economic policy to grow the sector two decades earlier. Noting the significance of healthcare as an industry and for the well-being of the population, Singapore embarked in 2000 on the strategy to establish itself as a regional biomedical hub. Singapore built core capabilities in terms of key human and industrial development initiatives in the first phase (2000-2005) of development, investing S$130m in two industrial parks to house pharmaceutical manufacturing facilities [75], and another S$700m in a purpose-built biomedical research hub, called the Biopolis. [75], [76] Building on this foundation, phase two of the industry's development (2006-2010) strengthened capabilities in translational and clinical research to bring innovations to the marketplace. Incentives in the form of tax reductions or grants for foreign direct investments and foreign talent were provided to encourage key global players in the biomedical industry to set up shop in Singapore. [75], [77]

Availability of good infrastructure facilities, a robust intellectual property protection and enforcement regime, financial incentives, and long-term governmental support and commitment to the sector has led to Singapore being the preferred manufacturing and R&D facility base for a number of leading pharmaceutical companies and research institutes. Singapore's location in the tropics also provides a promising setting for tropical disease studies, with access to patient populations in the surrounding countries. [75], [77] Public-private partnerships involving the public health, clinical and scientific communities enabled the development of effective biomedical applications in infectious disease control. [53], [77]

Notable examples include the collaboration among Novartis, the Economic Development Board and A*STAR to set up the Novartis Institute for Tropical Diseases in Biopolis in 2002, co-development of a SARS detection kit by A*STAR's Genome Institute of Singapore and Roche in 2003 [53], [77], and the

expedited development of Singapore's first influenza vaccine against the H1N1 virus in 2013 through the tie-up between A*STAR's Experimental Therapeutics Centre, D3 and bio-pharmaceutical company CytosBiotechnology. [53], [78]

Even as such partnerships drew global experts in the field to build a local base of foreign talent, the government concurrently nurtured homegrown talent to support industry growth over the longer term. Relevant educational programmes and industrial training were implemented across institutes of higher learning and pharmaceutical companies. As reported in an article by Independent Commodity Intelligence Services (ICIS) [1] in 2007, "In comparison with the other main Asian destinations, Singapore is probably the only country that has made a concerted effort to plan and implement a BMS strategy". [75]

In a short span of about 10 years, the biomedical sector in Singapore expanded rapidly. Its contribution to manufacturing value-added grew from 10% in 2000 to being the largest at 26% in 2013, while sector employment more than doubled over the period. [77] The sector continues to be a key driver of manufacturing growth. [79] The number of biomedical sciences research institutes has also burgeoned, and Singapore has developed an extensive R&D system for disease-specific research. Coupled with the government's focus on epidemic intelligence (see page 6), this has enabled advanced molecular techniques for faster pathogen detection and reliable diagnostics or vaccine development in infectious disease control [53], [54], [77], as well as the ability to scale these up in a pandemic situation. Some key achievements in the COVID space include being the third country to successfully culture the virus, the world's first in use of serology for contact tracing, comparative investigation of SARS-CoV-2 T-cell immunity [9], and the scaling up of testing rates per million population to one of the highest levels globally (from 177K swabs in Jul 2020 to 1.738mil in May 2021). [80]

Trade Diversification

Development of the biomedical sector was part of a larger economic plan to broaden the country's product and export base. Singapore enjoyed robust trade growth in the 1980s and 1990s, with domestic exports expanding by an average of 8% per annum from 1985 to 2001. This was mainly driven by domestic export growth in electronics, with rapid expansion in production and export of disk drives/PCs in the earlier years and then higher value-added semiconductors in the later years as Singapore transitioned from a manufacturing to service centre linking electronics production activities in the region. [57], [58], [81] Thereafter, the changing external landscape and its implications for Singapore's export competitiveness as a re-export economy (where imported intermediate inputs are

[1] ICIS is an independent commodity intelligence that provides market intelligence, analytics and other specialist services for the petrochemical, energy and fertilizer businesses and markets. [78]

re-exported after local processing) led to a recognised need to broaden the country's export base. The global electronics industry was becoming increasingly more competitive after 1996, with major products facing sharply declining prices. Increased volatility of the electronics cycle was also noted from the late 1990s, subjecting Singapore to cyclical demand fluctuations. Economic policy noted the need to reduce this vulnerability through product and export diversification.

In addition to initial efforts to diversify into the biomedical and petrochemical sectors, the Economic Review Committee looked at new opportunities in the services sectors, including infocommunication services, healthcare, education, tourism and financial services. [58], [81] The share of electronics in domestic exports declined from a peak of almost 60% in the mid-1990s to about 30% in 2019, while the share of chemicals and biotechnology in manufacturing output grew from about 15 to 30% over the same period. [81]–[83] The services industry's contribution to GDP also increased from 65 to 70% since the 1990s, with the financial and infocomm sectors driving most of the growth. [83]–[86]

A diversified approach enabled the recapture of economic activity in other sectors when supply and demand dynamics recalibrated across sectors during the COVID pandemic, buffering to some degree the systemic shock to the economy. [87]–[89] Across Q2 to Q4 2020, growth in the infocomm and financial services and manufacturing (the last driven mainly by output expansions in biomedical manufacturing and the semiconductors segment) slightly offset broad-based contractions across other sectors, especially the sharp contractions in the worst-hit sectors of travel-related and consumer-facing services and construction. [26], [88], [89] (See Figure 3) The core industries of semiconductors, biomedical, digitally powered businesses and financial services have also been able to attract significant foreign investments even during the COVID pandemic. An estimated $14.3 billion of foreign investment was received in the first half of 2020, compared with $15.2 billion for the whole of 2019. [27] The economic performance for 2020 thus turned out to be better than initially forecast. [26]

Figure 3: Economic activity level by sectors and vis-a-vis pre-COVID levels

Index (Q4 2019=100), SA	Contraction		Growth Rebound
	Q1 2020	Q2 2020	Q3 2020
Overall GDP	99.2	86.1	92.8
Worst-hit Sectors (12% of real GDP in 2019)			
• Travel-related (air transport, accommodation, AER)			
• Consumer-facing (food services, retail, land transport)			
• Construction			
Significantly-hit Sectors (15% of GDP)			
• Real estate			
• Other business services			
Less Affected Sectors (63% of GDP)			
• Trade-related (manufacturing, wholesale, transport & storage excluding air and land)			
• Modern services (ICT, financial)			
• Other domestic-oriented (public admin, health & social, education, others)			
Others (11% of GDP)			
• Ownership of dwellings			
• Taxes on products			

Source: EPG, MAS estimates [88]

Red (green) cells refer to output declines (increases) relative to Q4 2019 levels. The darker the colour, the greater the segment's deviation from its Q4 2019 level.

A unique labour market: Singapore's large foreign workforce

To remain globally competitive in some labour-intensive industries, Singapore's economic growth model relies on low-wage migrant workers. The labour market thus includes a large pool of foreign workers. [90] As of Dec 2019, there were 1.43 million foreign workers in Singapore, nearly a quarter of the country's population of 5.7 million. About 800,000 of this foreign workforce are in low-wage and low-skilled positions, mainly in the construction, marine shipyard and process sectors, with nearly 300,000 living in purpose-built dormitories and factory-converted dormitories across the island. [5], [90]–[92] This reliance on migrant workers has been noted early (since the early 2000s) and policy efforts to reduce this through tightening the proportion of foreign workers employed by firms have had limited progress. [58], [93]

During the COVID pandemic, large clusters emerged across the migrant worker dormitories, revealing the vulnerabilities inherent in their accommodation and community networks, and the need for a more pre-emptive approach to instituting infection control and preventive structures for this population group. [5] The outbreaks in the dormitories severely impaired economic productivity in the affected sectors. The construction industry was among the worst hit, contracting by 35.9% in 2020 (compared to 1.6% growth in 2019), due to declines in both public and private sector construction works because of suspended building activities when there were infections among migrant workers in the dormitories. [88], [89]

Fiscal prudence

With a consistent and historical focus on economic performance and fiscal prudence, Singapore has run a budget surplus in most years and accumulated large reserves. [83], [94] The reserves are managed across the entities of the Monetary Authority of Singapore (MAS), GIC Private Limited [2], and Temasek Holdings[3], each of which are positioned at different points along the spectrum of liquidity and investment risk. The government regularly reviews capital allocation among them to optimise the overall risk profile of the portfolio. To help protect the country's reserves, an elected presidency system with the ability to safeguard the national reserves was introduced in 1991. There is currently a 'two key' system where both government and the President's approval are required to tap on past reserves. [95]–[97] From 2002, Temasek Holdings' investment strategy transitioned from wealth preservation to wealth creation, becoming a highly active sovereign wealth fund that makes equity investments in Singapore's national interests. [98]

Singapore's large reserves has enabled a fiscal stimulus with one of the largest fiscal response ratios across the world to cushion the economic impact from COVID, without having to commit to high levels of debt taking generations to pay off. Continued prudence is exercised with plans to finance recurrent needs (such as healthcare spending and the continued pandemic response) from recurrent revenues (eg from taxes) and reallocated monies from areas of reduced spending (eg postponed development projects). [88], [99], [100]

The evolution of Temasek Holdings' role as a sovereign wealth fund driven by both commercial and national motives enabled its active part in the pandemic response, marshalling networks, "connecting dots" and underwriting risks. Its initiatives include engaging private institutions to conduct swab tests to support the national testing plan, rallying its portfolio companies to build and manage care and recovery facilities for COVID-19 patients in the community, partnering its investee companies to develop and manufacture COVID treatment drugs and ventilators, investing in an effort to develop a Covid-19 vaccine, and backstopping the raising of capital for Singapore Airlines. [98], [101]–[104]

As described by a periodical article, the state-owned investment company 'emerged as a double-barrelled weapon against uncertainty', playing its 'dual role as unemotional long-term investor and as a steward with a duty of service to the nation' [102].

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[2] GIC is a professional fund management organisation that manages Government assets.

[3] Temasek Holdings is a sovereign wealth fund (SWF)—a state-owned company—that manages an investment fund on behalf of the Government of Singapore. Using federal reserves, it focuses on investments located in Singapore, China, and North America, as well as Europe and some emerging economies.

Uniquely Singapore: Other Influencing Factors

An island nation

A number of other factors unique to Singapore's situation and psyche have helped shaped its capacity for response in the pandemic. The small size of the island nation and its well defined borders mean that there are limited points of entry for travellers without the added complexity of inter-state travel and the need for coordination of policy formulation and implementation across states or provinces [5], [105].

A high digital baseline

The country's compactness, coupled with its relative maturity of e-commerce services, internet connectivity and data digitisation practices, facilitated a data-driven and technology-enabled COVID response. This includes broad ranging applications such as the ordering and delivery of necessities and the communications for people under quarantine, [21], [106] the use of TraceTogether, SafeEntry, SafeTravel and digital passes to support contact tracing and border controls [18], [19], [107]–[109], the use of telemedicine for routine health and social care services, [110]–[112] and the use of transport data to monitor mobility status across the island/sectors. [113], [114]

On the economic front, pre-COVID data collection and usage capabilities and public-private collaborations enabled the integration of island-wide trade data to enhance surveillance capabilities and sharpen the strategic response to supply chain disruptions. [108] The country's relative maturity in digital technology positioned it well to benefit from the increased share of digital global trade, with formalisation of digital economy agreements with various countries over the past year [108], [115].

Model of political governance

As a democratic republic with a one-party dominant since the country's independence, the people and the government have grown accustomed to a longstanding relationship with a reasonable degree of trust. [116] Such trust is marked by the populace's acceptance of government intervention on behavioural changes in social and personal spaces, with national campaigns in the past encouraging the speaking of good English, being courteous, and even having smaller or larger families in line with the then national population policy. [5], [117], [118]

This high level of sociopolitical trust is predicated on the government's historical and continued performance of efficient and effective public administration and strong governace, which have contributed to decades of economic growth and social stability for the country as well as to positive aspects in the COVID response. This longstanding reciprocal relationship enabled high levels of political centralisation (allowing bills to be passed quickly) and high levels of social compliance among

citizens and residents [105], [119]–[121], leading to the swift, whole-of-government, and almost technocratic, national response to the pandemic.

It has been pointed out that this same model of political governance ironically blindsided the state to the 'black elephant' event of the migrant worker dormitory COVID outbreaks. As pointed out in an academic paper, 'the prevalence of performance legitimacy as source and driver of political trust', and the strong national focus on economic growth, has led to 'insufficient communication between the state and Singapore's NGOs, particularly those that deal with the foreign worker welfare' and prevented the pandemic response policymakers 'from gaining awareness of the cramped and unsanitary living conditions that many foreign workers were made to live in by the employers' [105].

Vigilance

The government historically takes a strong and pre-emptive approach to crises. The 'island mentality' of a small nation-state with limited resources and having "to do it on our own" has evolved a psyche of vulnerability, watchfulness, competitiveness and defensive pessimism, setting unrealistically low expectations despite successes of the past. [122]–[124] It is this underlying mindset that has maintained the nation's fiscal prudence and amassed reserves, leading to water recycling efforts and long term climate change measures, [125], [126], and underpins its foreign policy principles of maintaining deterrent military defence, peace and engagement, and an open market economy. [127] The government initiated its Risk Assessment and Horizon Scanning (RAHS) programme in 2004 to scan for, identify and interpret weak signals that can evolve into sudden shocks. The Centre for Strategic Futures (CSF), a strategy group within the Prime Minister's Office, was set up in 2009 to go beyond signal detection and function as a thinktank to build 'capacities, mindsets, expertise and tools for strategic anticipation and risk management'. [105], [128]

This national preoccupation with survival is central to the proactive whole-of-government approach in Singapore's broadscale COVID public health measures.

Conclusive Points and Future Directions

Singapore's comparative resilience in the COVID pandemic has brought much of its favourable pre-COVID governance structures, systems and developments to the fore. The benefits of heightened national vigilance, pandemic alertness and evidence-based policymaking has prompted continued investments by the government into epidemiological modelling and biomedical research, as well as to other crisis mode preparedness efforts. [99], [103], [104], [126] The pandemic relevance of digital capabilities and expansive opportunities in related business sectors have also seen the government

stepping up its national AI strategy with investment crossing $710 million in infocommunication technology projects in 2020.

Learning from the limitations and setbacks from earlier policy outcomes, Singapore has strengthened preventive structures and healthcare accessibility mechanisms for the migrant worker population. [6], [129], [130] Concurrently, it has increased focus to produce essential supplies locally to bolster resilience to potential supply chain disruptions and resource constraints. For the agri-food sector, a national goal has been set to produce 30% of nutritional needs locally by 2030, up from less than 10% just prior to the onset of COVID. [99]

Meanwhile, the pandemic experience has sparked broader societal discourse on future policy directions. The necessity for a large foreign workforce dependent labour market is re-evaluated against alternative economic growth models. [90] Similarly, the centrality of an 'open economy' model to Singapore's survival, even as it subjects the country to continued importation risks in the evolving pandemic situation, is reinforced, with discussions on how the conflicting situation can be managed with a variegated border control policy approach. [131], [132].

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References

[1] R. Kurohi, "S'pore is gold standard for case detection: Harvard study, Health News & Top Stories - The Straits Times," Feb. 18, 2020.

[2] R. Niehus, P. De Salazar, A. R. Taylor, and M. Lipstich, "Estimating underdetection of internationally imported COVID-19 cases," *Alliance for Pandemic Preparedness*, Feb. 18, 2020. https://depts.washington.edu/pandemicalliance/2020/02/18/estimating-underdetection-of-internationally-imported-covid-19-cases/ (accessed May 08, 2021).

[3] J. Hong, "Singapore Is Now the World's Best Place to Be During Covid," *Bloomberg.com*, Apr. 27, 2021.

[4] Singapore Tourism Board, "STB unveils targeted measures to support tourism businesses affected by 2019-nCoV | STB," Feb. 02, 2020. https://www.stb.gov.sg/content/stb/en/media-centre/media-releases/stb-unveils-targetedmeasurestosupporttourismbusinessesaffectedby.html.html (accessed May 04, 2021).

[5] J. I.-P. Chen, J. C.-H. Yap, L. Y. Hsu, and Y. Y. Teo, "COVID-19 and Singapore: From Early Response to Circuit Breaker," *Ann. Acad. Med. Singapore*, vol. 49, no. 8, pp. 561–572, Aug. 2020, doi: 10.47102/annals-acadmedsg.2020239.

[6] Ministry of Manpower, "Measures to contain the COVID-19 outbreak in migrant worker dormitories," *Ministry of Manpower Singapore*, Dec. 14, 2020. https://www.mom.gov.sg/newsroom/press-releases/2020/1214-measures-to-contain-the-covid-19-outbreak-in-migrant-worker-dormitories (accessed Apr. 27, 2021).

[7] Ministry of Health, “MOH | Situation Report,” *Ministry of Health, Singapore*. https://www.moh.gov.sg/COVID-19/situation-report (accessed May 04, 2021).

[8] The Straits Times, “Wuhan virus task force: Singapore’s high-powered members, Singapore News & Top Stories - The Straits Times,” Jan. 27, 2020.

[9] S. H. Chotirmall, L.-F. Wang, and J. A. Abisheganaden, “Letter from Singapore: The clinical and research response to COVID-19,” *Respirol. Carlton Vic*, doi: 10.1111/resp.13929.

[10] R. J. Lin, T. H. Lee, and D. C. Lye, “From SARS to COVID-19: the Singapore journey,” *Med. J. Aust.*, vol. 212, no. 11, pp. 497-502.e1, Jun. 2020, doi: 10.5694/mja2.50623.

[11] A. Q. Chua *et al.*, “Health system resilience in managing the COVID-19 pandemic: lessons from Singapore,” *BMJ Glob. Health*, vol. 5, no. 9, Sep. 2020, doi: 10.1136/bmjgh-2020-003317.

[12] J. I.-P. Chen, C. K. Khin, A. M. Yamato Leow, J. C. Yap, and J. Lim, “COVID-19 Health System Response Monitor: Singapore,” Feb. 2021. [Online]. Available: http://www.searo.who.int/entity/asia_pacific_observatory/publications/en/.

[13] Channel News Asia, “COVID-19: Two more foreign worker dormitories declared as isolation areas,” *CNA*, Apr. 23, 2020.

[14] Ministry of Manpower, “Advisory for dormitory operators to submit essential errands form for migrant workers to carry out essential errands.” https://www.mom.gov.sg/covid-19/advisory-for-dorm-operators-to-submit-essential-errands (accessed May 08, 2021).

[15] Ministry of Manpower, “Workers in Dormitories Returning to Work and Updates on AccessCode,” *Ministry of Manpower Singapore*. https://www.mom.gov.sg/newsroom/press-releases/2020/0610-workers-in-dormitories-returning-to-work-and-updates-on-accesscode (accessed May 08, 2021).

[16] R. Phua and H. M. Ang, “‘Dedicated strategy’ to break COVID-19 spread in dormitories, including housing healthy workers in army camps - CNA,” Apr. 09, 2020.

[17] R. Kurohi, “Coronavirus: MOM outlines new measures for workers resuming work after June 1, including staggered rest days in Phase 2 of reopening,” *The Straits Times*, May 30, 2020.

[18] B. Ang, “A-Z inventions of Covid-19: TraceTogether and SafeEntry programmes,” *The Straits Times*, Dec. 20, 2020.

[19] “How do TraceTogether and SafeEntry work together? Is SafeEntry still required since there is TraceTogether?,” *TraceTogether FAQs*. https://support.tracetogether.gov.sg/hc/en-sg/articles/360052744534-How-do-TraceTogether-and-SafeEntry-work-together-Is-SafeEntry-still-required-since-there-is-TraceTogether- (accessed May 03, 2021).

[20] Z. Tee, “Coronavirus: Tracking workers’ health with mobile apps, wearable devices, Jobs News & Top Stories - The Straits Times,” Aug. 12, 2020. https://www.straitstimes.com/singapore/manpower/tracking-workers-health-with-tech-help (accessed May 08, 2021).

[21] J. Lim, “Singapore’s experience tackling COVID-19,” *Saw Swee Hock School of Public Health*, Mar. 18, 2020. https://sph.nus.edu.sg/2020/03/singapores-experience-tackling-covid-19/ (accessed May 03, 2021).

[22] P. De Salazar, R. Niehus, A. Taylor, C. Buckee, and M. Lipsitch, “Using predicted imports of 2019-nCoV cases to determine locations that may not be identifying all imported cases,” *medRxiv*, Feb. 2020, doi: 10.1101/2020.02.04.20020495.

[23] Y. Ng, “Evaluation of the Effectiveness of Surveillance and Containment Measures for the First 100 Patients with COVID-19 in Singapore — January 2–February 29, 2020,” *MMWR Morb. Mortal. Wkly. Rep.*, vol. 69, 2020, doi: 10.15585/mmwr.mm6911e1.

[24] Singapore Economic Development Board, “Singapore Budget 2020: COVID-19 Relief Measures for Singaporeans and Businesses,” Jun. 23, 2020. http://www.edb.gov.sg/en/business-insights/insights/singapore-budget-2020--covid-19-relief-measures-for-singaporeans.html (accessed May 08, 2021).

[25] KPMG, “Singapore,” *KPMG*, Nov. 18, 2020. https://home.kpmg/xx/en/home/insights/2020/04/singapore-government-and-institution-measures-in-response-to-covid.html, https://wknd.site/content/kpmgpublic/xx/en/home/insights/2020/04/singapore-government-and-institution-measures-in-response-to-covid.html (accessed May 08, 2021).

[26] O. Subhani, “S’pore economy to return to growth next year, forecast at 4% to 6%,” *The Straits Times*, Nov. 23, 2020.

[27] V. Khanna, “Covid-19’s impact to still weigh on Singapore’s economy in 2021, Opinion News & Top Stories - The Straits Times,” *The Straits Times*, Jan. 02, 2021.

[28] A. Aravindan, “Singapore to taper spending in 2021 after record budget deficit,” *Reuters*, Feb. 09, 2021.

[29] Government of Singapore, “MOF | Singapore Budget 2020 |Ministerial Statement - Aug 2020,” Aug. 2020. https://www.singaporebudget.gov.sg/budget_2020/AugustStatement#t4 (accessed May 08, 2021).

[30] SG Singapore, “At a glance: Singapore’s Fortitude Budget for workers and businesses affected by COVID-19.” Accessed: May 06, 2021. [Online]. Available: https://www.edb.gov.sg/content/dam/edb-en/insights/headquarters/singapore-budget-2020-covid-19-relief-measures-for-singaporeans-and-businesses--/EDB_SG%20Fortitude%20Budget_Summary%20Infographic.pdf.

[31] J. Lim, *Myth or magic :the Singapore healthcare system*. Select Publishing, 2013.

[32] W. A. Haseltine, *Affordable excellence: the Singapore healthcare story*. Washington, D.C: Brookings Institution Press, 2013.

[33] Zoe Mitchell, “Real Time Research in a Singapore Public Primary Care Institution,” 12:07:26 UTC, Accessed: Apr. 28, 2021. [Online]. Available: https://www.slideshare.net/RespiratoryEffectivenessGroup/real-time-research-in-a-singapore-public-primary-care-institution.

[34] E. Quah and B. S. Neo, “Evolving the Governance of Public Healthcare Institutions ? A Continuous Improvement Journey,” in *Singapore’s Health Care System*, 0 vols., WORLD SCIENTIFIC, 2015, pp. 57–74.

[35] A. B. Jalelah, “MOH publishes fee benchmarks for surgical procedures in private hospitals,” *CNA*, Nov. 13, 2018.

[36] M. K. Lee, “More than 8 in 10 patients rate service at public hospitals, polyclinics as good or excellent, Health News & Top Stories - The Straits Times,” *The Straits Times*, Jun. 13, 2016.

[37] *Safe but soulless: nursing homes need a new narrative*. Singapore: Lien Foundation, 2016.

[38] A. Chia, “MOH may run its own nursing homes,” *TODAYonline*, Aug. 01, 2014.

[39] W. L. Lai, “Paying for Healthcare,” in *Singapore’s Health Care System*, 0 vols., WORLD SCIENTIFIC, 2015, pp. 75–94.

[40] M. Ramesh and S. B. Azad, “The healthcare system in Singapore,” Lee Kuan Yew School of Public Policy.

[41] J. W. Thomas and S. G. Lim, “Using Markets to Govern Better in Singapore,” *HKS Fac. Res. Work. Pap. Ser.*, vol. HKS Working Paper No. RWP02-010, 2001, Accessed: Apr. 28, 2021. [Online]. Available: https://www.hks.harvard.edu/publications/using-markets-govern-better-singapore.

[42] C. Huang, “MOH steps up disease prevention amid ramp-up of primary care,” *The Business Times*, Mar. 10, 2017.

[43] Ministry of Health, “MOH | News Highlights: SPEECH BY DR LAM PIN MIN, SENIOR MINISTER OF STATE FOR HEALTH, AT THE MOH COMMITTEE OF SUPPLY DEBATE 2018,” Mar. 07, 2018. https://www.moh.gov.sg/news-highlights/details/speech-by-dr-lam-pin-min-senior-minister-of-state-for-health-at-the-moh-committee-of-supply-debate-2018 (accessed Apr. 28, 2021).

[44] Agency for Integrated Care, "Tote Board Community Health Fund." https://partners.aic.sg/funding-support/tbchf (accessed Apr. 28, 2021).

[45] Agency for Integrated Care, "Community Silver Trust." https://partners.aic.sg/funding-support/cst (accessed Apr. 28, 2021).

[46] C. H. Poon, "Bringing quality care up a notch at nursing homes," *The Straits Times*, Nov. 28, 2017.

[47] D. Standards and S. the Standards Development Subgroup of the National, "National Guidelines for Palliative Care," Jun. 2014.

[48] F. Crotty, R. Watson, and W. K. Lim, "Nursing homes: the titanic of cruise ships - will residential aged care facilities survive the COVID-19 pandemic?," *Intern. Med. J.*, vol. 50, no. 9, pp. 1033–1036, Sep. 2020, doi: 10.1111/imj.14966.

[49] Ministry of Health, "MOH | Time-limited Extension of CHAS Subsidy and Use of MediSave for Follow up of Chronic Conditions through Video Consultations in view of COVID-19." https://www.moh.gov.sg/covid-19/vc (accessed Apr. 28, 2021).

[50] F. Lam, "No hospitalisation coverage for those who violate Singapore's Covid-19 travel advisory: LIA, Banking & Finance - THE BUSINESS TIMES," *The Business Times*, Apr. 07, 2020.

[51] Y. T. Choo, "Coronavirus: Singapore Government to foot bills of infected patients at public hospitals, except outpatient expenses," *The Straits Times*, Feb. 12, 2020.

[52] G. Olano, "Singapore insurance associations issue joint statement on coronavirus," *Insurance Business Asia*, Feb. 12, 2020. https://www.insurancebusinessmag.com/asia/news/breaking-news/singapore-insurance-associations-issue-joint-statement-on-coronavirus-213346.aspx (accessed Apr. 28, 2021).

[53] L. Renia and L. Ng, "Singapore's war on infectious diseases," *00. A*STAR HQ Corporate Website*. https://www.a-star.edu.sg/News-and-Events/a-star-news/news/features/singapore-s-war-on-infectious-diseases (accessed Apr. 08, 2021).

[54] P.-L. Ooi, T. Seetoh, and J. Cutter, "The Singapore Field Epidemiology Service: Insights Into Outbreak Management," *J. Prev. Med. Pub. Health*, vol. 45, no. 5, pp. 277–282, Sep. 2012, doi: 10.3961/jpmph.2012.45.5.277.

[55] L. H. Lum, H. Badaruddin, S. Salmon, J. Cutter, A. Y. Lim, and D. Fisher, "Pandemic Preparedness: Nationally-Led Simulation to Test Hospital Systems," *Ann. Acad. Med. Singapore*, vol. 45, no. 8, p. 6, 2016.

[56] Ministry of Health, "MOH PANDEMIC READINESS AND RESPONSE PLAN FOR INFLUENZA AND OTHER ACUTE RESPIRATORY DISEASES (REVISED APRIL 2014)," Apr. 2014. Accessed: May 06, 2021. [Online]. Available: https://www.moh.gov.sg/docs/librariesprovider5/diseases-updates/interim-pandemic-plan-public-ver-_april-2014.pdf.

[57] K. M. Choy, "Trade Cycles in a Re-export Economy: The Case of Singapore," *Int. Econ. J.*, vol. 26, no. 2, pp. 189–201, Jun. 2012, doi: 10.1080/10168737.2012.688520.

[58] K. M. Choy, "Business Cycles in Singapore: Stylized Facts for a Small Open Economy," *Pac. Econ. Rev.*, vol. 16, no. 1, pp. 18–35, 2011, doi: https://doi.org/10.1111/j.1468-0106.2010.00532.x.

[59] Z. J. M. Ho *et al.*, "Outbreak of Zika virus infection in Singapore: an epidemiological, entomological, virological, and clinical analysis," *Lancet Infect. Dis.*, vol. 17, no. 8, pp. 813–821, Aug. 2017, doi: 10.1016/S1473-3099(17)30249-9.

[60] Y. Chen, J. H. Y. Ong, J. Rajarethinam, G. Yap, L. C. Ng, and A. R. Cook, "Neighbourhood level real-time forecasting of dengue cases in tropical urban Singapore," *BMC Med.*, vol. 16, Aug. 2018, doi: 10.1186/s12916-018-1108-5.

[61] Y. Chen, H. Badaruddin, V. J. Lee, J. Cutter, and A. R. Cook, "The Effect of School Closure on Hand, Foot, and Mouth Disease Transmission in Singapore: A Modeling Approach," *Am. J. Trop. Med. Hyg.*, vol. 99, no. 6, pp. 1625–1632, Dec. 2018, doi: 10.4269/ajtmh.18-0099.

[62] L. M. Ow Yong and L. W. P. Koe, “War on Diabetes in Singapore: a policy analysis,” *Health Res. Policy Syst.*, vol. 19, no. 1, p. 15, Feb. 2021, doi: 10.1186/s12961-021-00678-1.

[63] V. Offeddu, M. S. F. Low, S. Surendran, G. Kembhavi, and C. C. Tam, “Acceptance and feasibility of school-based seasonal influenza vaccination in Singapore: A qualitative study,” *Vaccine*, vol. 38, no. 7, pp. 1834–1841, Feb. 2020, doi: 10.1016/j.vaccine.2019.12.020.

[64] T. T. T. Doan, K. W. Tan, B. S. L. Dickens, Y. A. Lean, Q. Yang, and A. R. Cook, “Evaluating smoking control policies in the e-cigarette era: a modelling study,” *Tob. Control*, vol. 29, no. 5, pp. 522–530, Sep. 2020, doi: 10.1136/tobaccocontrol-2019-054951.

[65] T. P. Phan *et al.*, “Forecasting the burden of type 2 diabetes in Singapore using a demographic epidemiological model of Singapore,” *BMJ Open Diabetes Res. Care*, vol. 2, no. 1, p. e000012, Jun. 2014, doi: 10.1136/bmjdrc-2013-000012.

[66] J. Pang *et al.*, “Potential Rapid Diagnostics, Vaccine and Therapeutics for 2019 Novel Coronavirus (2019-nCoV): A Systematic Review,” *J. Clin. Med.*, vol. 9, no. 3, Feb. 2020, doi: 10.3390/jcm9030623.

[67] National University of Singapore, “Research on COVID-19,” *Saw Swee Hock School of Public Health*. https://sph.nus.edu.sg/covid-19/research/ (accessed Apr. 27, 2021).

[68] J. R. Koo *et al.*, “Interventions to mitigate early spread of SARS-CoV-2 in Singapore: a modelling study,” *Lancet Infect. Dis.*, vol. 20, no. 6, pp. 678–688, Jun. 2020, doi: 10.1016/S1473-3099(20)30162-6.

[69] A. Cook, “2021: COVID-19, Biomedical Insights into an Evolving Epidemic, What have we learned from the models?,” Jan. 11, 2021, Accessed: Apr. 27, 2021. [Online]. Available: https://medicine.nus.edu.sg/cet/open-enrollment/2021-covid-19-biomedical-insights-into-an-evolving-epidemic-2/.

[70] B. L. Dickens, J. R. Koo, A. Wilder-Smith, and A. R. Cook, “Institutional, not home-based, isolation could contain the COVID-19 outbreak,” *The Lancet*, vol. 395, no. 10236, pp. 1541–1542, May 2020, doi: 10.1016/S0140-6736(20)31016-3.

[71] B. L. Dickens *et al.*, “Strategies at points of entry to reduce importation risk of COVID-19 cases and reopen travel,” *J. Travel Med.*, vol. 27, no. taaa141, Dec. 2020, doi: 10.1093/jtm/taaa141.

[72] SingHealth and Duke-NUS, “COVID-19 Special Report,” *DukeNUS Medical School*. https://www.duke-nus.edu.sg/hssr/covid-19-special-report (accessed Apr. 27, 2021).

[73] A. Tan, S. Begun, and C. Tan, “6 scientists in Singapore who have pivoted to Covid-19 related work,” *The Straits Times*, Dec. 14, 2020.

[74] Channel News Asia, “Duke-NUS used COVID-19 antibody tests to establish link between church clusters in a world-first - CNA,” *Channel News Asia*, Feb. 26, 2020.

[75] F. Miraso, “Singapore aims to become a global biomedical sciences hub,” *ICIS Explore*. https://www.icis.com/explore/resources/news/2007/10/01/9065913/singapore-aims-to-become-a-global-biomedical-sciences-hub (accessed Apr. 07, 2021).

[76] Pharmaceutical Technology, “Biopolis Biomedical Research Hub, Buona Vista - Pharmaceutical Technology.” https://www.pharmaceutical-technology.com/projects/biopolis/ (accessed Apr. 07, 2021).

[77] Y. M. Chia, “A home for world’s best scientists,” *The Straits Times*, Jan. 03, 2014.

[78] ICIS, “Petrochemicals, Energy, and Fertilizers Market Information | ICIS,” *ICIS Explore*. https://www.icis.com/explore/ (accessed Apr. 13, 2021).

[79] Ministry of Trade and Industry Singapore, “Economic Survey of Singapore 2016,” 2016. Accessed: Apr. 13, 2021. [Online]. Available: https://www.mti.gov.sg/-/media/MTI/Resources/Economic-Survey-of-Singapore/2016/Economic-Survey-of-Singapore-2016/fullreport_aes2016.pdf.

[80] Ministry of Health, “MOH | Updates on COVID-19 (Coronavirus Disease 2019) Local Situation.” https://www.moh.gov.sg/covid-19 (accessed May 08, 2021).

[81] T. S. Chern, T. S. Ping, and E. Robinson, “Assessing Singapore’s Export Competitiveness Through Dynamic Shift-Share Analysis,” 2002.

[82] TrendEconomy, “Annual International Trade Statistics by Country (HS02).” https://trendeconomy.com/data/h2/Singapore/TOTAL (accessed Apr. 14, 2021).

[83] Government of Singapore, “Singapore Department Of Statistics | SingStat Table Builder,” *Department of Statistics Singapore*. https://www.tablebuilder.singstat.gov.sg/publicfacing/createDataTable.action?refId=16061 (accessed Apr. 14, 2021).

[84] Statista, “Singapore - GDP distribution across economic sectors 2019,” *Statista*. https://www.statista.com/statistics/378575/singapore-gdp-distribution-across-economic-sectors/ (accessed Apr. 14, 2021).

[85] Hawksford, “What makes the Singapore economy tick?,” *GuideMeSingapore.Hawksford*. https://www.guidemesingapore.com/business-guides/incorporation/why-singapore/singapore-economy---a-brief-introduction (accessed Apr. 14, 2021).

[86] M. L. Kuan, “Overview of Singapore’s Business Services Sector,” 2012. Accessed: Apr. 14, 2021. [Online]. Available: https://www.mti.gov.sg/Resources/feature-articles/2008/Overview-of-Singapores-Business-Services-Sector.

[87] Economic Policy Group, Monetary Authority of Singapore, “Issues and Challenges in the Fiscal Policy Response to COVID-19,” Oct. 2020. Accessed: Apr. 14, 2021. [Online]. Available: https://www.mas.gov.sg/publications/economic-essays/2020/issues-and-challenges-in-the-fiscal-policy-response-to-covid-19.

[88] Economic Policy Group Monetary Authority of Singapore, “Macroeconomic Review,” Oct. 2020. Accessed: Apr. 14, 2021. [Online]. Available: https://www.mas.gov.sg/monetary-policy/MAS-Macroeconomic-Review.

[89] Ministry of Trade and Industry, “MTI Maintains 2021 GDP Growth Forecast at ‘4.0 to 6.0 Per Cent,’” Feb. 2021. Accessed: Apr. 14, 2021. [Online]. Available: https://www.mti.gov.sg/Newsroom/Press-Releases/2021/02/MTI-Maintains-2021-GDP-Growth-Forecast-at-4_0-to-6_0-Per-Cent.

[90] R. Phua and H. M. Chew, “Can Singapore rely less on foreign workers? It’s not just about dollars and cents, say observers - CNA.”

[91] Government of Singapore, “Foreign workforce numbers,” *Ministry of Manpower*. https://www.mom.gov.sg/documents-and-publications/foreign-workforce-numbers (accessed Apr. 19, 2021).

[92] Government of Singapore, “Ministerial Statement by Mrs Josephine Teo, Minister for Manpower, 4 May 2020,” *Ministry of Manpower*. https://www.mom.gov.sg/newsroom/parliament-questions-and-replies/2020/0504-ministerial-statement-by-mrs-josephine-teo-minister-for-manpower-4-may-2020 (accessed Apr. 19, 2021).

[93] Nordea, “The economic context of Singapore - Economic and Political Overview - Nordea Trade Portal.” https://www.nordeatrade.com/no/explore-new-market/singapore/economical-context (accessed Apr. 19, 2021).

[94] Macrotrends LLC, “Singapore Trade to GDP Ratio 1960-2021,” *macrotrends*. https://www.macrotrends.net/countries/SGP/singapore/trade-gdp-ratio (accessed Apr. 21, 2021).

[95] Ministry of Finance, “What is the President’s role in safeguarding the reserves?,” *MOF*. https://www.mof.gov.sg/policies/reserves/what-is-the-president-s-role-in-safeguarding-the-reserves (accessed Apr. 21, 2021).

[96] Ministry of Finance, “What comprises the reserves and who manages them?,” *MOF*. https://www.mof.gov.sg/policies/reserves/what-comprises-the-reserves-and-who-manages-them (accessed Apr. 27, 2021).

[97] President's Office, "The Istana | President's Duties," *President of the Republic of Singapore*. https://www.istana.gov.sg/The-President/Presidents-Duties/Constitutional (accessed Apr. 27, 2021).

[98] W. Ng, "The evolution of sovereign wealth funds: Singapore's Temasek Holdings," *J. Financ. Regul. Compliance*, vol. 18, pp. 6–14, Dec. 2009, doi: 10.1108/13581981011019589.

[99] Government of Singapore, "MOF | Singapore Budget 2020 | Ministerial Statement Oct 2020." https://www.singaporebudget.gov.sg/budget_2020/ministerial-statement-oct-2020/ministerial-statement-oct-2020 (accessed Apr. 27, 2021).

[100] J. Heng, "Four Budgets may help Singapore avoid output loss of 5 percentage points or S$23.4b: DPM Heng, Government & Economy - THE BUSINESS TIMES," *The Business Times*, Jun. 05, 2020.

[101] Temasek, "Fighting COVID-19 Together - Steward," *Temasek Review 2020*. https://www.temasekreview.com.sg/steward/fighting-covid-19-together.html (accessed Apr. 27, 2021).

[102] C. Wright, "Inside Temasek's response to Covid," *Euromoney*, Sep. 09, 2020. https://www.euromoney.com/article/27gv1jmqd15tf03yldssh/capital-markets/inside-temaseks-response-to-covid (accessed Apr. 27, 2021).

[103] Y. H. Goh, "Temasek CEO on its investment in developing Covid-19 vaccine, Singapore News & Top Stories - The Straits Times," *The Straits Times*, Nov. 04, 2020.

[104] Y. H. Goh, "Temasek pitches in for Covid-19 vaccine, Singapore News & Top Stories - The Straits Times," *The Straits Times*, Nov. 04, 2020.

[105] J. J. Woo, "Policy capacity and Singapore's response to the COVID-19 pandemic," *Policy Soc.*, vol. 39, no. 3, pp. 345–362, Jul. 2020, doi: 10.1080/14494035.2020.1783789.

[106] J. C.-H. Yap *et al.*, "COVID-19 Science Report: Containment Measures," NUS Saw Swee Hock School of Public Health, Jul. 2020. Accessed: May 03, 2021. [Online]. Available: https://scholarbank.nus.edu.sg/handle/10635/164815.

[107] I. Cheng, "About 25,000 close contacts of COVID-19 cases identified using TraceTogether: Gan Kim Yong," *CNA*.

[108] T. J. Lim, "How Singapore managed essential supplies as Covid-19 hit," *GovInsider*, Aug. 05, 2020. https://govinsider.asia/future-of-work/kuhan-harichandra-mti-how-singapore-managed-essential-supplies-as-covid-19-hit/ (accessed May 03, 2021).

[109] ICC International Chamber of Commerce, "Breakthrough for air travel as Singapore becomes first government to accept digital COVID-19 test results for immigration purposes," *ICC - International Chamber of Commerce*, Dec. 23, 2020. https://iccwbo.org/media-wall/news-speeches/breakthrough-for-air-travel-as-singapore-becomes-first-government-to-accept-digital-covid-19-test-results-for-immigration-purposes/ (accessed May 08, 2021).

[110] C. Chong, "Patients who are well but still testing positive for Covid-19 to be moved to community isolation facility to preserve hospital capacity, Singapore News & Top Stories - The Straits Times," Mar. 24, 2020.

[111] M. L. Chia, D. H. Him Chau, K. S. Lim, C. W. Yang Liu, H. K. Tan, and Y. R. Tan, "Managing COVID-19 in a Novel, Rapidly Deployable Community Isolation Quarantine Facility," *Ann. Intern. Med.*, vol. 174, no. 2, pp. 247–251, Sep. 2020, doi: 10.7326/M20-4746.

[112] J. Lim, "Coronavirus: More doctors attending to patients through video call," *The Straits Times*, May 04, 2020.

[113] I. Tham, "Coronavirus: Google launches new tool to help public health officials plan social distancing measures," *The Straits Times*, Apr. 03, 2020.

[114] H. R. Stephanie Sy, "Using urban mobility and big data to track the pandemic," *Asian Development Blog*. https://blogs.adb.org/blog/using-urban-mobility-and-big-data-to-track-the-pandemic (accessed May 08, 2021).

[115] Monetary Authority of Singapore, "'Covid-19: We Need More Connectivity, Not Less' - Keynote Speech by Mr Ravi Menon, Managing Director, Monetary Authority of Singapore, at Caixin Summer Summit 2020 on 22 June 2020 [via Video Conference from Singapore]." https://www.mas.gov.sg/news/speeches/2020/covid19-we-need-more-connectivity-not-less (accessed May 08, 2021).

[116] Edelman, "2019_Edelman_Trust_Barometer_Global_Report," 2019. [Online]. Available: https://www.edelman.com/sites/g/files/aatuss191/files/2019-02/2019_Edelman_Trust_Barometer_Global_Report.pdf.

[117] T. Wong and B. S. A. Yeoh, "Fertility and the Family: An Overview of Pro-natalist Population Policies in Singapore," *ASIAN METACENTRE Res. Pap. Ser. No 12*, p. 27.

[118] K. Kanagaratnam, "Singapore: The National Family Planning Program," *Stud. Fam. Plann.*, vol. 1, no. 28, pp. 1–11, 1968, doi: 10.2307/1965364.

[119] W. G. Huff, "The developmental state, government, and Singapore's economic development since 1960," *World Dev.*, vol. 23, no. 8, pp. 1421–1438, Aug. 1995, doi: 10.1016/0305-750X(95)00043-C.

[120] E. D. Liow, "The Neoliberal-Developmental State: Singapore as Case Study," *Crit. Sociol.*, vol. 38, no. 2, pp. 241–264, Mar. 2012, doi: 10.1177/0896920511419900.

[121] M. Perry, L. Kong, and B. S. A. Yeoh, "Singapore: A Developmental City State," *Res. Collect. Sch. Soc. Sci.*, Jan. 1997, [Online]. Available: https://ink.library.smu.edu.sg/soss_research/1825.

[122] E. C. Schein, *Strategic Pragmatism: The Culture of Singapore's Economics Development Board*, vol. 1. The MIT Press, 1996.

[123] P. Chew, "Islands and national identity: the metaphors of Singapore," *Int. J. Sociol. Lang.*, vol. 143, no. 1, pp. 121–137, 2000, doi: 10.1515/IJSL.2000.143.121.

[124] W. C. Chang and R.-W. Sivam, "Constant vigilance: Heritage values and defensive pessimism in coping with severe acute respiratory syndrome in Singapore," *Asian J. Soc. Psychol.*, vol. 7, no. 1, pp. 35–53, 2004, doi: https://doi.org/10.1111/j.1467-839X.2004.00133.x.

[125] C. Tortajada, "Water Management in Singapore," *Int. J. Water Resour. Dev.*, vol. 22, pp. 227–240, Jun. 2006, doi: 10.1080/07900620600691944.

[126] Bloomberg, "Singapore Has a S$100 Billion Plan for Adapting to Climate Change - Bloomberg," Feb. 25, 2020. https://www.bloomberg.com/news/features/2020-02-25/singapore-has-a-100-billion-plan-for-adapting-to-climate-change (accessed May 08, 2021).

[127] Ministry of Foreign Affairs, "Foreign Policy," 2021. http://www.mfa.gov.sg/Overseas-Mission/Dubai/About-Singapore/Foreign-Policy (accessed May 08, 2021).

[128] P. HO and A. W. J. KUAH, "Governing for the Future: What Governments Can Do," *PRISM*, vol. 5, no. 1, pp. 8–21, 2014.

[129] Ministry of Manpower, "Advisory to employers on medical support for migrant workers after clearance of dormitories," *Ministry of Manpower Singapore*, Aug. 21, 2020. https://www.mom.gov.sg/covid-19/advisory-to-employers-on-medical-support-for-migrant-workers (accessed May 08, 2021).

[130] Ministry of Health, "MOH Circular: Medical Support for Migrant Workers After Clearance of Dormitories." 2020.

[131] A. R. Cook, "Commentary: Why Singapore's travel restrictions will keep changing for a while more," *CNA*, Apr. 29, 2021.

[132] S. Khalik, "Unlike large resource-rich countries, Singapore cannot afford to close its borders for long: Lawrence Wong," *The Straits Times*, May 04, 2021.